ACADEMIC REGULATIONS

COURSE STRUCTURE

AND

DETAILED SYLLABI

OF

INFORMATION TECHNOLOGY

FOR

B.TECH REGULAR FOUR YEAR DEGREE PROGRAM

(For the batches admitted from 2019-2020)

&

FOR B.TECH LATERAL ENTRY PROGRAM

(For the batches admitted from 2020-2021)

CHOICE BASED CREDIT SYSTEM

SREE VIDYANIKETHAN ENGINEERING COLLEGE (AUTONOMOUS)

(Affiliated to JNTUA, Ananthapuramu, Approved by AICTE, Programs Accredited by NBA, Accredited by NAAC with 'A' grade)
SREE SAINATH NAGAR, A. Rangampet -517102:: NEAR TIRUPATI (A.P)

VISION

To be one of the Nation's premier Engineering Colleges by achieving the highest order of excellence in Teaching and Research.

MISSION

- To foster intellectual curiosity, pursuit and dissemination of knowledge.
- To explore students' potential through academic freedom and integrity.
- To promote technical mastery and nurture skilled professionals to face competition in ever increasing complex world.

QUALITY POLICY

SreeVidyanikethan Engineering College strives to establish a system of Quality Assurance to continuously address, monitor and evaluate the quality of education offered to students, thus promoting effective teaching processes for the benefit of students and making the College a Centre of Excellence for Engineering and Technological studies.

DEPARTMENT OF INFORMATION TECHNOLOGY

VISION

To become a nationally recognized quality education center in the domain of Computer Science and Information Technology through teaching, training, learning, research and consultancy.

MISSION

- The Department offers undergraduate program in Information Technology to produce high quality information technologists and software engineers by disseminating knowledge through contemporary curriculum, competent faculty and adopting effective teaching-learning methodologies.
- Igniting passion among students for research and innovation by exposing them to real time systems and problems
- Developing technical and life skills in diverse community of students with modern training methods to solve problems in Software Industry.
- Inculcating values to practice engineering in adherence to code of ethics in multicultural and multi discipline teams.

PROGRAM EDUCATIONAL OBJECTIVES

After few years of graduation, the graduates of B. Tech. (IT) Program will be:

1. Enrolled or completed higher education in the core or allied areas of Computer Science and Information Technology or management.
2. Successful entrepreneurial or technical career in the core or allied areas of Computer Science and Information Technology.
3. Continued to learn and to adapt to the world of constantly evolving technologies in the core or allied areas of Computer Science and Information Technology.

PROGRAM OUTCOMES

On successful completion of the Program, the graduates of B. Tech. (IT) Program will be able to:

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

On successful completion of the program, the graduates of B.Tech. (IT) program will be able to:

PSO1: Design and develop database systems, apply data analytics techniques, and use advanced databases for data storage, processing and retrieval.

PSO2: Apply network security techniques and tools for the development of highly secure systems.

PSO3: Analyze, design and develop efficient algorithms and software applications to deploy in secure environment to support contemporary services using programming languages, tools and technologies.

PSO4: Apply concepts of computer vision and artificial intelligent for the development of efficient intelligent systems and applications.

SREE VIDYANIKETHAN ENGINEERING COLLEGE (AUTONOMOUS)

(Affiliated to J.N.T. University Anantapur, Ananthapuramu)

ACADEMIC REGULATIONS (SVEC-19)

CHOICE BASED CREDIT SYSTEM

B.Tech. Regular Four Year Degree Program

(For the batches admitted from the academic year 2019–20)

and

B.Tech. (Lateral Entry Scheme)

(For the batches admitted from the academic year 2020-21)

For pursuing four year undergraduate Degree Program B.Tech offered by SreeVidyanikethan Engineering College under Autonomous status and herein after referred to as SVEC:

1. Applicability:

All the rules specified herein, approved by the Academic Council, shall be in force and applicable to students admitted from the academic year 2019-2020 onwards. Any reference to "College" in these rules and regulations stands for SVEC.

2. Extent:

All the rules and regulations, specified hereinafter shall be read as a whole for the purpose of interpretation and as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. It shall be ratified by the Academic Council in the forthcoming meeting. As per the requirements of statutory bodies, Principal, SreeVidyanikethan Engineering College shall be the Chairman, Academic Council.

3. Admission:

3.1. Admission into First Year of Four Year B.Tech. Degree Program in Engineering:

3.1.1. Eligibility: A candidate seeking admission into the First Year of four year B.Tech. Degree Program should have:

Passed either Intermediate Public Examination (I.P.E.) conducted by the Board of Intermediate Education, Andhra Pradesh, with Mathematics, Physics and Chemistry as optional courses (or any equivalent examination recognized by JNTUA, Ananthapuramu) for admission as per the guidelines of Andhra Pradesh State Council of Higher Education (APSCHE).

3.1.2. Admission Procedure: Admissions shall be made into the first year of four year B.Tech. Degree Program as per the stipulations of APSCHE, Government of Andhra Pradesh:

(a) By the Convener, EAMCET, (for Category-A Seats).

(b) By the Management (for Category-B Seats).

(c) By the Management (for 15% Supernumerary Quota) for Persons of Indian Origin (PIO)/Foreign Nationals (FN)/ Children of Indian Workers in Gulf Countries/ Overseas Citizen of India (OCI)

3.2. Admission into the Second Year of Four year B.Tech Degree Program in Engineering (Lateral Entry).

3.2.1. Eligibility: A candidate seeking admission into the Second Year of four year B.Tech. Degree Program (Lateral Entry) should have:

(i) Passed Diploma in Engineering in the relevant branch conducted by the Board of Technical Education, Andhra Pradesh (or equivalent Diploma recognized by JNTUA, Ananthapuramu).

(ii) Candidates qualified in ECET and admitted by the Convener, ECET. In all such cases for admission, when needed, permissions from the statutory bodies are to be obtained.

3.2.2. Admission Procedure: 10% of the sanctioned strength in each Program of study as lateral entry students or as stipulated by APSCHE shall be filled in by the Convener, ECET.

4. Programs of study offered leading to the award of B.Tech. Degree:

Following are the four year undergraduate Degree Programs of study offered in various branches in SVEC leading to the award of B.Tech (Bachelor of Technology) Degree:

1) Civil Engineering
2) Electrical and Electronics Engineering
3) Mechanical Engineering
4) Electronics and Communication Engineering
5) Computer Science and Engineering
6) Electronics and Instrumentation Engineering
7) Information Technology
8) Computer Science and Systems Engineering

5. Duration of the Program:

5.1 Minimum Duration: The program shall extend over a period of four years leading to the Degree of Bachelor of Technology (B.Tech) of the JNTUA, Ananthapuramu. The four academic years shall be divided into eight semesters with two semesters per year. Each semester shall normally consist of 21 weeks (Minimum of 90 working days) having - Continuous Internal Evaluation (CIE) and Semester End Examination (SEE), Choice Based Credit System (CBCS) and Credit Based Semester System(CBSS) as suggested by UGC and Curriculum/ Course

Structure as suggested by AICTE are followed. Provision is made for lateral entry admission of students into the Second Year of the program in all the branches of study and they shall be required to satisfy the conditions of admissions thereto prescribed by the JNTUA, Ananthapuramu and Government of Andhra Pradesh.

5.2 MaximumDuration:

The student shall complete all the passing requirements of the B.Tech degree program within a maximum duration of 8 years (6 years for lateral entry), these durations reckoned from the commencement of the semester to which the student was first admitted to the program.

6. Structure of the Program:

Each Program of study shall consist of:

(i) HS (Humanities and Social Sciences) Courses
(ii) BS (Basic Sciences) Courses
(iii) ES (Engineering Sciences) Courses
(iv) PC (Professional Core) Courses
(v) PE (Professional Electives)
(vi) OE (Open Electives) Courses
(vii) Mandatory Courses (MC)
(viii) Audit Courses (AC)
(ix) Projects (PR) (Socially Relevant Projects, Internship, Project Work)

S.No	Course Category	Course Type	No. of Credits
1.	HS – Humanities and Social Sciences	Humanities, Social Sciences and Management.	11
2.	BS – Basic Sciences	Mathematics, Physics and Chemistry Courses, etc.	22
3.	ES – Engineering Sciences	Fundamental Engineering courses.	22-23
4.	PC – Professional Core	Core courses related to the Parent Discipline/ Branch of Engg.	60-61
5.	PE – Professional Electives	Elective courses related to the Parent Discipline/ Branch of Engg.	15
6.	OE – Open Electives	Electives from other technical and /or emerging subjects	15
7.	PR - Projects	Socially Relevant Projects, Internship, Project Work	14
8.	MC - Mandatory Courses	Induction Program, Environmental Science, Universal Human Values	--
9.	AC - Audit Courses	Skill Development / Value Added Courses.	--

Contact Periods:

The contact periods per week are assigned depending on the complexity and volume of the course.

7. Credit Courses:

All Courses are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Course in a L: T: P: C (Lecture Hours: Tutorial Hours: Practical Hours: Credits) Structure, based on the following general pattern.

- **Theory Courses:** One Lecture Hour (L) per week in a semester: 01 Credit
- **Practical Courses:** One Practical Hour (P) Per week in a semester: 0.5 Credit
- **Tutorial:** One Tutorial Hour (T) Per week in a semester: 01 Credit
- **Mandatory Courses:** No **CREDIT** is awarded.
- **Audit Courses:** No **CREDIT** is awarded.
- **Open Elective** (MOOC): 03 Credits

Student activities like NCC, NSS, Sports, Study Tour and Guest Lecture etc. shall not carry ANY Credits.

For Socially Relevant Projects, Internship and Project Work where formal contact periods are not specified, credits are assigned based on the complexity of the work to be carried out.

The four year curriculum of any B. Tech Program of study shall have a total of **160** credits. However the curriculum for students admitted under lateral entry shall have a total of **118** credits.

8. Choice Based Credit System (CBCS):

Choice Based Credit System (CBCS) is introduced in line with UGC guidelines in order to promote:

- Student centred learning
- Students to learn courses of their choice
- Interdisciplinary learning

A Student has a choice of registering for courses comprising program core, professional electives, open electives, MOOC courses, value added / Skill based courses. Besides, choice is also offered to students for registering courses to earn Minor in Engineering/Honors degree.

9. Course Enrollment and Registration

9.1 Each student, on admission shall be assigned to a Faculty Advisor (Mentor) who shall advice and counsel the student about the details of the academic program

and the choice of courses considering the student's academic background and career objectives.

9.2 Each student on admission shall register for all the courses prescribed in the curriculum in the student's first and second Semesters of study. The student shall enroll for the courses with the help of the student's Faculty Advisor (Mentor). The enrollment for the courses from II B.Tech I Semester to IV B.Tech I Semester shall commence 10 days prior to the last instructional day of the preceding semester for registration process. If the student wishes, the student may drop or add courses (vide clause 8) 10 days prior to commencement of the concerned semester and complete the registration process duly authorized by the Chairman, Board of Studies of concerned department.

9.3 If any student fails to register the courses in a semester, he shall undergo the courses as per the program structure.

9.4 After registering for a course, a student shall attend the classes, satisfy the attendance requirements, earn Continuous Assessment marks and appear for the Semester-end Examinations.

9.5 Elective courses shall be offered by a Department only if a minimum of 40 students register for that course.

10. OPEN ELECTIVE (MOOC)

OPEN ELECTIVE (MOOC) is an online course aimed at unlimited participation and open access via the web.

10.1 A Student is offered an Open Elective (MOOC), in the IV B.Tech I-Semester, and is pursued through Massive Open Online Course (MOOC) platforms. The duration of the MOOC courses shall be for a minimum period of 08 weeks.

10.2 The student shall confirm registration by enrolling the course within 10 days prior to the last instructional day of the III B.Tech II-Semester along with other courses.

10.3 The list of courses along with MOOC service providers shall be identified by the Chairman, BOS, and Head of the Department. The identified Open Elective (MOOC) courses are to be approved by the Chairman, Academic Council.

10.4 The student has to submit MOOC certificate with percentage of Score earned to the Head of the Department at the end of the semester. Based on the score earned, the equivalent Grade Point and Credits will be assigned.

10.5 Attendance is not applicable for MOOC Course and also attendance will not be monitored.

10.6 If the student fails to submit the MOOC certificate at the end of the semester, his performance in MOOC will be shown as "Fail" in the Grade sheet. Then the student shall register for the supplementary examinations and submit the MOOC certificate.

11. BREAK OF STUDY FROM A PROGRAM (Gap Year)

11.1 A student is permitted to go on break of study for a maximum period of two years either as two breaks of one year each or a single break of two years.

11.2 In case, a student wishes to extend the gap year for one more consecutive year, he shall be permitted with the prior approval of the Principal on the recommendations of the Head of the Department prior to the beginning of the semester in which he has taken break of study.

11.3 The student shall apply for break of study in advance, in any case, not later than the last date of the first assessment period in a semester. The gap year concept is introduced for start-up (or) incubation of an idea, National/International Internships, and professional Volunteering. The application downloaded from the website and duly filled in by the student shall be submitted to the Principal through the Head of the department. A committee shall be appointed by the Principal in this regard. Based on the recommendations of the committee, Principal shall decide whether to permit the student to avail the gap year or not.

11.4 The students permitted to rejoin the program after break of study shall be governed by the Curriculum and Regulations in force at the time of rejoining.

The students rejoining in new regulations shall apply to the Principal in the prescribed format through Head of the Department, at the beginning of the readmitted semester for registering additional/equivalent courses to comply with the curriculum in-force.

11.5 The two years period of break of study shall not be counted for the maximum Period of graduation (i.e the maximum period of graduation is 10 years for Regular admitted students and 8 years for Lateral Entry admitted students availing Gap Year).

11.6 If a student has not reported to the college after completion of the approved period of break of study he is deemed to be detained in that semester. Such students are eligible for readmission into the semester when offered next.

12. Examination System:

12.1 All components in any Program of study shall be evaluated through internal evaluation and/or an external evaluation conducted as Semester-end examination.

<table>
<tr><th>Sl. No.</th><th>Course</th><th>Marks</th><th colspan="2">Examination and Evaluation</th><th>Scheme of examination</th></tr>
<tr><td rowspan="4">1.</td><td rowspan="4">Theory</td><td>60</td><td colspan="2">Semester-end examination for 3 hours duration (External evaluation)</td><td>The examination question paper in theory courses shall be for a maximum of 60 marks. The question paper shall be of descriptive type with 10 questions each of 12 marks, taken two from each unit. Each unit shall have internal choice and 5 questions shall be answered, one from each unit.</td></tr>
<tr><td rowspan="3">40</td><td>10</td><td>Assignments (Internal evaluation).</td><td>One Assignment shall be given to the student for 10 marks during the semester and Assignment Marks finalized.</td></tr>
<tr><td>30</td><td>Mid-term Examination of 2 hours duration (Internal evaluation).</td><td>Two mid-term examinations each for 30 marks are to be conducted. For a total of 30 marks, 80% of better one of the two and 20% of the other one are added and finalized.
Mid-I: After first spell of instruction (I & II Units).
Mid-II: After second spell of instruction (III, IV & V Units).
The question paper shall be of descriptive type with 5 essay type questions each of 8 marks, out of which 3 are to be answered and evaluated for 24 marks. There shall also be 6 short answer questions each of 01 mark, all are to be answered and evaluated for 6 marks.</td></tr>
<tr><td></td></tr>
<tr><td rowspan="3">2.</td><td rowspan="3">Laboratory</td><td>50</td><td colspan="2">Semester-end Lab Examination for 3 hours duration (External evaluation)</td><td>The examination shall be conducted by the faculty member handling the laboratory (Examiner-2) and another faculty member (Examiner-1) appointed by the Chief Controller of Examinations.</td></tr>
<tr><td rowspan="2">50</td><td>30</td><td>Day-to-Day evaluation for Performance in laboratory experiments and Record. (Internal evaluation).</td><td rowspan="2">Two laboratory examinations, which includes Day-to-Day evaluation and Practical test, each for 50 marks are to be evaluated by the faculty members handling the laboratory. For a total of 50 marks 80% of better one of the two and 20% of the other one are added and finalized.
Laboratory examination-I: Shall be conducted just before FIRST mid-term examinations.
Laboratory examination-II: Shall be conducted just before SECOND mid-term examinations.</td></tr>
<tr><td>20</td><td>Practical test (Internal evaluation).</td></tr>
<tr><td>3.</td><td>Internship</td><td>100</td><td colspan="2">Semester-end Examination</td><td>The evaluation shall be done by the Department Evaluation Committee (DEC) at the end of the semester as given in 12.2.1.</td></tr>
<tr><td>4.</td><td>Open Elective (MOOC)</td><td>100</td><td colspan="2">-</td><td>Thestudent has to submit MOOC certificate with percentage of Score earned to the Head of the Department at the end of the semester. Based on the score the equivalent Grade Point and Credits will be assigned as given in10.4.</td></tr>
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Sl. No.	Course	Marks	Examination and Evaluation		Scheme of examination
5.	Socially Relevant Project	100	50	Internal Evaluation	Shall be evaluated as given in 12.2.2(i)
			50	Semester-end evaluation	Viva-Voce examination shall be conducted at the end of the semester as given in 12.2.2(ii)
6.	Mandatory Courses	40	Internal Evaluation		Shall be evaluated as given in 12.2.4
7.	Audit Courses	-	-		As detailed in 12.2.5
8.	Project Work	200	100	Internal evaluation	Continuous evaluation shall be done by the Project Evaluation Committee (**PEC)** as given in 12.2.3.
			100	Semester-end evaluation	Project Work Viva-Voce Examination shall be conducted by a Committee at the end of the semester as given in 12.2.3.

12.2 Internship/Socially Relevant Project/Project Work/Mandatory Course/ Audit Course Evaluation:

12.2.1 Internship:

The student shall undergo **Internship** in an Industry/National Laboratories/ Academic Institutions relevant to the respective branch of study. This course is to be registered during III B.Tech II-Semester and taken up during the summer vacation after completion of the III B.Tech II-Semester, for a period of FOUR weeks duration. The Industry Training/Internship shall be submitted in a Report form, and a presentation of the same shall be made before a Department Evaluation Committee (DEC) and it should be evaluated for 100 marks. The DEC shall consist of the Head of the Department, the concerned Supervisor and a Senior Faculty Member of the Department. The DEC is constituted by the Chief Controller of Examinations on the recommendations of the Head of the Department. There shall be no internal marks for Internship. The Internship shall be evaluated at the end of the IV B.Tech I-Semester.

12.2.2 Socially Relevant Project:

A project for community services shall be carried out in teams (maximum 5 students per team) to solve real life problems of society. The Students shall visit the society (Villages/Hospitals/social service organizations etc,.) to identify the problem, conduct literature survey and provide a feasible solution. Each team shall work under the supervision of a guide (faculty member).

(i) Internal Evaluation: Two internal evaluations (First evaluation before the I-Mid-term examinations and second evaluation before the II-Mid-term examinations) shall be conducted by the guide and a faculty member

nominated by the HOD. For a total of 50 marks, 80% of better one of the two and 20% of the other one are added and finalized.

(ii) Semester-end Evaluation: A report on socially relevant project shall be submitted by the team of students to the department at the end of the semester. The Viva-Voce examination shall be conducted by the concerned guide and a senior faculty member recommended by the Head of the Department and appointed by the Chief Controller of Examinations.

12.2.3 Project Work:

(i) Internal Evaluation: The Internal Evaluation shall be made by the Project Evaluation Committee (PEC) consisting of concerned supervisor and two senior faculty members, on the basis of TWO project reviews on the topic of the project. Each review shall be conducted for a maximum of "100" marks. For a total of 100 marks, 80% of better one of the two and 20% of the other one are added and finalized. The PEC is constituted by the Principal on the recommendations of the Head of the Department.

(ii) Semester-end Evaluation: The Semester-end Project Work Viva-Voce Examination shall be conducted by a Committee consisting of External examiner (nominated by the Chief Controller of Examinations), HOD and concerned Supervisor. The evaluation of project work shall be done at the end of the IV B.Tech II Semester.

Three copies of the dissertation certified in the prescribed format by the concerned Supervisor and HOD shall be submitted to the Department. One copy is to be submitted to the Chief Controller of Examinations. The examiner shall be nominated by the Chief Controller of the Examinations from the panel of SIX examiners submitted by the Department.

12.2.4 Mandatory Courses:

Mandatory courses carry **"ZERO"** credits. There shall be **NO Semester-end** examination. However, ATTENDANCE in Mandatory courses shall be considered while calculating aggregate attendance in a semester. The internal examination shall be conducted and evaluated similar to the THEORY courses. The student shall be declared to have passed the mandatory courses only when HE secures **40% marks in the internal examination.** If the student FAILS, a re-examination shall be conducted for FAILED candidates in the CONSEQUETIVE semester. The performance of the student shall be indicated in the grade sheets "**SATISFACTORY" (or) "NOT SATISFACTORY"** as given in 17.1**.** The student should pass all the mandatory courses, for the award of B.Tech degree.

12.2.5 Audit Courses:

Audit courses carry "ZERO" credits. There shall be **NO Internal** and **Semester-end examination**. However, ATTENDANCE in Audit courses shall be considered while calculating aggregate attendance in a semester. The student should study all the audit courses, and it shall be indicated in the GRADE Sheet.

12.3. Eligibility to appear for the Semester-End Examination (SEE):

12.3.1 A student shall be eligible to appear for semester-end examinations if he acquires a minimum of 75% of attendance in aggregate of all the courses in a semester.

12.3.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

12.3.3 Shortage of Attendance below 65% in aggregate **shall in no case be condoned.**

12.3.4 Students whose shortage of attendance is not condoned in any semester are not eligible to take their semester-end examinations of that class and their registration shall stand cancelled.

12.3.5 A student shall not be promoted to the next semester unless he satisfies the attendance requirements of the current semester, as applicable. The student may seek readmission for the semester when offered next. He shall not be allowed to register for the courses of the semester while he is in detention. A student detained due to shortage of attendance, shall have to repeat that semester when offered next.

12.3.6 A stipulated fee shall be payable to the College towards Condonation of shortage of attendance.

12.3.7 The attendance in ***Student Development Activities*** shall be considered for finalization of aggregate attendance.

12.3.8 For the calculation of a student attendance in any semester, the total number of classes conducted shall be counted as scheduled in the class-work time table.

12.4. Evaluation:

Following procedure governs the evaluation.

12.4.1. Marks for components evaluated internally by the faculty shall be submitted to the Controller of Examinations one week before the commencement of the

Semester-end examinations. The marks for the internal evaluation components shall be added to the external evaluation marks secured in the Semester-end examinations, to arrive at the total marks for any course in that semester.

12.4.2. Performance in all the courses is tabulated course-wise and shall be scrutinized by the Results Committee and moderation is applied if needed and course-wise marks are finalized. Total marks obtained in each course are converted into letter grades.

12.4.3. Student-wise tabulation shall be done and individual grade Sheet shall be generated and issued to the student.

12.5. Recounting/Revaluation/Personal Verification/Challenging Evaluation:

Students shall be permitted to apply for **Recounting/Revaluation/Personal Verification/Challenging Evaluation** of the Semester-end examination answer scripts within a stipulated period after payment of the prescribed fee. After completion of the process of **Recounting/Revaluation/Personal Verification/ Challenging Evaluation**, the records are updated with changes if any, and the student shall be issued a revised grade sheet. If there are no changes, the student shall be intimated the same through a notice.

12.6. Supplementary Examination:

In addition to the regular semester-end examinations conducted, the College may also schedule and conduct supplementary examinations for all the courses of other semesters when feasible for the benefit of students. Such of the candidates writing supplementary examinations may have to write more than one examination per day.

13. Academic Requirements for promotion/completion of regular B.Tech Program of study:

The following academic requirements have to be satisfied in addition to the attendance requirements for promotion/completion of regular B.Tech Program of study.

For students admitted into B.Tech. (Regular) Program:

13.1 A student shall be deemed to have satisfied the minimum academic requirements for each theory course, laboratory course, socially relevant project and project work, if he secures not less than 40% of marks in the Semester-end examination and a minimum of 40% of marks in the sum total of the internal evaluation and Semester-end examination taken together. For the courses **"Internship"** and **"Open Elective (MOOC)",** he should secure not less than 40% of marks in the semester-end examination.

13.2 A student shall be promoted from second year to third year of Program of study only if he fulfills the academic requirement of securing 25 credits from the following examinations (Irrespective of whether or not the candidate appears for the semester-end examinations as per the normal course of study):

a. **One** regular and **two** supplementary examinations of I B.Tech I Semester.

b. **One** regular and **one** supplementary examinations of I B.Tech II Semester.

c. **One** regular examination of II B.Tech I Semester.

13.3 A student shall be promoted from third year to fourth year of Program of study only if he fulfills the academic requirements of securing 42 credits from the following examinations (Irrespective of whether or not the candidate appears for the semester-end examinations as per the normal course of study):

a. **One** regular and **four** supplementary examinations of I B.Tech I Semester.

b. **One** regular and **three** supplementary examinations of I B.Tech II Semester.

c. **One** regular and **two** supplementary examinations of II B.Tech I Semester.

d. **One** regular and **one** supplementary examinations of II B.Tech II Semester.

e. **One** regular examination of III B.Tech I Semester.

* In case of getting detained for want of credits by sections 13.2 and 13.3 above, the student may make up the credits through supplementary examinations.

13.4 A student shall register for all the 160 credits and earn all the 160 credits. Marks obtained in all the 160 credits shall be considered for the calculation of the DIVISION based on CGPA.

13.5 A student who fails to earn 160 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit his seat in B.Tech. Program and his admission stands cancelled.

For Lateral Entry Students (batches admitted from the academic year 2020-2021):

13.6 A student shall be deemed to have satisfied the minimum academic requirements for each theory, practical course, Socially relevant project and Project Work, if he secures not less than 40% of marks in the semester-end examination and a minimum of 40% of marks in the sum total of the internal evaluation and semester-end examination taken together. For the courses "Internship" and "Open Elective (MOOC)", he shall be declared to have passed if he secures minimum of 40% of marks in the semester-end examination.

13.7 A student shall be promoted from third year to fourth year only if he fulfills the academic requirements of securing 25 credits from the following examinations:

a. **One** regular and **Two** supplementary examinations of II B.Tech I Semester.

b. **One** regular and **One** supplementary examinations of II B.Tech II Semester.

c. **One** regular examination of III B.Tech I Semester.

Irrespective of whether or not the candidate appears for the semester-end examination as per the normal course of study and in case of getting detained for want of credits the student may make up the credits through supplementary examinations.

13.8 A student shall register for all 118 credits and earn all the 118 credits. Marks obtained in all the 118 credits shall be considered for the calculation of the DIVISION based on CGPA.

13.9 A student who fails to earn 118 credits as indicated in the course structure within six academic years from the year of their admission shall forfeit his seat in B.Tech Program and his admission stands cancelled.

14. Minor degree in a discipline:

The concept of Minor degree is introduced in the curriculum of all B. Tech. programs offering a Major degree. The main objective of Minor degree in a discipline is to provide additional learning opportunities for academically motivated students and it is an optional feature of the B.Tech. Program. In order to earn a Minor degree in a discipline, a student has to earn 18 extra credits (By studying FIVE theory & THREE laboratory courses or SIX Theory Courses) from the core courses of the minor discipline.

a. Students having a CGPA of 8.0 or above up to II B.Tech I-Semester without any backlogs shall be permitted to register for Minor degree by paying the requisite fee.
b. An SGPA and CGPA of 7.5 has to be maintained in the subsequent semesters without any backlog subjects in order to keep the Minor Degree registration live or else it shall be cancelled.
c. Students aspiring for a Minor degree must register from III B.Tech I-Semester onwards and must opt for a Minor in a discipline other than the discipline he is registered in.
d. A Student shall register for a Minor with following combinations:

Offering Theory and Laboratory Courses: SEVEN credits in a semester starting from III B.Tech I-Semester to III B.Tech II-Semester (TWO theory & ONE laboratory courses) and FOUR credits in IV B.Tech I-Semester (ONE theory & ONE laboratory courses).

Offering Theory Courses only: SIX credits in a semester starting from III B.Tech I-Semester to IV B.Tech I-Semester (TWO theory courses).

e. The evaluation pattern of the courses shall be similar to the regular program courses evaluation.
f. Minimum strength required for offering a **Minor Degree in a** discipline is 40 students.
g. **A student registered for Minor degree shall pass in all subjects that constitute the requirement for the Minor** degree program**.** No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for **Minor** degree program.
h. The **Minor degree** shall be mentioned in the degree certificate as Bachelor of Technology in XXX with Minor in YYY. For example, Bachelor of Technology in Computer Science & Engineering with Minor in Title of the Minor Pursued. This shall also be reflected in the transcripts, along with the list of courses taken for **Minor degree** program with CGPA mentioned separately.
i. Separate course/class work and time table shall be arranged for the various Minor degree programs. Attendance regulations for these Minor discipline programs shall be as per regular courses.

NOTE: Interested meritorious students shall be permitted to register either for Minor degree in a discipline (or) Honors Degree in a discipline only, but not both.

15. Honors degree in a discipline:

The concept of Honors degree is introduced in the curriculum for all B. Tech. programs. The main objective of Honors degree is to provide additional learning opportunities for academically motivated students in the same or allied discipline and it is an optional feature of the B. Tech. program. In order to earn Honors degree in a discipline, a student has to earn **18** extra credits(By studying FIVE theory & THREE laboratory courses or SIX Theory Courses).

a. Students having a CGPA of 8.0 and above up to II B.Tech I-Semester without any backlogs shall be permitted to register for Degree with Honors by paying the requisite fee.
b. An SGPA and CGPA of 7.5 has to be maintained in the subsequent semesters without any backlog subjects in order to keep the Honors Degree registration live or else it shall be cancelled.
c. Students aspiring for a Honors degree must register from III B.Tech I-Semester onwards.
d. A Student shall register for a Honors with following combinations:

Offering Theory and Laboratory Courses: SEVEN credits in a semester starting from III B.Tech I-Semester to III B.Tech II-Semester (TWO theory &ONE laboratory courses) and FOUR credits in IV B.Tech I-Semester (ONE theory &ONE laboratory courses).

Offering Theory Courses only: SIX credits in a semester starting from III B.Tech I-Semester to IV B.Tech I-Semester (TWO theory courses).

e. The evaluation pattern of the courses shall be similar to the regular program courses evaluation.

f. Minimum strength required for offering a **Honors in a** discipline is 10% of sanctioned intake.

g. **A student registered for Honors degree shall pass in all subjects that constitute the requirement for the Honors**degree program**.** No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for **Honors**degree program.

h. The **Honors degree** shall be mentioned in the degree certificate as Bachelor of Technology Honors in XXX. Example, Bachelor of Technology (Honors) in Computer Science & Engineering. This shall also be reflected in the transcripts, along with the list of courses taken for **Honors degree** program with CGPA mentioned separately.

i. Separate course/class work and time table shall be arranged for the various Honors degree programs. Attendance regulations for these Honors discipline programs shall be as per regular courses.

NOTE: Interested meritorious students shall be permitted to register either for Minor degree in a discipline (or) Honors Degree in a discipline only, but not both.

16. Transitory Regulations:

Students who got detained for want of attendance (or) who have not fulfilled academic requirements (or) who have failed after having undergone the Program in earlier regulations (or) who have discontinued and wish to continue the Program are eligible for admission into the unfinished semester from the date of commencement of class work with the same (or) equivalent courses as and when courses are offered and they shall be in the academic regulations into which they are presently readmitted.

A regular student has to satisfy all the eligibility requirements within the maximum stipulated period of eight years and a lateral entry student within six years for the award of B.Tech Degree.

17. Grades, Semester Grade Point Average and Cumulative Grade Point Average:

17.1. Grade System: After all the components and sub-components of any course (including laboratory courses) are evaluated, the final total marks obtained shall be converted into letter grades on a "10 point scale" as described below.

Grades Conversion and Grade points Attached

% of Marks obtained	Grade	Description of Grade	Grade Points (GP)
> = 95	O	Outstanding	10
> = 85 to < 95	S	Superior	9
> = 75 to < 85	A	Excellent	8
> = 65 to < 75	B	Very Good	7
> = 55 to < 65	C	Good	6
> = 45 to < 55	D	Fair	5
> = 40 to < 45	E	Pass	4
< 40	F	Fail	0
Not Appeared	N	Absent	0
For Mandatory Courses			
>=40	P	Satisfactory	-
<40	I	Not Satisfactory	-

Pass Marks:

A student shall be declared to have passed theory course, laboratory course, Socially relevant project and project work if he secures minimum of 40% marks in external examination, and a minimum of 40% marks in the sum total of internal evaluation and external examination taken together. For Industrial training/internship he shall be declared to have passed if he secures minimum of 40% of marks in the semester-end examination. Otherwise, he shall be awarded fail grade - '**F'** in such a course irrespective of internal marks. '**F'** is considered as a fail grade indicating that the student has to pass the Semester-End Examination in that course in future and obtain a grade other than '**F'** and '**N'** for passing the course.

For the Mandatory Courses, if the student obtained 40% or more marks, then his performance shall be indicated as "P" (SATISFACTORY), otherwise the performance shall be indicated as "I" (NOT SATISFACTORY) in the grade sheet.

17.2. Semester Grade Point Average (SGPA): SGPA shall be calculated as given below on a "10 point scale" as an index of the student's performance:

$$SGPA = \frac{\sum (C\ X\ GP)}{\sum C}$$

Where "C" denotes the "credits" assigned to the courses undertaken in that semester and "GP" denotes the "grade points" earned by the student in the respective courses.

Note: SGPA is calculated only for the candidates who appeared in the semester-end regular examinations in a particular semester:

17.3. Cumulative Grade Point Average (CGPA):

The CGPA shall be calculated for a candidate appeared in the Semester-end examinations for all the courses (including Regular & Supplementary) till that semester. The CGPA shall be displayed in the Grade sheet of the Regular Semester-end examinations and also in the consolidated Grade Sheet issued at the end of the program. The CGPA is computed on a 10 point scale as given below:

$$CGPA = \frac{\sum (C\ X\ GP)}{\sum C}$$

where C denotes the credits assigned to courses undertaken up to the end of the Program and GP denotes the grade points earned by the student in the respective courses.

18. Grade Sheet: A grade sheet (Marks Memorandum) shall be issued to each student on his performance in all the courses registered in that semester indicating the **SGPA and CGPA.**

19. Consolidated Grade Sheet: After successful completion of the entire Program of study, a Consolidated Grade Sheet indicating performance of all academic years shall be issued as a final record. Duplicate Consolidated Grade Sheet shall also be issued, if required, after payment of requisite fee.

20. Award of Degree: The Degree shall be conferred and awarded by Jawaharlal Nehru Technological University Anantapur, Ananthapuramu on the recommendations of the Chairman, Academic Council, SVEC (Autonomous).

20.1. Eligibility: A student shall be eligible for the award of B.Tech Degree if he fulfills all the following conditions:

- Registered and successfully completed all the components prescribed in the Program of study to which he is admitted.
- Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of study within the stipulated time.
- Obtained CGPA greater than or equal to 4.0 (Minimum requirement for declaring as passed).

- Has NO DUES to the College, Hostel, Library etc. and to any other amenities provided by the College.
- No disciplinary action is pending against him.

20.2. Award of Division: Declaration of Division is based on CGPA.

Awarding of Division

CGPA	Division
> = 7.0	First Class with Distinction
> = 6.0 and < 7.0	First Class
> = 5.0 and < 6.0	Second Class
> = 4.0 and < 5.0	Pass Class

21. Additional Academic Regulations:

21.1 A student may appear for any number of supplementary examinations within the stipulated time to fulfill regulatory requirements for award of the degree.

21.2 In case of malpractice/improper conduct during the examinations, guidelines shall be followed as given in the ANNEXURE-I.

21.3 When a student is absent for any examination (Mid-term or Semester-end) he shall be awarded zero marks in that component (course) and grading shall be done accordingly.

21.4 When a component is cancelled as a penalty, he shall be awarded zero marks in that component.

22. Withholding of Results:

If the candidate has not paid dues to the College/University (or) if any case of indiscipline is pending against him, the result of the candidate shall be withheld and he shall not be allowed/promoted to the next higher semester.

23. Re-Registration for Improvement of Internal Marks:

Following are the conditions to avail the benefit of improvement of internal marks.

23.1 The candidate should have completed the 4 years of B.Tech course work and obtained examinations results from I B.Tech I Semester to IV B.Tech II semester.

23.2 Out of the courses the candidate has failed in the examinations due to internal evaluation marks secured being less than 40%, the candidate shall be given a chance for improvement of internal evaluation marks in the failed theory courses.

23.3 This provision is only for Theory courses. The candidate has to register for the chosen courses and fulfil the academic requirements (i.e. a student has to attend the classes regularly and appear for the mid-examinations and satisfy the

attendance requirements to become eligible for appearing at the semester-end examinations).

23.4 For each course, the candidate has to pay a fee of Rs. 10,000/- and the amount is to be remitted in the form of D.D. in favor of the Principal, SreeVidyaniketan Engineering College payable at Tirupati along with the requisition through the concerned Head of the Department.

23.5 In the event of availing the provision of Improvement of Internal evaluation marks, the internal evaluation marks as well as the Semester-end Examinations marks secured in the previous attempt(s) for the re-registered courses shall stand cancelled.

24. Amendments to Regulations:

The Academic Council of SVEC (Autonomous) reserves the right to revise, amend, or change the Regulations, Scheme of Examinations, and / or Syllabi or any other policy relevant to the needs of the society or industrial requirements etc., with the recommendations of the concerned Board(s) of Studies.

25. General:

The words such as "he", "him", "his" and "himself" shall be understood to include all students irrespective of gender connotation.

Note: Failure to read and understand the regulations is not an excuse.

ANNEXURE-I

GUIDELINES FOR DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

Rule No.	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the course of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester. The Hall Ticket of the candidate is to be cancelled.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four consecutive semesters from class work and all Semester-end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the courses of the examination (including labs and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester. The candidate is also debarred for four consecutive semesters from class work and all Semester-end examinations, if his involvement is established. Otherwise, The candidate is debarred for two consecutive semesters from class work and all Semester-end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining

		examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all Semester-end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course only.
6.	Refuses to obey the orders of the Chief Controller of Examinations/Controller of Examinations/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the Controller of Examinations or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the Controller of Examinations, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester. If the candidate physically assaults the invigilator/Controller of the Examinations, then the candidate is also debarred and forfeits his/her seat. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all Semester-end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred and forfeits the seat.

Note: Whenever the performance of a student is cancelled in any course(s) due to Malpractice, he has to register for Semester-end Examinations in that course(s) consequently and has to fulfill all the norms required for the award of Degree.

SVEC-19 CURRICULUM

Course Structure for B.Tech Program

(Effective from the Academic year 2019-20 onwards)

INFORMATION TECHNOLOGY

Mandatory Induction Program	03 weeks duration
Induction program offered before commencement of the I-Semester course work	Physical activity
	Creative Arts
	Universal Human Values
	Literary
	Proficiency Modules
	Lectures by Eminent People
	Visits to local Areas
	Familiarization to Department/Branch and Innovations

COURSE STRUCTURE

INFORMATION TECHNOLOGY (IT)

I B.Tech. – I Semester

Sl. No.	Course Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	19BT1BS01	Differential Equations and Multivariable Calculus	3	1	-	4	4	40	60	100
2.	19BT1BS04	Engineering Chemistry	3	-	-	3	3	40	60	100
3.	19BT1HS01	Communicative English	3	-	-	3	3	40	60	100
4.	19BT10501	Programming for Problem Solving	3	1	-	4	4	40	60	100
5.	19BT1BS32	Engineering Chemistry Lab	-	-	2	2	1	50	50	100
6.	19BT1HS31	Communicative English Lab	-	-	2	2	1	50	50	100
7.	19BT10331	Computer Aided Engineering Drawing	-	1	2	3	2	50	50	100
8.	19BT10531	Programming for Problem Solving Lab	-	-	2	2	1	50	50	100
Total:			**12**	**3**	**8**	**23**	**19**	**360**	**440**	**800**

I B.Tech. – II Semester

Sl. No.	Course Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	19BT2BS01	Transformation Techniques and Linear Algebra	3	1	-	4	4	40	60	100
2.	19BT1BS02	Biology for Engineers	2	-	-	2	2	40	60	100
3.	19BT1BS03	Engineering Physics	3	-	-	3	3	40	60	100
4.	19BT10201	Basic Electrical and Electronics Engineering	3	-	-	3	3	40	60	100
5.	19BT20501	Digital Logic Design	3	-	-	3	3	40	60	100
6.	19BT21501	Object Oriented Programming through Java	3	-	-	3	3	40	60	100
7.	19BT1BS31	Engineering Physics Lab	-	-	2	2	1	50	50	100
8.	19BT10231	Basic Electrical and Electronics Engineering Lab	-	-	2	2	1	50	50	100
9.	19BT20331	Engineering Workshop	-	-	2	2	1	50	50	100
10.	19BT21531	Object Oriented Programming through Java Lab	-	1	2	3	2	50	50	100
Total:			**17**	**2**	**8**	**27**	**23**	**440**	**560**	**1000**
11.	19BT1AC01	Spoken English	2	-	-	2	-	-	-	-

II B.Tech. – I Semester

Sl. No.	Course Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	19BT3BS01	Numerical Methods, Probability and Statistics	3	1	-	4	4	40	60	100
2.	19BT30501	Computer Graphics	3	-	-	3	3	40	60	100
3.	19BT30502	Computer Organization	3	-	-	3	3	40	60	100
4.	19BT30503	Data Structures	3	1	-	4	4	40	60	100
5.	19BT31201	Discrete Mathematical Structures	3	-	-	3	3	40	60	100
6.	19BT31202	Software Engineering	3	-	-	3	3	40	60	100
7.	19BT30531	Data Structures Lab	-	-	2	2	1	50	50	100
8.	19BT31231	IT Workshop	-	-	2	2	1	50	50	100
9.	19BT31232	Software Engineering Lab	-	-	2	2	1	50	50	100
Total:			**18**	**2**	**6**	**26**	**23**	**390**	**510**	**900**
10.	19BT315AC	Design Thinking	2	-	-	2	-	-	-	-

II B.Tech. – II Semester

Sl. No.	Course Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	19BT40501	Computer Networks	3	-	-	3	3	40	60	100
2.	19BT40502	Database Management Systems	3	1	-	4	4	40	60	100
3.	19BT31502	Operating Systems	3	-	-	3	3	40	60	100
4.	19BT41501	Theory of Computation	3	-	-	3	3	40	60	100
5.	**Open Elective-2**		3	-	-	3	3	40	60	100
6.	19BT3HS31	Soft Skills Lab	-	-	2	2	1	50	50	100
7.	19BT40531	Computer Networks Lab	-	-	2	2	1	50	50	100
8.	19BT40532	Database Management Systems Lab	-	-	2	2	1	50	50	100
9.	19BT31532	Operating Systems Lab	-	-	2	2	1	50	50	100
		Total:	**15**	**1**	**8**	**24**	**20**	**400**	**500**	**900**
10.	19BT3MC01	Environmental Science	2	-	-	2	-	40	-	40

III B.Tech. – I Semester

Sl. No.	Course Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	19BT40503	Design and Analysis of Algorithms	3	-	-	3	3	40	60	100
2.	19BT51201	Data Warehousing and Data Mining	3	-	-	3	3	40	60	100
3.	19BT51202	Web Technologies	3	-	-	3	3	40	60	100
4.	**Professional Elective-1**		3	-	-	3	3	40	60	100
	19BT60502	Machine Learning								
	19BT60503	Cryptography and Network Security								
	19BT51505	Software Testing								
	19BT51203	Advanced Databases								
	19BT51204	Linux Programming								
5.	**Open Elective-1**		3	-	-	3	3	40	60	100
6.	**Inter Disciplinary Elective-1**		3	-	-	3	3	40	60	100
	19BT50441	Microprocessors and Interfacing								
	19BT60407	Image Processing								
	19BT51205	Mobile Computing								
	19BT51206	Wireless Networks								
7.	19BT51231	Data Warehousing and Data Mining Lab	-	-	2	2	1	50	50	100
8.	19BT51232	Web Technologies Lab	-	-	2	2	1	50	50	100
9.	19BT51233	Socially Relevant Project-I	-	-	-	-	1	50	50	100
		Total:	**18**	-	**4**	**22**	**21**	**390**	**510**	**900**
10.	19BT5MC01	Universal Human Values	2	-	-	2	-	40	-	40

III B.Tech. – II Semester

Sl. No.	Course Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	19BT6HS02	Organizational Behavior	3	-	-	3	3	40	60	100
2.	19BT60501	Compiler Design	3	-	-	3	3	40	60	100
3.	19BT61201	Cloud Computing	3	-	-	3	3	40	60	100
4.	**Professional Elective–2**		3	-	-	3	3	40	60	100
	19BT50501	Advanced Computer Architecture								
	19BT60505	Soft Computing								
	19BT60504	Full Stack Development								
	19BT61202	Information Retrieval Systems								
	19BT61203	Semantic Web and Social Networks								
5.	**Professional Elective–3**		3	-	-	3	3	40	60	100
	19BT50502	Artificial Intelligence								
	19BT50503	Cyber Security								
	19BT61506	User Interface Design								
	19BT61204	Information Security and Management								
	19BT61205	.Net Technologies								
6.	**Inter Disciplinary Elective–2**		3	-	-	3	3	40	60	100
	19BT70412	Pattern Recognition								
	19BT70401	Embedded Systems								
	19BT60541	Ad Hoc and Wireless Sensor Networks								
	19BT61206	Intrusion Detection Systems								
7.	19BT61531	Internet of Things Lab	-	1	2	3	2	50	50	100
8.	19BT61231	Cloud Computing Lab	-	-	2	2	1	50	50	100
9.	19BT61232	Socially Relevant Project-II	-	-	-	-	1	50	50	100
Total:			**18**	**1**	**4**	**23**	**22**	**390**	**510**	**900**
10.	19BT503AC	Foundations of Entrepreneurship	2	-	-	2	-	-	-	-

IV B.Tech. – I Semester

Sl. No.	Course Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	19BT6HS01	Principles of Business Economics and Accountancy	3	-	-	3	3	40	60	100
2.	19BT71201	Data Analytics	3	-	-	3	3	40	60	100
3.	19BT71202	Mobile Application Development	3	-	-	3	3	40	60	100
4.	**Professional Elective–4**		3	-	-	3	3	40	60	100
	19BT71503	Deep Learning								
	19BT71203	Big Data Technologies								
	19BT71204	Computer Forensics								
	19BT71205	Decision Support and Intelligent Systems								
	19BT71206	System and Network Administration								
5.	**Professional Elective–5**		3	-	-	3	3	40	60	100
	19BT70501	Augmented Reality and Virtual Reality								
	19BT70503	Blockchain Technologies								
	19BT71504	High Performance Computing								
	19BT71207	Game Development								
	19BT71208	Mobile Databases								
6.	19BT7MOOC	MOOC	-	-	-	-	3	-	100	100
7.	19BT71231	Data Analytics Lab	-	-	2	2	1	50	50	100
8.	19BT71232	Mobile Application Development Lab	-	-	2	2	1	50	50	100
9.	19BT71233	Internship	-	-	-	-	2	-	100	100
		Total:	**15**	-	**4**	**19**	**22**	**300**	**600**	**900**
10.	19BT712AC	Data Science and Applications	2	-	-	2	-	-	-	-

IV B.Tech. – II Semester

Sl. No.	Course Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	19BT81231	Project Work	-	-	-	-	10	100	100	200
Total:			**-**	**-**	**-**	**-**	**10**	**100**	**100**	**200**

LIST OF COURSES FOR

OPEN ELECTIVE–1 and OPEN ELECTIVE-2

Course Code	Open Elective -1	Course Code	Open Elective -2
19BT4BS01	Material Science	19BT4HS01	Banking and Insurance
19BT4HS02	Business Communication and Career Skills	19BT4HS03	Cost Accounting and Financial Management
19BT4HS04	Entrepreneurship for Micro, Small and Medium Enterprises	19BT4HS05	Gender and Environment
19BT4HS06	German Language	19BT4HS07	Indian Economy
19BT4HS08	Indian History	19BT4HS09	Life Skills
19BT4HS10	Personality Development	19BT4HS11	Professional Ethics
19BT4HS12	Women Empowerment	19BT4HS13	Indian Tradition and Culture
19BT4HS14	Constitution of India	19BT40106	Disaster Mitigation and Management
19BT40205	Reliability and Safety Engineering	19BT40107	Sustainable Engineering
19BT50107	Environmental Pollution and Control	19BT40108	Contract Laws and Regulations
19BT50108	Planning for Sustainable Development	19BT40306	Global Strategy and Technology
19BT50109	Rural Technology	19BT40307	Management Science
19BT50505	Ethical Hacking	19BT40504	Cyber Laws and Security
19BT51207	AI in Healthcare	19BT50208	Intellectual Property Rights
19BT51506	Bioinformatics	19BT50409	Green Technologies

HONORS DEGREE and MINOR DEGREE

In addition to the Major Degree, Students have an opportunity to pursue either Minor Degree or Honors Degree as per the eligibility criteria mentioned in Academic Regulations Point No.: 14 & 15.

Honors Degree: Honors degree is awarded to the students who has undergone additional learning for 18 credits in the same discipline.

HONORS DEGREE IN INFORMATION TECHNOLOGY

Semester	Course Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
III B.Tech. I-Sem. (2 Theory +1 lab)	19BT51211	Cloud Architectures	3	-	-	3	3	40	60	100
	19BT51212	IoT on Cloud	3	-	-	3	3	40	60	100
	19BT51213	Virtualization Techniques	3	-	-	3	3	40	60	100
	19BT51235	IoT Application Development using Cloud Lab	-	-	2	2	1	50	50	100
III B.Tech. II-Sem. (2 Theory+ 1 lab)	19BT61210	Cloud Application Development	3	-	-	3	3	40	60	100
	19BT61507	Cloud Security	3	-	-	3	3	40	60	100
	19BT61207	Cloud Storage and Computing	3	-	-	3	3	40	60	100
	19BT61234	Cloud Application Development Lab	-	-	2	2	1	50	50	100
IV B.Tech. I-Sem. (1 Theory+ 1 lab)	19BT71211	Back up and Disaster Recovery	3	-	-	3	3	40	60	100
	19BT71212	Cloud and DevOps	3	-	-	3	3	40	60	100
	19BT71235	Cloud and DevOps Lab	-	-	2	2	1	50	50	100

Minor Degree: Minor degree is awarded to the students who has undergone additional learning for 18 credits in any discipline other than parent discipline.

MINOR DEGREES OFFERED UNDER SVEC-19 REGULATIONS

Offering Department	Title of the Minor	Students of Eligible Branches
CSE	Artificial Intelligence and Machine Learning	All branches except CSE, IT and CSSE
IT	Internet of Things	All branches except IT
CSSE	Cyber Security	All branches except CSE, IT and CSSE
ECE	VLSI and Embedded Systems	All branches except ECE
EEE	Power Systems and Drives	All branches except EEE
EIE	Instrumentation and Control Engineering	All branches except EIE
ME	Robotics	All branches except ME
CE	Sustainable Engineering	All branches except CE

I B. Tech. - I Semester

(19BT1BS01) **DIFFERENTIAL EQUATIONS AND MULTIVARIABLE CALCULUS**

(Common to CE, ME, EEE, ECE, EIE, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	1	-	4

PRE-REQUISITES: -

COURSE DESCRIPTION: Ordinary Differential Equations; Partial Differential Equations; Multivariable Calculus (Differentiation); Multivariable Calculus (Integration); Multivariable Calculus (Vector Calculus).

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1. Formulate and solve differential equations by applying knowledge of calculus for engineering problems.

CO2. Demonstrate knowledge in multivariable calculus for evaluating multiple integrals through techniques of integration.

CO3. Identify scalar and vector valued functions and evaluate vector integrals through knowledge of vector integral theorems and techniques.

DETAILED SYLLABUS:

UNIT-I: Ordinary Differential Equations (09 Periods)

Second and higher order linear differential equations with constant coefficients: Non-Homogeneous equations with R.H.S terms of the type e^{ax}, $\sin ax$, $\cos ax$, polynomials in x, $e^{ax}V(x)\ and\ xV(x)$; method of variation of parameters; Equations reducible to linear differential equations with constant coefficients: Cauchy's and Legendre's linear equations; Applications to L-C-R Circuit problems.

UNIT-II: Partial Differential Equations (09 Periods)

Formation of PDE, solutions of first order linear and non-linear PDEs, solution to homogenous and non-homogenous linear partial differential equations of second and higher order by complimentary function and particular integral method, method of separation of variables in Cartesian coordinates.

UNIT- III: Multivariable Calculus (Differentiation) (09 Periods)

Partial derivatives, Chain rule, Total derivative, Jacobian, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

UNIT-IV: Multivariable Calculus (Integration) (09 Periods)

Evaluation of Double integrals (Cartesian and polar coordinates), Change of order of integration (Cartesian form only); Evaluation of Triple integrals; Change of variables: double integration from Cartesian to polar coordinates, Triple integration from Cartesian to spherical and cylindrical polar coordinates; Areas enclosed by plane curves.

UNIT-V: Multivariable Calculus (Vector Calculus) (09 Periods)

Vector Differentiation: Scalar and Vector fields: Gradient of a scalar field, directional derivative, divergence of a vector field, solenoidal vector, curl of a vector field, irrotational vector, Laplacian operator. **Vector Integration:** Line integral-circulation-work done, Surface integral-flux and Volume integral; Vector integral theorems: Theorems of Green, Gauss and Stokes (without proofs).

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. T. K. V. Iyengar, B. Krishna Gandhi, S. Ranganatham and M. V. S. S. N. Prasad, *Engineering Mathematics, vol-1*, S. Chand and Company, 13th edition, 2014.
2. B. S. Grewal, *Higher Engineering Mathematics*, Khanna publishers, 44th edition, 2017.

REFERENCE BOOKS:

1. Dennis G. Zill and Warren S. Wright, *Advanced Engineering Mathematics*, Jones and Bartlett, 6th edition, 2011.
2. R. K. Jain and S. R. K. Iyengar, *Advanced Engineering Mathematics*, Alpha Science International Ltd., 6th edition, 2017.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Level of correlation of the course	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. - I Semester

(19BT1BS04) ENGINEERING CHEMISTRY

(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Atomic Structure and Bonding Theories; Water Treatment; Electrochemistry and Applications; Corrosion; Instrumental Methods and Applications; Fuel chemistry and Lubricants.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1. Apply the basic knowledge of quantum mechanical approach to atomic structure and bonding theories to identify shapes of different orbitals and molecules.

CO2. Analyze and solve problems associated with hardness of water, boiler troubles and address the societal, health and safety issues related to quality of water.

CO3. Apply the basic knowledge of corrosion phenomenon to identify solutions for control of corrosion and demonstrate competency in the basic concepts of electrochemical cells.

CO4. Demonstrate the basic knowledge of instrumental methods and their applications in the structural analysis of materials.

CO5. Apply the basic knowledge of fuel chemistry and lubricants to identify the quality of fuels and lubricants.

DETAILED SYLLABUS:

UNIT-I: ATOMIC STRUCTURE AND BONDING THEORIES (09 Periods)

Quantum-mechanical model of atom, Schrodinger wave equation, significance of Ψ and Ψ^2, applications to particle in a box and hydrogen atom; Molecular orbital theory – bonding in homo and hetero nuclear diatomic molecules – energy level diagrams of N_2, O_2, NO and CO; Π-molecular orbitals of butadiene and benzene; VSEPR theory and molecular shapes.

UNIT-II: WATER TREATMENT (09 Periods)

Introduction, types of water, Impurities in water and their consequences. Hardness of water, units of hardness, disadvantages of hardness, measurement of hardness by EDTA method, numerical problems on measurement of hardness of water, boiler troubles-priming & foaming, scales & sludge, caustic embrittlement, boiler corrosion, softening of water– Ion exchange process, zeolite process, desalination of brackish water by reverse osmosis, Drinking water treatment- Ozonisation & chlorination, specifications of potable water as per WHO and BIS standards. Fluoride in ground water: Effects on human health, defluoridation method – Nalgonda method; merits and demerits of various defluoridation methods.

UNIT-III: ELECTROCHEMISTRY AND APPLICATIONS (10 Periods)

Electrode potential, Nernst equation, reference electrodes (Calomel electrode and glass electrode), electrochemical cell, cell potential calculations. Primary cells – dry cell, alkali metal sulphide batteries, Secondary cells – lead acid, lithium ion batteries, Fuel cells - Hydrogen-oxygen fuel cell, Methanol-oxygen fuel cell, Solid-oxide fuel cell.

Corrosion: Introduction, Definition, types of corrosion- wet (galvanic corrosion, concentration cell corrosion) and dry corrosion, Factors influencing corrosion, control of corrosion- sacrificial anodic protection, Impressed current cathodic protection, electroplating method (Nickel).

UNIT-IV: INSTRUMENTAL METHODS AND APPLICATIONS (09 Periods)

Introduction to spectroscopy–types of energy present in molecules, types of spectra, UV-Vis spectroscopy – principle, types of electronic transitions, chromophore, auxochrome, Bathochromic shift, Hypsochromic shift, Instrumentation of UV-Vis spectrophotometer, applications; Infrared spectroscopy – principle, types of vibrational modes, group frequencies, Instrumentation of IR spectrophotometer, applications. principle and applications of physicochemical methods (SEM, TEM, X-ray diffraction).

UNIT-V: FUEL CHEMISTRY AND LUBRICANTS (08 Periods)

Fuel chemistry: Types of fuels, calorific value, numerical problems based on calorific value; Liquid fuels, cracking of oils (Thermal and Fixed-bed catalytic cracking), knocking and anti-knock agents, Octane and Cetane values, Synthetic petrol: Fischer-Tropsch method and Bergius process.

Lubricants: Definition, functions of lubricants, mechanism of lubrication, classification of lubricants, properties of lubricants – viscosity and viscosity index , flash and fire points, cloud and pour points, Aniline points, neutralization number and mechanical strength.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. P. C. Jain & Monika Jain*, Engineering Chemistry*, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 16th edition, 2013.
2. K. N. Jayaveera, G. V. Subba Reddy and C. Ramachandriah, *Engineering Chemistry,* Mc.Graw Hill Publishers, New Delhi.

REFERENCE BOOKS:

1. J. D. Lee, *Concise Inorganic Chemistry*, Oxford University Press, 5th edition 2010.
2. Skoog and West, *Principles of Instrumental Analysis*, Thomson, 6th edition, 2007.
3. Peter Atkins, Julio de Paula and James Keelar, *Atkins' Physical Chemistry*, Oxford University Press, 10th edition, 2010.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	2	1	-	-	-	-	-	-	-	-	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	1.2	-	-	-	2	1	-	-	-	-	-	-	-	-	-
Level of correlation of the course	3	2	-	-	-	2	1	-	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. – I Semester

(19BT1HS01) COMMUNICATIVE ENGLISH

(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Introduction to communication; Active listening; Effective speaking; Reading; Technical writing.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1. Demonstrate knowledge of English language, examining and applying the aspects of Process of communication, Paralinguistic features, Skimming, Scanning, and Elements of style in writing.

CO2. Analyze the modes and techniques of listening, speaking, reading, writing and apply appropriately to communicate effectively with the engineering community and society.

CO3. Apply reading and writing techniques in preparing documents by examining SQ3R Technique, Writer's Block, and Précis Writing.

CO4. Communicate effectively applying appropriate speaking techniques by examining and applying the communication styles in Conferences, Symposia, Seminars and Persuasive Speaking.

DETAILED SYLLABUS:

UNIT- I: INTRODUCTION TO COMMUNICATION (09 Periods)

Introduction – Language as a Tool of Communication – Communicative Skills (Listening, Speaking, Reading and Writing) – Effective Communication – Modes of Communication– Barriers to Communication (classification) - Case study

UNIT- II: ACTIVE LISTENING (09 Periods)

Introduction –Traits of a Good Listener – Listening Modes – Types of Listening – Barriers to Effective Listening – Listening for General Content and Specific Information - Case study

UNIT- III: EFFECTIVE SPEAKING (09 Periods)

Introduction – Achieving Confidence, Clarity and Fluency – Paralinguistic Features – Barriers to Speaking – Types of Speaking – Conferences; significance, planning and preparation and procedure – Symposia and Seminars - Persuasive Speaking - Case study

UNIT- IV: READING (09 Periods)

Introduction – Reading and Interpretation – Intensive and Extensive Reading – Critical Reading ––Techniques for Good Comprehension- SQ3R Reading Technique –Study Skills - Case study

UNIT – V: TECHNICAL WRITING (09 Periods)

Introduction – Language – Elements of Style – Techniques for Good Technical Writing – Paragraphs Construction – Essays: types, Steps to Essay Writing and Checklist – Précis Writing - Case study

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Meenakshi Raman & Sangeetha Sharma, *Technical Communication*, Oxford University Press, New Delhi, 2012.
2. Ashraf Rizvi*, Effective Technical Communication*, McGraw-Hill Education (India) Pvt. Ltd., New Delhi, 2018.

REFERENCE BOOKS:

1. Sanjay Kumar & Pushp Lata, *Communication Skills*, Oxford University Press, New Delhi, 2013.
2. Rajendra Pal and J. S. Korlahalli, *Essentials of Business Communication*, Sultan Chand and Son, New Delhi, 2010.

ADDITIONAL LEARNING RESOURCES

1. https://www.skillsyouneed.com/ips/active-listening.html: A useful summary of what active listening skills are.
2. https://en.wikipedia.org/wiki/Active_listening: Wikipedia entry about active listening.
3. https://www.forbes.com/sites/womensmedia/2012/11/09/10-steps-to-effective-listening/#4b27a2503891: Ten steps to Active Listening (by Forbes magazine).
4. https://goo.gl/t1Uqrt: 20 tips for organizing a conference.
5. https://goo.gl/kPMr9u: 10 important issues for speakers at a conference.
6. https://goo/gl/C5bDvv: Wikihow guide to organizing a conference.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-		-	-	-	-	-	-	-	-	-	-	-
CO2	1	3	-	-	-		-	-	-	-		-	-	-	-	-
CO3	1	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-
CO4	1	1	-	-	2	-	-	-	-	3	-	1	-	-	-	-
Average	1.25	1.6	-	-	2	-	-	-	-	3	-	1	-	-	-	-
Level of correlation of the course	1	2	-	-	2	-	-	-	-	3	-	1	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. – I Semester

(19BT10501) PROGRAMMING FOR PROBLEM SOLVING

(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	1	-	4

PRE-REQUISITES: A course on Basic Mathematics

COURSE DESCRIPTION: Introduction to problem solving approach, Introduction to Python programming, control structures, sequences, sets, Dictionaries, Implementation of Data structures using Python, Modular programming, file handling, Data representation and Visualization.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1: Demonstrate knowledge on Python constructs to solve basic problems.
CO2: Develop and use Python modules to provide solutions to problems.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO PROBLEM SOLVING AND PYTHON PROGRAMMING (10 Periods)

Problem Solving Aspect: top-down design, implementation of algorithms, building blocks of flow charts, program verification and efficiency of algorithms.
Python Programming: tokens, literals, identifiers, keywords, special symbols and operators; fundamental data types, expressions, type conversions, handling Input and output in Python.

UNIT-II: CONTROL STRUCTURES (08 Periods)

Selection Statements: if statement, if-else statement, if-elif-else statement, nested-if statement.
Iterative Statements: while loop, for loop, break statement, continue statement, pass and else statements used with loops.

UNIT-III: SEQUENCES, SETS, DICTIONARIES AND DATA STRUCTURES (09 Periods)

Sequences: Lists and operations - creating, inserting elements, updating elements, deleting elements, searching and sorting, list comprehensions, nested lists; **tuples -** creating, searching and sorting, nested tuples; **strings -** Initializing a string and string operations, string handling methods, string formatting; **sets -** set creation and operations; **dictionaries -** operations on dictionaries, dictionary methods, sorting elements using lambdas.
Data structures: Stacks - push, pop, peek and display operations on stack, applications of stack; **Queues –** enqueue, dequeue and display operations on queue, applications of queues.

UNIT-IV: MODULAR PROGRAMMING AND FILE HANDLING (10 Periods)

Modular Programming: need for functions, function definition, function call, variable scope and lifetime, return statement, positional arguments, keyword arguments, default arguments and variable-length arguments, recursive functions; Modules - math, NumPy, date and time.
File Handling: types of files, opening and closing files, reading and writing data.

UNIT-V: DATA REPRESENTATION AND VISUALIZATION (08 Periods)

Pandas: creating data frame, reading data from CSV files, indexing and selecting data, dealing with rows and columns; Visualization - bar plots, histogram, Scatter Plot.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. R. Nageswara Rao, *Core Python Programming,* 2nd edition, Dreamtech Press, 2018.
2. R. G. Dromey, *How to solve it by Computer,* Pearson, 2006.

REFERENCE BOOKS:

1. Reema Thareja, *Python Programming using Problem Solving Approach,* 1st edition, Oxford University Press, 2017.
2. Charles Dierbach*, Introduction to Computer Science using Python: A Computational Problem-Solving Focus,* Wiley India, 2016.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
Average	3	2.5	2.5	2.5	3	-	-	-	-	-	-	-	-	-	3	-
Level of correlation of the course	3	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. - I Semester

(19BT1BS32) ENGINEERING CHEMISTRY LAB

(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: -

COURSE DESCRIPTION: Estimation of hardness, alkalinity, dissolved oxygen of water samples, Iron, Strength of an acid in Pb-acid battery and residual chlorine in drinking water by volumetric methods; Measurement of viscosity of lubricants; Instrumental methods like conductivity meter, potentiometer, P^H meter and colorimeter; Characterization of simple organic compounds by UV-Vis and IR spectroscopy.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1. Apply analytical skills for the quantitative estimation of materials through volumetric methods of analysis and address the societal, health issues related to quality of water.

CO2. Develop analytical skills for the quantitative estimation of materials through instrumental methods of analysis.

CO3. Work independently and in teams to solve problems with effective communication.

A minimum of any **Ten** experiments are to be conducted among the following:

List of Experiments

1. Estimation of Hardness of water by EDTA method
2. Determination of alkalinity of Water sample
3. Estimation of Dissolved Oxygen in water by Winkler's method.
4. Estimation Fe (II) by Dichrometry
5. Conductometric titration of strong acid Vs strong base
6. Estimation of Ferrous ion by Potentiometry
7. Determination of strength of acid by P^H metric method
8. Determination of Strength of an acid in Pb-Acid battery
9. Determination of Viscosity by Ostwald's viscometer
10. Determination of percentage of Iron in Cement sample by colorimetry
11. Estimation of residual chlorine in drinking water.
12. Identification of simple organic compounds by UV-Vis and IR spectroscopy

TEXT BOOKS:

1. K. Mukkanti, *Practical Engineering Chemistry*, BS Publications, 2013.
2. K. N. Jayaveera, K.B. Chandra Sekhar, *Chemistry laboratory manual*, S.M. Enterprises Limited, 2013.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	-	2	1	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	2	2	2	-	-	-	-	-	-
Average	3	3	-	-	2	2	1	2	2	2	-	-	-	-	-	-
Level of correlation of the course	3	3	-	-	2	2	1	2	2	2	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech.-I Semester

(19BT1HS31) COMMUNICATIVE ENGLISH LAB

(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: -

COURSE DESCRIPTION: Phonetics; Vocabulary Building; Grammar; Just a Minute; Elocution/Impromptu; Giving Directions; Role Plays; Public Speaking; Describing Objects; Reading Comprehension; Listening Comprehension; Information Transfer; Letter Writing

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge of Phonetics by examining and applying sounds of English in Phonetic Transcription.

CO2. Analyze sentence structures by applying and demonstrating the skills of Vocabulary and Grammar.

CO3. Apply appropriate listening and reading skills by analyzing the context and demonstrate in Listening Comprehension and Reading Comprehension.

CO4. Function effectively as an individual and as a member in diverse teams examining and applying speaking skills in Just A Minute and Role Play.

CO5. Communicate effectively applying appropriate writing and speaking techniques by examining and demonstrating knowledge through Describing Objects, Information Transfer and Letter Writing.

***First ten exercises are mandatory among the following:**

List of Exercises:

1. **Just a Minute, Elocution/Impromptu**
   Steps to be followed – Useful tips – Dos & Don'ts – Preparation – Examples
2. **Phonetics**
   Sounds of English – Consonants – Vowels – Speech Organs – Phonetic Transcription – Word Accent – Basics of Intonation
3. **Vocabulary Building**
   Prefixes & Suffixes – Synonyms & Antonyms – Phrasal verbs – Idioms – One word substitutes – Words often confused
4. **Grammar**
   Tenses –Nouns – Word order and error correction
5. **Giving Directions**
   Useful phrases – Sample conversations - Exercises
6. **Role Plays**
   Useful tips – Dos & Don'ts – Exercises – Role Plays for practice
7. **Public Speaking**
   Stage presence – Voice control – Body Language – Rehearsals – Audience – Delivery - Dos & Don'ts – Project Submission
8. **Letter Writing**
   Introduction – Objective – Formats – Types – Exercises
9. **Describing Objects**
   Jargon – Useful Phrases – Do's & Don'ts – Exercises
10. **Listening Comprehension**
    Introduction – Types of listening – Practice – Benefits of listening – Exercises
11. **Information Transfer**
    Tables – Pie Charts – Venn Diagrams – Graphs – Flow Charts – Steps to be followed – Exercises

12. Reading Comprehension

Introduction – Types of reading – Inferring – Critical analysis – Exercises

TEXT BOOK:

1. *Communicative English Lab Manual* (SVEC-19)

REFERENCE BOOKS:

1. D. Sudha Rani, *A Manual for English Language Laboratories*, Pearson, Noida, 2010.
2. Nira Kumar, English *Language Laboratories*, PHI Learning Pvt. Ltd., New Delhi, 2011.

SUGGESTED SOFTWARE:

1. SoftX
2. Speech Solutions
3. English Pronunciation Dictionary by Daniel Jones
4. Learning to Speak English 8.1, The Learning Company – 4 CDs.
5. Mastering English: Grammar, Punctuation and Composition.
6. English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
7. Dorling Kindersley Series of Grammar.
8. Language in Use 1, 2 & 3
9. Cambridge Advanced Learner's Dictionary - 3rd Edition
10. Centronix – Phonetics
11. Let's Talk English, Regional Institute of English South India.

ADDITIONAL LEARNING RESOURCES

1. https://goo.gl/IjE45p:Amazon India site – with thousands of different product descriptions
2. https://goo.gl/3ozeO6: 15 ways to calm your nerves before giving a presentation.
3. https://goo.gl/p20ttk: useful site for more language about introducing yourself.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO4	1	1	-	-	2	-	-	-	1	-	-	-	-	-	-	-
CO5	1	2	-	-	2	-	-	-	-	3	-	1	-	-	-	-
Average	1.4	1.75	-	-	1.6	-	-	-	1	3	-	1	-	-	-	-
Level of correlation of the course	1	2	-	-	2	-	-	-	1	3	-	1	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. – I Semester

(19BT10331) COMPUTER AIDED ENGINEERING DRAWING

(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	1	2	2

PRE-REQUISITES: -

COURSE DESCRIPTION: Engineering drawing conventions; Importance of engineering drawing; fundamental concepts of sketching; computer aided drafting and different types of projections of geometric entities (both 2D and 3D) through computer aided drafting packages.

COURSE OUTCOMES: After successful completion of this course, students will be able to:

CO1: Apply the principles of engineering drawing, Methods and CAD tools to draw the Geometries, Curves and Orthographic projections used to communicate in engineering applications.

CO2: Develop lateral surfaces of solids and draw Isometric views of given objects for engineering communication using principles of engineering drawing and CAD tools.

CO3: Work independently / in groups & communicate effectively in oral and written forms.

DETAILED SYLLABUS:

Introduction to Engineering Graphics and Design:

Principles, significance -Conventions in drawing-lettering - BIS conventions-Dimensioning principles and conventional representations.

Exercises:

1. Practice exercise on Basic Lettering and Dimensioning
2. Practice exercise on Conventional representations

Introduction to AutoCAD: Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions.

Exercises:

3. Practice exercise using basic drawing commands
4. Practice exercise using editing commands

CONICS, CURVES, PROJECTION OF POINTS, LINES AND PLANES

Conics & Special Curves: Conic sections including the rectangular hyperbola-eccentricity method only; Cycloid, Epicycloid and Hypocycloid, Involutes.

Exercises:

5. Practice exercises on Ellipse, Parabola, Hyperbola and Rectangular Hyperbola
6. Practice exercises on Cycloid, Epicycloid, Hypocycloid and Involutes

Projection of points, lines and planes: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line , Projections of regular plane surfaces.

Exercises:

7. Practice exercises on Projection of points
8. Practice exercises on projection of lines inclined to one plane
9. Practice exercises on projection of lines inclined to both planes
10. Practice exercises on Projections of regular plane surfaces

PROJECTION OF SOLIDS AND SECTION OF SOLIDS

Projection of solids: Projection of regular solids inclined to one plane.

Sections of solids: Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone, True shapes of the sections.

Exercises:

11. Practice exercises on Projections of regular solids
12. Practice exercises on Sections of solids

DEVELOPMENT OF SURFACES

Development of surfaces: Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

Exercises:

13. Practice exercises on Development of surfaces of right regular solids

ORTHOGRAPHIC AND ISOMETRIC PROJECTIONS

Orthographic Projections: Systems of projections, conventions and application to orthographic projections.

Isometric Projections: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple solids.

Exercises:

14. Practice exercises on Orthographic Projections
15. Practice exercises on Isometric Projections

TEXT BOOKS:

1. D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, *Engineering Graphics with AutoCAD*, PHI Learning Private Limited, New Delhi, Revised edition, 2010.
2. N D Bhatt and V M Panchal, *Engineering Drawing*, Charotar Publishing House, Gujarat, 51st edition, 2013.

REFERENCE BOOKS/LABORATORY MANUALS:

1. Sham Tickoo, *AutoCAD 2013 for Engineers and Designers*, Dreamtech Press, 2013.
2. M. H. Annaiah & Rajashekar Patil, *Computer Aided Engineering Drawing*, New Age International Publishers, 4th edition, 2012.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1	3	1	1	1	-	-	-	-	-	-	-	-
CO2	3	3	3	1	3	1	1	1	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Average	3	3	3	1	3	1	1	1	3	3	-	-	-	-	-	-
Level of correlation of the course	3	3	3	1	3	1	1	1	3	3	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. – I Semester

(19BT10531) PROGRAMMING FOR PROBLEM SOLVING LAB

(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A course on Basic Mathematics

COURSE DESCRIPTION: The course is designed to provide hands on practice on Scratch programming and python programming for problem solving.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Develop scripts using Scratch tool to simulate simple problems.
CO2. Apply Python Constructs and Modules to develop solutions for real-life problems.
CO3. Function effectively as an individual and in team to foster knowledge and creativity.
CO4. Write and present a substantial technical report/ document effectively.

PRACTICAL EXERCISES:

1) a) Design a script in Scratch to simulate Airplane for take-off and land.
   b) Design a script in Scratch to make a sprite to ask the user to enter two different numbers and an arithmetic operator and then calculate and display the result.
2) a) Design a script in Scratch to calculate factorial of a given number.
   b) Design a script in Scratch to simulate Maze game. (Hint: To get Maze images refer http://inventwithScratch.com/downloads/)
3) a) Write a python script to read two integer numbers and perform arithmetic operations.
   b) Write a python script to evaluate following expressions by considering necessary inputs.
   i) $ax^2 + bx + c$ ii) $ax^5 + bx^3 + c$ iii) (ax + b) / (ax - b) iv) x - a / b + c
4) a) Write a python script to convert given decimal number into octal, hexa decimal and binary.
   b) Write a python script to read four integer values separated with commas and display the sum of those four numbers.
   c) Write a python script to print "SVEC" with prefix of ten spaces by using format().
5) a) Write a python script to calculate electricity bill based on following slab rates.

Consumption units	Rate (in Rupees/Unit)
0-100	4
101-150	4.6
151-200	5.2
201-300	6.3
Above 300	8

   (Hint: To get Consumption units take current Meter reading, old meter reading from the user as input)
   b) Print the following pattern using python script.

```
                1
            1   2   1
        1   2   3   2   1
    1   2   3   4   3   2   1
1   2   3   4   5   4   3   2   1
```

6) a) Write a python script to read *N* student details like name, roll number, branch and age. Sort the student details based on their names and display.
   b) Write a python script to delete duplicate strings from a list of strings.

(Insertion order should maintain after deleting duplicate string).

c) Write a python script to read N number of student details into nested list and convert that as a nested dictionary.

7) a) Design a function that can perform sum of two or three or four numbers.

b) Write a python script to implement towers of Hanoi problem.

c) Write a Python function prime square(l) that takes a nonempty list of integers and returns True if the elements of l alternate between perfect squares and prime numbers, and returns False otherwise. Note that the alternating sequence of squares and primes may begin with a square or with a prime. Here are some examples to show how your function should work.

```
>>>primesquare([4])
True
>>>primesquare([4,5,16,101,64])
True
>>>primesquare([5,16,101,36,27])
False
```

8) a) Write a python script to perform arithmetic operations on numpyarrays.

b) Write a python script to perform following matrix operations using numpy.
i) Dot product ii) Matrix product iii) Determinant iv) Inverse

9) a) Write a python script to Create Pandas data frame using list of lists.

b) Write a python script to load data from a CSV file into a Pandas Data Frame and perform basic operations on it.

10) a) Draw a Scatter Plot by considering an appropriate data set.

b) Draw histograms by considering an appropriate data set.

11) **Mini Project-1**

12) **Mini Project-2**

TEXT BOOK:

1. R. Nageswara Rao, *Core Python Programming*, 2nd edition, Dreamtech Press, 2018.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	-	-	-	-	-	-	3	-	-	-	-	-	3	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-	3	-
Average	3	2.5	3	3	3	-	-	-	3	3	-	-	-	-	3	-
Level of correlation of the course	3	2.5	3	3	3	-	-	-	3	3	-	-	-	-	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. - II Semester

(19BT2BS01) TRANSFORMATION TECHNIQUES AND LINEAR ALGEBRA

(Common to CE, ME, EEE, ECE, EIE, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	1	-	4

PRE-REQUISITES: -

COURSE DESCRIPTION: Fourier Series and Fourier Transforms; Laplace Transforms; Inverse Laplace Transforms; Linear Algebra-I (Matrices); Linear Algebra-II (Vector Spaces).

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply the knowledge of Fourier and Laplace transform techniques to solve differential equations.

CO2. Analyze linear transformations and associated matrices to solve engineering problems by applying the knowledge of linear algebra.

DETAILED SYLLABUS:

UNIT- I: FOURIER SERIES AND FOURIER TRANSFORMS (09 Periods)

Fourier series: Determination of Fourier coefficients, Euler's formulae, convergence of Fourier series (Dirichlet's conditions), Fourier series in $(0,2l),(-l,l)$; Fourier series of even and odd functions; Half-range Fourier sine and cosine expansions in $(0,l)$; Fourier integral theorem (statement only), Fourier sine and cosine integrals; Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier transforms.

UNIT-II: LAPLACE TRANSFORMS (09 Periods)

Definition of Laplace transform, existence conditions, Laplace transform of standard functions, Properties of Laplace transforms, Laplace transforms of derivatives, Laplace transforms of integrals, multiplication by t^n, division by t, Laplace transform of periodic functions, Laplace transforms of unit step function and unit impulse function.

UNIT- III: INVERSE LAPLACE TRANSFORMS (09 Periods)

Inverse Laplace transform by different methods; Convolution theorem (without proof), inverse Laplace transforms by convolution theorem; Applications of Laplace transforms to ordinary differential equations of first and second order with constant coefficients.

UNIT- IV: LINEAR ALGEBRA-I (MATRICES) (09 Periods)

Rank of a matrix: echelon form; Linear systems of equations: solving system of Homogeneous and Non-Homogeneous equations; Eigen values and Eigen vectors of a matrix and properties (without proofs), Diagonalization of a matrix by orthogonal transformation; Quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical form by orthogonal transformation.

UNIT- V: LINEAR ALGEBRA-II (VECTOR SPACES) (09 Periods)

Vector spaces, Linear dependence and independence of vectors, basis, dimension, Linear transformations (maps), range and kernel of a linear map, rank and nullity, inverse of a linear transformation, rank-nullity theorem (without proof), matrix associated with a linear map.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. T.K.V. Iyengar, B. Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad, *Engineering Mathematics-II,* S. Chand & Company, 10th edition, 2016.
2. B. S. Grewal, *Higher Engineering Mathematics,* Khanna publishers, 44th edition, 2017.
3. David Poole, *Linear Algebra:A Modern Introduction,* Brooks/Cole, 2nd edition, 2005.

REFERENCE BOOKS:

1. B.V. Ramana, *Higher Engineering Mathematics*, Tata McGraw hill, 1st edition, 2017.
2. V.Krishna Murthy, Mainra and Arora: *An Introduction to Linear Algebra*, Affiliated East-West Press, 1993.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Level of correlation of the course	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. - II Semester

(19BT1BS02) BIOLOGY FOR ENGINEERS

(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	2	-	-	2

PRE-REQUISITES: -

COURSE DESCRIPTION: Living Organisms; Proteins, Nucleic acids and Enzymes; Genetics and Molecular Biology; Recombinant DNA technology; Human Physiology and Applied Biology.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply the basic knowledge of biology to understand the significance of various biological techniques.

CO2. Identify the role of DNA in the molecular basis of information transfer and understand single gene disorders related to the health perspective.

CO3. Apply the basic knowledge of bio-analytical devices and methods to assess health issues.

DETAILED SYLLABUS:

UNIT- I: LIVING ORGANISMS (06 Periods)

Comparison of biological organisms with man-made systems, Classification of living organisms, Cellular basis of life, differences between prokaryotes and eukaryotes, classification on the basis of carbon and energy sources, molecular taxonomy

UNIT- II: PROTEINS, NUCLEIC ACIDS AND ENZYMES (06 Periods)

Bio molecules, structure and functions of proteins and nucleic acids, Industrial applications of enzymes, Fermentation and its industrial applications

UNIT- III: GENETICS AND MOLECULAR BIOLOGY (06 Periods)

Mendel's laws, single gene disorders in humans, Genetic code, DNA replication, Transcription, Translation.

UNIT- IV: RECOMBINANT DNA TECHNOLOGY (06 Periods)

Recombinant DNA Technology: recombinant vaccines, transgenic microbes, plants and animals, animal cloning, biosensors, biochips.

UNIT- V: HUMAN PHYSIOLOGY AND APPLIED BIOLOGY (06 Periods)

Fundamentals of Human physiology, neurons, synaptic and neuromuscular junctions, Introduction to EEG, DNA fingerprinting, DNA Micro array and Genomics.

Total Periods: 30

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Rajiv Singal, Gaurav Agarwal, *Biology for Engineers*, CBS, 2019.
2. S. Sing and T. Allen, *Biology for Engineers*, Vayu Education of India, 2014.

REFERENCE BOOKS:

1. B. Alberts, A. Johnson et al., *The molecular biology of the cell*, Garland Science, 6th edition, 2014.
2. A. T. Johnson, *Biology for Engineers*, CRC press, 2011.

ADDITIONAL LEARNING RESOURCES:

1. Structure and function of Proteins: https://nptel.ac.in/courses/104102016/16
2. Enzyme catalysis: https://nptel.ac.in/courses/103103026/module3/lec35/4.html
3. Biochips: https://nptel.ac.in/courses/112104029/3

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
Average	3	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-
Level of correlation of the course	3	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. - II Semester

(19BT1BS03) **ENGINEERING PHYSICS**

(Common to CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES:-

COURSE DESCRIPTION: Wave Optics; Electromagnetic Waves; Fiber Optics; Semiconductors; Dielectrics; Magnetism; Superconductors and Nanomaterials

COURSE OUTCOMES: After successful completion of course, students will be able to:

CO1. Apply the knowledge of light waves to interpret the concepts of Interference, Diffraction and Polarization

CO2. Demonstrate the concepts of electromagnetic wave propagation in an Optical fibers.

CO3. Apply the basic knowledge of semiconductors to understand the functioning of various optoelectronic devices.

CO4. Demonstrate the basic knowledge of dielectric and magnetic properties to understand the various dielectric polarizations and magnetic materials.

CO5. Understand the concepts of superconductors and nanomaterials to familiarize their applications in relevant fields.

DETAILED SYLLABUS:

UNIT-I: WAVE OPTICS (09 Periods)

Interference: Principle of superposition - Interference of light - Theory of interference fringes - Conditions for sustained interference - Interference in thin films (reflected light) - Newton's rings - Determination of wavelength.

Diffraction: Fraunhofer diffraction - Single slit diffraction - Diffraction grating - Grating spectrum - Determination of wavelength.

Polarization: Polarization by reflection, refraction and double refraction - Nicol's prism - Half wave and Quarter wave plate - Engineering applications of interference, diffraction and polarization.

UNIT-II: ELECTROMAGNETIC WAVES AND FIBER OPTICS (10 Periods)

Divergence, Curl of Electric and Magnetic Fields - Maxwell's Equations (qualitative)- Electromagnetic wave propagation (conducting and non conducting media).

Introduction to fiber optics - Total Internal Reflection - Critical angle of propagation - Acceptance angle, Acceptance cone - Numerical Aperture - Classification of fibers based on Refractive index profile, modes - Attenuation losses - Dispersion - Propagation of electromagnetic wave through optical fiber - Block diagram of fiber optic communication - Applications of an optical fiber - Fiber optic Sensors (temperature, displacement).

UNIT-III: SEMICONDUCTORS (10 Periods)

Origin of energy bands - Classification of solids based on energy bands - Intrinsic semiconductors - Density of electrons in intrinsic semiconductor - Density of holes in intrinsic semiconductor (qualitative) - Intrinsic carrier concentration - Fermi energy - Electrical conductivity of intrinsic semiconductors - Extrinsic semiconductors - Density of charge carriers in n-type - Density of charge carriers in p-type (qualitative) - Direct and Indirect band gap semiconductors - Hall effect, Hall coefficient - Applications of Hall effect - Drift and Diffusion currents - pn junction - Semiconducting materials for optoelectronic devices : Photodiode and Semiconductor diode laser.

UNIT-IV: DIELECTRICS AND MAGNETISM (09 Periods)

Introduction to dielectrics - Electric polarization - Dielectric polarizability, susceptibility and dielectric constant - Types of polarizations (qualitative) - Frequency dependence of polarization - Lorentz (internal) field - Dielectric break down - Piezoelectricity - Applications of dielectrics.

Introduction to magnetics - Magnetic dipole moment, magnetization, magnetic susceptibility and permeability - Origin of magnetic moment - Classification of magnetic materials - Hysteresis loop - Soft and hard magnetic materials.

UNIT-V: SUPERCONDUCTORS AND NANOMATERIALS (07 Periods)

Introduction to Superconductors, Properties - Critical parameters of Superconductors - Meissner effect - Penetration depth - Types of Superconductors - BCS Theory - Josephson effect (AC & DC) - High T_C Superconductors - Applications.

Basic principles of nanomaterials - Synthesis of nanomaterials by PLD method - Properties of nanomaterials (Electrical, Magnetic, Optical and Mechanical) - Applications of nanomaterials.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. M. N. Avadhanulu, P. G. Kshirsagar & T. V. S Arun Murthy*, A Text book of Engineering Physics,* S. Chand Publications, 11th edition, 2019.
2. P. K. Palaniswamy, *Engineering Physics,* Scitech Publications India Private Limited, 2nd edition, 2009.

REFERENCE BOOKS:

1. K. Thyagarajan, *Engineering Physics*, McGraw-Hill Education (India) Pvt. Ltd, 2016.
2. R. K. Gaur and S. L. Gupta, *Engineering Physics*, Dhanpat Rai Publications (P) Ltd, 2015.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Level of correlation of the course	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. – II Semester

(19BT10201) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCREPTION: Principles of Electrical Systems; AC Machines; Semiconductor Devices and Op-Amps.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze electrical circuits by applying the conceptual knowledge of circuit elements.

CO2. Demonstrate knowledge on various generation technologies, protection devices, safety procedures and BEE standards.

CO3. Demonstrate knowledge on characteristics and applications of transformers and AC machines.

CO4. Demonstrate knowledge on characteristics and applications of diode, BJT and Op-amps.

DETAILED SYLLABUS:

UNIT-I: PRINCIPLES OF ELECTRICAL SYSTEMS-I (09 Periods)

Basic electrical sources: DC-Battery, AC sources–Single loop generator; Single phase and three phase supply; Electrical circuit elements (R, L and C), Ohm's law, Kirchhoff's laws, Representation of sinusoidal waveforms, peak and RMS values, phasor representation, reactive power, apparent power, real power, energy and power factor.

UNIT-II: PRINCIPLES OF ELECTRICAL SYSTEMS-II (09 Periods)

Significance of Power factor and power factor correction, most economical power factor. Typical layout of electrical grid; Typical layout and operation of Hydro, Thermal and Solar Power Plants; Fuse, circuit breaker (MCB, MCCB, RCCB, ELCB), relay (elementary treatment); Inverter and UPS (block diagram approach only). Earthing – importance of earthing, pipe earthing and plate earthing; Safety measures. Energy Efficiency (Star rating) standards by BEE.

UNIT-III: TRANSFORMERS AND AC MACHINES (09 Periods)

Construction and working of a single phase transformer, EMF Equation; Construction and working of three phase induction motor, torque equation, torque-slip characteristics, applications; construction and working of a resistor start &capacitor start and run single phase induction motor, applications; Construction and working of synchronous machine, applications.

UNIT-IV: SEMICONDUCTOR DEVICES (10 Periods)

PN Junction diode, Characteristics, applications - half wave and full wave rectifier. Zener diode, characteristics, application–Regulator. BJT- operation, configurations, characteristics, applications - switch and amplifier.

UNIT-V: OP-AMPS (08 Periods)

Operational Amplifier: Block diagram of Op-Amp, equivalent circuit, Op-Amp AC and DC Characteristics, Inverting and Non-Inverting modes. Applications - Adder, Comparator, Integrator and Differentiator.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Ashfaq Hussain*, Fundamentals of Electrical Engineering,* Dhanpatrai & Co. (P) Ltd., 3rd Edition, New Delhi, 2009.
2. R. L. Boylestad and Louis Nashelsky, *Electronics Devices and Circuits*, PHI, 11th Edition, 2009.

REFERENCE BOOKS:

1. M. S. Naidu, S. Kamakshaiah, *Introduction to Electrical Engineering* ,Tata Mc Graw-Hill Education, New Delhi, 2007.
2. D. Roy Chowdhury, *Linear Integrated Circuits*, New Age International Pvt. Ltd., 4th edition, 2011.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO2	3	-	-	-	-	--	1	1	-	-	-	-	-	-	-	1
CO3	3	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
CO4	3	1	-	-	-	1	-	-	-	-	-	-	-	-	-	1
Average	3	2	1	-	-	1	1	1	-	-	-	-	-	-	-	1
Level of correlation of the course	3	3	1	-	-	1	1	1	-	-	-	-	-	-	-	1

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. – II Semester

(19BT20501) **DIGITAL LOGIC DESIGN**

(Common to CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Foundation in design and analysis of the operation of digital gates; Concepts of Boolean algebra, Minimization of logic circuits; Design and implementation of combinational and sequential logic circuits; Analysis and design of flip-flops, registers, and counters and comparison of their behavior and characteristics; Design digital systems using Programmable logic.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply knowledge of binary systems, logic gates and Boolean functions to minimize and implement digital circuits.

CO2. Develop digital systems using combinational and sequential logic to solve engineering problems.

DETAILED SYLLABUS:

UNIT- I: BINARY SYSTEMS AND BOOLEAN ALGEBRA (10 Periods)

Introduction, Binary Numbers, Number Base Conversions, Error Detection and Correction, Complements of Numbers, Signed Binary Numbers, Binary Codes, Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates.

UNIT-II: GATE LEVEL MINIMIZATION (09 Periods)

The Map Method, Four Variable K-Map, Product-of-Sums and Sum-of-Products Simplification, Don't Care Conditions, NAND and NOR Implementations, Other Two Level Implementations, Exclusive–OR function.

UNIT-III: COMBINATIONAL LOGIC (09 Periods)

Combinational Circuits, Analysis of Combinational Circuits, Design Procedure, Binary Adder- Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, De-Multiplexers.

UNIT-IV: SEQUENTIAL LOGIC (10 Periods)

Latches, Flip-Flops, Analysis of Clocked Sequential Circuits, Design of Synchronous Sequential Circuits, Registers, Shift Registers, Ripple Counters, Synchronous Counters, Ring Counter and Johnson Counter.

UNIT-V: PROGRAMMABLE LOGIC (07 Periods)

Programmable Memories – RAM, ROM, Programmable Logic Array, Programmable Array Logic, Sequential Programmable Devices.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. M. Morris Mano, Michael D. Ciletti, *Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog*, 6th Edition, Pearson, 2018.

REFERENCE BOOKS:

1. A. Anand Kumar, *Switching Theory and Logic Design*, 3rd edition, PHI Learning Private Limited, India, 2016.
2. Charles H. Roth, Jr. and Larry L. Kinney, *Fundamentals of Logic Design*, 7th edition, Cengage Learning, 2015.
3. Alan B. Marcovitz, *Introduction to Logic Design*, 3rd edition, McGraw Hill, 2010.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	3	3	3	3	-	-	-	-	-	-	-	-	-	-	2
Average	3	2.5	2.5	3	3	-	-	-	-	-	-	-	-	-	-	2
Level of correlation of the course	3	3	3	3	3	-	-	-	-	-	-	-	-	-	-	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. – II Semester

(19BT21501) **OBJECT ORIENTED PROGRAMMING THROUGH JAVA**

(Common to CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Programming for Problem Solving

COURSE DESCRIPTION: Introduction to Object Oriented Programming, Classes and Objects; Inheritance, Packages, Interfaces; Exception handling, Multithreading; Collection Classes; Applets, Swings, Event handling.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on object oriented programming constructs to solve programming problems.
CO2. Analyze object oriented programming features – polymorphism, inheritance, exception handling and multithreading for reusability.
CO3. Develop user interfaces using GUI programming techniques.

DETAILED SYLLABUS:

UNIT I: INTRODUCTION (09 Periods)

Introduction to Object Oriented Programming, Java Buzzwords, History, Java Environment, Java Components, Programming Paradigms, Naming Conventions.

Classes and Objects: Introduction to classes, objects, Constructors, Garbage Collection, this keyword, Access Control, Features of Object Oriented Programming.

UNIT- II: DATA TYPES, CONTROL STATEMENTS, POLYMORPHISM (09 Periods)

Data Types, Variables, Type Conversions (Boxing and Unboxing/Wrapping and Unwrapping) and Casting, Arrays, Operators, Decision Making Statements, Looping Statements, Methods, Recursion, Method Overloading, Constructor Overloading, Parameter Passing, String Class, Final Keyword.
Utility Classes: String Tokenizer, Scanner, Random, Bit Set.

UNIT- III: INHERITANCE, PACKAGES, INTERFACES (09 Periods)

INHERITANCE: Introduction, Classification, Abstract Classes, Final keyword with Inheritance.

PACKAGES: Basics, Creating and Accessing a package, CLASSPATH, Importing packages.

INTERFACES: Definition, Implementing Interfaces, Extending Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces.

UNIT- IV: EXCEPTION HANDLING, MULTITHREADING, COLLECTION FRAMEWORK (09 Periods)

EXCEPTION HANDLING: Exception, Types of Exception, Keywords: try, catch, throw, throws and finally, Built-in Exceptions, User Defined Exceptions.

MULTITHREADING: Process, Thread, Thread Model, Creating a thread, Priorities, Thread Synchronization, Inter-thread Communication.

COLLECTION FRAMEWORK: Framework Hierarchy, ArrayList, LinkedList, HashSet.

UNIT- V: APPLETS, SWINGS, EVENT HANDLING (09 Periods)

APPLET CLASS: Basics, Types, Architecture, Skeleton, Parameter passing to applets.

SWINGS: Introduction, Features, Hierarchy, Swing GUI Components, Packages in Swings, Swing Control Classes and Methods.

EVENT HANDLING: Event Classes, Event Listener Interfaces - Mouse and Key, Adapter Classes.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Herbert Schildt, *Java the Complete Reference*, 9th edition, Oracle Press, 2014.

REFERENCE BOOKS:

1. Sachin Malhotra and Saurab Choudhary, *Programming in Java*, 2nd edition, Oxford University press, 2014.
2. Y. Daniel Liang, *Introduction to Java Programming,* Pearson Education.
3. T. Budd, *Understanding Object-Oriented Programming with Java,* Pearson Education.

ADDITIONAL LEARNING RESOURCES

1. https://docs.oracle.com/javase/tutorial/index.html

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
Average	3	2.25	3	-	-	-	-	-	-	-	-	-	-	-	3	-
Level of correlation of the course	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. - II Semester

(19BT1BS31) **ENGINEERING PHYSICS LAB**

(Common to CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: -

COURSE DESCRIPTION: Determination of wavelength of light and thickness of a thin film; numerical aperture and acceptance angle of optical fiber; Characteristics of various semiconductor diodes; Resistivity of semiconductor; magnetic field along axial line of a current carrying coil

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply the basic knowledge of light waves and semiconductors to demonstrate the functioning of optoelectronic devices.

CO2. Understand the experimental procedures to calculate the thickness of a thin film, Hall coefficient, Hysteresis losses, and acceptance angle of an optical fiber.

CO3. Determine the experimental values of magnetic field induction, wave length of a light source, energy gap of a semiconductor.

CO4. Apply skills to plot characteristic curves to determine the various parameters of semiconductor diodes.

CO5. Work independently and in teams to solve problems with effective communication.

A minimum of any **Ten** experiments are to be conducted among the following:

List of Engineering Physics Experiments:

1. Determine the thickness of the wire using wedge shape method.
2. Determination of wavelength of light source by Newton's ring method.
3. Determination of wavelength by plane diffraction grating method.
4. Estimation of magnetic field along the axis of a circular coil carrying current.
5. Study the variation of Magnetic field induction (B) vs Magnetic field strength (H) by magnetizing the magnetic material (B-H Curve).
6. Determination the numerical aperture of a given optical fiber and hence to estimate its acceptance angle.
7. Determination of number of charge carriers and Hall coefficients of a given semiconductor using Hall Effect.
8. Determine the resistivity of semiconductor by Four probe method.
9. Determine the energy gap of a semiconductor.
10. Study the I-V characteristics of pn junction diode.
11. Estimation of threshold voltages of different LED's.
12. Study the characteristics of Photodiode.
13. Determination of wavelength of laser by using diffraction grating.

REFERENCES:

1. S. Balasubramaniah and M.N. Srinivasan, *A Text book of practical physics,* S Chand Publications, 2017.
2. http://vlab.amrita.edu/index.php - Virtual Labs, Amrita University.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	2	2	2	-	-	-	-	-	-
Average	3	3	-	-	-	-	-	2	2	2	-	-	-	-	-	-
Level of correlation of the course	3	3	-	-	-	-	-	2	2	2	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. – II Semester

(19BT10231) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB

(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: Physics at intermediate level.

COURSE DESCREPTION: Practical investigations on Electrical circuits, AC Machines, Semiconductor Devices and Op-Amps.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze, measure, interpret and validate the practical observations by applying the fundamental knowledge of electrical circuits, machines and electronic devices.

CO2. Design Op-amp based amplifier, voltage summer and integrator circuits for desired specifications.

CO3. Work independently and in teams to solve problems with effective communication.

List of Experiments:

Minimum Ten experiments are to be conducted.

1. Measurement of electrical quantities (AC & DC) using Voltmeter, Ammeter and Wattmeter.
2. Verification of Ohm's law and Kirchhoff's laws.
3. Circuit
   (a) with one lamp controlled by one switch and provision of 2-pin or 3-pin socket PVC surface conduit system.
   (b) With two lamps controlled by two switches with PVC surface conduit system.
   (c) for Stair case wiring and Godown wiring.
4. Measurement of Power factor and it's improvement.
5. Load test on 1-Phase Transformer.
6. Brake test on 3-Phase Induction Motor.
7. Brake test on 1- phase induction motor.
8. VI Characteristics of PN and Zener Diodes.
9. Ripple factor and load regulations of rectifier with and without filters.
10. Input and output characteristics of CE configuration.
11. Design of inverting and non-inverting amplifiers using op-amp.
12. Design of voltage summer and integrator using op-amp.
13. Soldering practice.

REFERENCES BOOKS/ LAB MANUALS:

1. P. S. Dhogal, *Basic Practicals in Electrical Engineering*, Standard Publishers, 2004.
2. Yannis Tsividis, *A First Lab in Circuits and Electronics*, Wiley, 1st edition, 2001.

ADDITIONAL LEARNING RESOURCES:

1. www.vlab.co.in, Virtual Electric Circuits Lab, A initiative of MHRD under NMEICT.
2. www.vlab.co.in, Basic Electronics Lab, A initiative of MHRD under NMEICT.
3. https://nptel.ac.in/courses/117106108/
4. https://ocw.mit.edu/high-school/physics/exam-prep/electric-circuits/
5. https://nptel.ac.in/courses/108105017/
6. https://nptel.ac.in/courses/108108112/
7. https://nptel.ac.in/courses/117107094/

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	1	-	-	-	-	-	-	-	-	-	-	1
CO2	1	2	3	2	-	-	-	-	-	-	-		-		-	1
CO3	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	1
Average	2	2.5	2.5	2	1	-	-	-	2	2	-	-	-	-	-	1
Level of correlation of the course	2	3	3	2	1	-	-	-	2	2	-	-	-	-	-	1

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. – II Semester

(19BT20331) **ENGINEERING WORKSHOP**

(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES:-

COURSE DESCRIPTION: Knowledge on various workshop hand and power tools; hands on experience in different manufacturing trades such as fitting, carpentry, sheet metal forming and foundry; Demonstration on dismantling and assembling of various two wheeler parts, power tools in machining and metal joining, basics of plumbing and working of 3D printer.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Design and model various basic prototypes in the trade of fitting such as square/half round mating, V- mating and dovetail mating from the given MS work pieces using fitting tools.

CO2. Develop different prototypes in the carpentry trade such as cross lap joint, dovetail / bridle joints and Mortise and Tenon joint using carpentry tools.

CO3. Design and model different prototypes in the sheet metal forming trade such as rectangular tray, square vessel/cylinder, Funnel as per the dimensions using sheet metal forming tools.

CO4. Develop sand mold using single piece pattern and split piece pattern in the foundry trade using foundry tools.

CO5. Demonstrate the knowledge on automobile parts, power tools, plumbing operation, 3D printing technology involved in different engineering applications.

CO6. Work independently / in groups & communicate effectively in oral and written forms.

DETAILED SYLLABUS:

FITTING: Conduct a detailed study on various aspects in fitting trade which includes the details of fitting operations, safety precautions, types of tools, tool holders, miscellaneous tools, care and maintenance of hand tools, marking and measurement tool, and finishing tool.

List of Exercises:

1. Make a square/half round mating from the given MS work pieces
2. Make a V- mating from the given MS work pieces
3. Make a dovetail mating from the given MS work pieces

CARPENTRY: Conduct a detailed study on various aspects in carpentry trade which includes the details of types of wood, carpentry tools, wood working techniques, types of joints, safety precautions, and care and maintenance of tools.

List of Exercises:

4. Prepare a cross lap joint
5. Prepare dovetail / bridle joints
6. Prepare a Mortise and Tenon joint.

SHEET METAL FORMING: Conduct a detailed study on various aspects in sheet metal forming which includes the details of sheet materials, hand tools, sheet metal fabrication, and safety and precautions

List of Exercises:

7. Fabricate a rectangular tray as per the dimensions
8. Fabricate square vessel/cylinder as per the dimensions
9. Fabricate a Funnel as per the dimensions

FOUNDRY: Conduct a detailed study on various aspects in foundry which includes the details of moulding sand, properties of moulding sand, types of patterns and pattern, materials, foundry tools, and safety and precautions

List of Exercises:

10. Prepare a sand mold, using the given single piece pattern (stepped pulley/cube)
11. Prepare a sand mold, using the given split piece pattern (pipe bent/dumbbell)

DEMONSTRATION:

12. Demonstrate the dismantling and assembling of various two wheeler parts
13. Demonstrate the usage of power tools.
14. Demonstrate the plumbing operation and identify the essential tool and materials required for plumbing.
15. Demonstrate the working of 3D printer

Note: Student shall perform any **Twelve Exercises**

REFERENCE BOOKS/LABORATORY MANUALS:

1. P. Kannaiah and K. L. Narayana, *Workshop Manual*, SciTech Publishers, 2009.
2. K. Venkata Reddy, *Workshop Practice Manual*, BS Publications, 2008.
3. V. Ramesh Babu, *Engineering Workshop Practice*, V R B Publishers Private Limited, 2009.

ADDITIONAL LEARNING RESOURCES:

1. R. K. Jain, *Production Technology*, Khanna Publishers, 17th edition, 2012.
2. Kalpakjian, Serope, *Manufacturing Engineering and Technology*, Pearson Education, 7th edition, 2014.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1	3	1	1	-	-	-	-	-	-	-	-	-
CO2	3	3	3	1	3	1	1	-	-	-	-	-	-	-	-	-
CO3	3	3	3	1	3	1	1	-	-	-	-	-	-	-	-	-
CO4	3	3	3	1	3	1	1	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Average	3	3	3	1	3	1	1	1	3	3	-	-	-	-	-	-
Level of correlation of the course	3	3	3	1	3	1	1	1	3	3	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. – II Semester

(19BT21531) OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

(Common to CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	1	2	2

PRE-REQUISITES: A course on Object Oriented Programming Through Java.

COURSE DESCRIPTION: Hands-on experience on Polymorphism; Inheritance and Interfaces; Exception Handling; Multithreading; Event Handling; Applets, swings.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply syntactic constructs of the JAVA programming language to solve logic based problems

CO2. Develop application programs using concepts of object oriented programming.

CO3. Function effectively as an individual and on terms to solve problems with effective communication.

CO4. Write and prepare mini project reports/ documents effectively.

LIST OF EXERCISES:

1 Demonstrate the following programs using command line arguments:
   a Write a program that computes the sum of all its integer arguments
   b Write a program to input n integers and perform sorting between them.

2 a The Fibonacci sequence is defined by the following rule. The first 2 values in the sequence are 0, 1. Every subsequent value is the sum of the 2 values preceding it. Write a Java program that uses both recursive and non-recursive functions to print the nth value of the Fibonacci sequence?
   b Write a program to define a class student with name, registration number and marks for three subjects as instance variables and describe a constructor to initialize them. Also define a method display to print all the values.

3 a Write a program to print the element of an array that has occurred highest number of times.
   b Write a program that displays a menu with options 1. Add 2. Sub. Based on the options chosen, read 2 numbers and perform the relevant operation. After performing the operation, the program should ask the user if he wants to continue. If the user presses y or Y, then the program should continue displaying the menu else the program should terminate. [Use Scanner class]

4 a Write a Program to count tokens- number of words and characters in a string.
   b Write and test overloaded methods to find sum of three integers, sum of three double values and sum of four integers.

5 a Write a program to create an abstract class named Shape that contains an empty method named number Of Sides ( ). Provide three classes named Trapezoid, Triangle and Hexagon such that each one of the classes extends the class Shape. Each one of the classes contains only the method number Of Sides ( ) that shows the number of sides in the given geometrical figures.
   b Write a program that imports the User-defined package P1 and access the member variables and methods of classes that contained in the package P1.

6 A University awards some grace marks to students who participate in the Inter University games. Therefore, total marks awarded = Exam_Marks +Sports_Grace_Marks. If total marks scored are greater than maximum marks, then the final marks awarded will be equal to the maximum marks. An Object Oriented based implementation will contain a class called Results, which extends a class called Exam, which itself extends a class called Student. It will also contain an interface called Sports, which is implemented by the Results class. The Results class will be responsible for computing the final marks scored by the students. Write a Java program along with an interactive driver class.

7 a Write a program to handle Arithmetic Exception, Array Out Of Bounds Exception using try and multiple catch statements.

b Write a java program to throw a user defined exception called Negative, if the entered input is a negative number.

8 a Write a Java program that creates three threads. First thread displays - Good Morning for every one second, the second thread displays - Hello for every two seconds and the third thread displays - Welcome for every three seconds.

b Write a Java program that correctly implements producer consumer problem using the concept of inter-thread communication.

9 a Write a program create a class "Book" with name, id, author, publisher and quantity as instance variables and a constructor to initialize them. Create a HashSet object of type Book and three Book instances b1, b2 and b3. Add these instances into HashSet and display them.

b Develop an Applet that receives an integer in one text field, and computes its factorial value and returns it in another text field, when the button named "Compute" is clicked.

10 a Write a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box.

b Write a java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light is turned on, and only one light can be on at a time No light is on when the program starts.

11 Write a java program that handles all mouse and key events and shows the event name at the center of the window when mouse event is fired (Use Adapter classes).

Mini Project 1:

Given coordinates of the box, radius of the circle and color, using these elements design an animation of a bouncing ball using Java applet program.

Mini Project 2:

Design and implement a simple Inventory Control System for a small Video Rental Store using appropriate User-Interface. Define the following classes: Video to model a video and Video Store to model the actual store. Assume following are the attributes of the class Video: title, user_rating, a flag to say whether it is checked out or not and define required member methods. The Video Store class will contain an instance variables that refers an array of videos (say of length 10) and the following member functions: add Video(String), checkout(String), return Video(String), receive Rating(String) and list Inventory(). Finally create a Video Store Launcher class with a main method which will test the functionality.

REFERENCE BOOKS:

1. Herbert Schildt, *Java the Complete Reference*, 9th Edition, Oracle Press, 2014.
2. Sachin Malhotra and Saurab Choudhary, *Programming in Java*, 2nd Edition, Oxford University Press, 2014.

SOFTWARES/Tools used:

Java SE 12.0.1

ADDITIONAL LEARNING RESOURCES

1. Problems to be considered from Hackerearth and CodeChef platforms

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	-	-	-	-	-	-	3	-	-	-	-	-	3	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-	3	-
Average	3	3	2.5	-	-	-	-	-	3	3	-	-	-	-	3	-
Level of correlation of the course	3	3	3	-	-	-	-	-	3	3	-	-	-	-	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

I B. Tech. - II Semester

(19BT1AC01) SPOKEN ENGLISH

(Audit Course)

(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	-	-	2	-	-	-

PRE-REQUISITES:-

COURSE DESCRIPTON: Functional English; Vocabulary Building; Functional Grammar-I; Functional Grammar – II; Communication Skills.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge of grammar and vocabulary in writing effective formal letters and e-mails.

CO2. Communicate effectively by applying appropriate speaking and writing techniques by examining and applying functional English.

DETAILED SYLLABUS:

UNIT- I: FUNCTIONAL ENGLISH: (06 Periods)

Introduction - Functional Spoken English; Self Introduction; **Listening – Speaking:** Do's and Don'ts; **Expressing:** Ability / Admiration / Agreement / Annoyance / Appreciation / Pleasure / Sarcasm / Satisfaction / Surprise / Approval / Certainty/ Doubt / Gratitude/ Possibility / Fear / Worry / Condolences; **Asking for:** Advice / Clarification / Direction / Information / Permission; **Making:** Predictions / recommendations.

UNIT- II: VOCABULARY BUILDING: (06 Periods)

Introduction: Vocabulary for day-to-day conversations; Vegetables / Groceries / Fruits / Weather; Parts of a Human body / Dresses / Furniture / Relations; Birds / Cries of Animals; Food / Hospitality / Houses / Rooms / Tools; Airport / News Paper/ Books/ Gems; Corporate Vocabulary / Jobs / Occupations / Diseases; British / American spelling; Slang Words and Technical Jargon.

UNIT- III: FUNCTIONAL GRAMMAR - I: (06 Periods)

Parts of Speech, Verb forms; Tenses; Voice; Speech.

UNIT- IV: FUNCTIONAL GRAMMAR - II: **(06 Periods)**

Universal Auxiliaries; Sentence Structure - WH - Questions - How to frame Questions and give answers; Question Tags; Subject and verb agreement; Spotting Errors.

UNIT- V: COMMUNICATION SKILLS: **(06 Periods)**

Polite, Courteous and Diplomatic expressions; Good Manners and Etiquette; Conversation Techniques; Narrating Stories.

Total Periods: 30

Topics for Self Study are provided in Lesson Plan

TEXT BOOKS:

1. L. Adinarayana and V. Prakasam, *Spoken English*, Neelkamal Publications Pvt. Ltd., New Delhi, 2008.
2. Ram Bhasker Raju, *The Complete Book on Spoken English*, Goutham Buddha Publications, Hyderabad, 2002.

REFERENCE BOOKS:

1. Sabina Pillai, *Spoken English for my World,* Oxford University Press, New Delhi, 2016.
2. K. R. Lakshminarayanan, *Speak in English,* Scitech Publications, Chennai, 2009.

ADDITIONAL LEARNING RESOURCES

1. https://www.britishcouncil.in/programmes/english-partnerships/state/skills-projects/AP-English-Skills.
2. https://www.fluentu.com/blog/english/websites-to-learn-english.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-		1	-	-	-	-	1	-	-	-	-	-	-
CO2	2	3	-		1	-	-	-	-	2	-	-	-	-	-	-
Average	2.5	2	-	-	1	-	-	-	-	1.5	-	-	-	-	-	-
Level of correlation of the course	3	2	-	-	1	-	-	-	-	1	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - I Semester

(19BT3BS01) NUMERICAL METHODS, PROBABILITY AND STATISTICS

(Common to CSE, CSSE, IT, CE and ME)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	1	-	4

PRE-REQUISITES: -

COURSE DESCRIPTION: Numerical solutions of equations; interpolation; numerical differentiation and integration; random variables; mathematical expectations; probability distributions; test of hypothesis.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyse the data and develop skills to solve equations and integrals by applying numerical methods.

CO2. Demonstrate knowledge in statistics and analyse the data for validations by applying statistical testing methods and distributions.

DETAILED SYLLABUS:

UNIT I - NUMERICAL SOLUTIONSOF EQUATIONS AND INTERPOLATION (8 periods)

Solutions of algebraic and transcendental equations: Regula-falsi method, Newton-Raphson method; Interpolation: Forward and backward differences, interpolation using Newton's forward and backward difference formulae, Lagrange's interpolation formula, partial fractions using Lagrange's interpolation formula.

UNIT II - NUMERICAL DIFFERENTIATION AND INTEGRATION (9 Periods)

Numerical differentiation using Newton's forward and backward interpolation formulae; Numerical integration using Simpson's $1/3^{rd}$ and $3/8^{th}$ rules; Numerical solutions of first order ordinary differential equations using Taylor's series method, fourth order Runge-Kutta method.

UNIT III - RANDOM VARIABLES AND MATHEMATICAL EXPECTATIONS (8 periods)

Random Variables: Discrete and continuous random variables, distribution function of random variable, properties, probability mass function, probability density function; mathematical expectation, properties of mathematical expectation, mean and variance.

UNIT IV - PROBABILITY DISTRIBUTIONS (9 Periods)

Discrete probability distributions:Binomial, Poisson- mean, variance, standard deviation (without derivations); Continuous probability distributions:Normal, uniform and exponential distributions- mean, variance, standard deviation (without derivations), area under the normal curve.

UNIT V -TEST OF HYPOTHESIS (11 Periods)

Population and sample, parameter and statistic, null and alternative hypothesis, Type I and Type II errors, level of Significance, critical region, degrees of freedom; Large sample test: Tests of significance for proportions and means; Small sample test: Student's t-test- single mean, difference of means; F-test for equality of population variance; Chi-Square test for independence of attributes.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. T. K. V. Iyengar, B. Krishna Gandhi, S. Ranganatham and M. V. S. S. N. Prasad, *Mathematical Methods,* S. Chand & Company, 5th Edition, 2016.
2. T. K. V. Iyengar, B. Krishna Gandhi, S. Ranganatham and M. V. S. S. N. Prasad, *Probability and Statistics,* S. Chand & Company, 5th Edition, 2016.

REFERENCE BOOKS:

1. B. S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 44th Edition, 2017.
2. P. Kandasamy, K. Thilagavathy, K. Gunavathi, *Numerical Methods*, S. Chand and Company, 2nd Edition, Reprint 2012.
3. S. C. Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics*, Sultan Chand and Sons Publications, 11th Edition, 2012.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Level of correlation of the course	3	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - I Semester

(19BT30501) **COMPUTER GRAPHICS**

(Common to CSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Transformation Techniques and Linear Algebra.

COURSE DESCRIPTION: Introduction to computer graphics; Output primitives; 2D geometric transformations and viewing; 3D geometric transformations and viewing; 3D object representation; Color models; Illumination models; Visible surface detection methods and rendering methods.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze raster scan and random scan systems by applying knowledge on graphical interactive devices.
CO2. Design algorithms for output primitives such as lines, circles, ellipse and filled area primitives to fill specified area.
CO3. Analyze the concepts of geometrical transformations, representations, and viewing for 2D and 3D objects.
CO4. Apply appropriate techniques for visible surface detection, color models, illumination models and rendering methods.

DETAILED SYLLABUS:

UNIT I - INTRODUCTION TO GRAPHICS SYSTEMS AND OUTPUT PRIMITIVES (9 periods)

Graphics Systems: Video display devices, Raster-scan systems, Random-scan systems, Graphics monitors and workstations.

Output Primitives: Points and lines, Line drawing algorithms, Midpoint circle algorithm, Midpoint ellipse algorithm.

UNIT II - FILLED AREA PRIMITIVES AND 2D GEOMETRIC TRANSFORMATIONS (9 periods)

Filled Area Primitives: Scan-line polygon fill algorithm, Boundary-fill algorithm and Flood-fill algorithm.

2D Geometric Transformations: Transformations – translation, scaling, rotation, reflection and shear; Homogeneous coordinates, Composite transformations, Transformations between coordinate systems.

UNIT III - 2D VIEWING AND 3D OBJECT REPRESENTATIONS (9 periods)

2D Viewing: The viewing pipeline, Viewing coordinate reference frame, Window-to-viewport coordinate transformation, Cohen-Sutherland line clipping algorithm, Sutherland-Hodgeman polygon clipping algorithm.

3D Object Representations: Polygon surfaces, Quadric surfaces, Spline representations, Hermite curve, Bezier curves and surfaces.

UNIT IV - 3D GEOMETRIC TRANSFORMATIONS AND VIEWING, COLOR MODELS (9 periods)

3D Transformations: Translation, Rotation, Scaling, Reflections, Shears.

3D Viewing: Viewing pipeline, Viewing coordinates, Clipping.

Color Models: Standard primaries and chromaticity diagram, Color models - RGB, YIQ, CMY, HSV, HLS.

UNIT V – VISIBLE SURFACE DETECTION AND SURFACE RENDERING METHODS, ILLUMINATION MODELS (9 periods)

Visible Surface Detection Methods: Classification, Back-face detection, Depth-buffer method, Scan-line method, Depth-sorting method, BSP-tree method.

Surface Rendering methods: Gouraud shading, Phong shading.
Illumination Models: Ambient Light, Diffuse Reflection, Specular Reflectionand the Phong Model.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK(S):

1. Donald D. Hearn and M. Pauline Baker, *Computer Graphics C version*, Pearson Education, 2nd Edition, 2006.

REFERENCE BOOKS:

1. Fabio Ganovelli, Massimiliano Corsini, SumantaPattanaik, Marco Di Benedetto, *Introduction to Computer Graphics: A Practical Learning Approach*, CRC Press, 2014.
2. Apurva A. Desai, *Computer Graphics*, PHI Learning, 2008.
3. William M. Newman and Robert F. Sproull, *Principles of Interactive Computer Graphics*, McGraw-Hill, 2nd Edition, 2005.

ADDITIONAL LEARNING RESOURCES:

- Sumanta Guha, Computer Graphics through OpenGL, Second Edition, CRC Press, 2015.
- https://nptel.ac.in/courses/106/106/106106090/

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	2	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	-	-	2	-	-	-	-	-	-	-	-	-	3	-
CO3	2	-	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO4	2	-	-	-	2	-	-	-	-	-	-	-	-	-	3	-
Average	2	3	3	2	2	-	-	-	-	-	-	-	-	-	3	-
Level of correlation of the course	2	3	3	2	2	-	-	-	-	-	-	-	-	-	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - I Semester

(19BT30502) **COMPUTER ORGANIZATION**

(Common to CSE, CSSE & IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Digital Logic Design.

COURSE DESCRIPTION: Basic structure and operation of a digital computer; Organization and functional principles of the arithmetic and logic unit, control unit, memory unit and I/O unit; Concepts of pipelining and parallel processing techniques; Multicore computers.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze computer arithmetic algorithms for fixed-point and floating-point binary operations.
CO2. Analyze the architecture, organization and functions of the components of a digital computer.
CO3. Design digital circuits for the given functional description of microoperations and memory elements.
CO4. Investigate the performance of memory systems, I/O systems, pipelined processors and multiprocessors to evaluate the cost-performance trade-offs.

DETAILED SYLLABUS:

UNIT I - COMPUTER ARITHMETIC, REGISTER TRANSFER AND MICROOPERATIONS
(9 periods)

Computer Arithmetic: Fixed point representation, Floating point representation, Addition and subtraction, Binary multiplication algorithms.

Register Transfer and Microoperations: Register transfer, Bus and memory transfers, Arithmetic microoperations, Logic microoperations, Shift microoperations, Arithmetic logic shift unit.

UNIT II - BASIC COMPUTER ORGANIZATION AND DESIGN (8 periods)

Instruction codes, Computer registers, Computer instructions, Instruction formats, Addressing modes, Timing and control, Instruction cycle, Input-Output and Interrupt.

UNIT III - MICRO PROGRAMMED CONTROL AND INPUT-OUTPUT ORGANIZATION (10 periods)

Micro Programmed Control: Control memory, Address sequencing, Design of control unit, Hardwired control, Microprogrammed control.

Input-Output Organization: Peripheral devices, Input-Output interface, Modes of transfer, Priority interrupt – Daisy chaining priority, Parallel priority interrupt, Priority encoder; Direct Memory Access, Input-Output Processor – CPU-IOP communication; PCI Express - PCI physical and logical architecture.

UNIT IV - THE MEMORY SYSTEM (9 periods)

Semiconductor RAM memories – Internal organization, Static memories, Dynamic RAMs, Synchronous and Asynchronous DRAMs, Structure of larger memories; Read-only memories, Cache memories – Mapping functions; Nonvolatile Solid-State Memory Technologies, Solid state drives.

UNIT V - PIPELINE AND VECTOR PROCESSING, MULTIPROCESSORS, MULTICORE COMPUTERS

(9 periods)

Pipeline and Vector Processing: Parallel processing, Pipelining, Instruction pipeline, Vector processing, Array processors.

Multiprocessors: Characteristics of multiprocessors, Interconnection structures, Inter-processor arbitration.

Multicore Computers: Hardware performance issues, Software performance issues, Multicore organization, Intel Core i7-990X.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. M. Morris Mano, Rajib Mall, *Computer System Architecture*, Revised 3rd Edition, Pearson Education, 2017.
2. Carl Hamacher, ZvonkoVranesic, SafwatZaky, NaraigManjikian, *Computer Organization and Embedded Systems*, 6th Edition, McGraw Hill, 2012.

REFERENCE BOOKS:

1. William Stallings, *Computer Organization and Architecture: Designing for Performance*, 11th Edition, Pearson Education, 2018.
2. Andrew S. Tanenbaum, Todd Austin, *StructuredComputer Organization*, 6th Edition, Pearson, 2016.

ADDITIONAL LEARNING RESOURCES:

- https://nptel.ac.in/courses/106105163/
- Bilkent Online Courses, Bilkent University, Lectures by William Sawyer, https://www.youtube.com/watch?v=CDO28Esqmcg

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Average	2.5	2.25		-	-	-	-	-	-	-	-	-	-	-	-	3
Level of correlation of the course	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - I Semester

(19BT30503) DATA STRUCTURES

(Common to CSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	1	-	4

PRE-REQUISITES: A Course on Object Oriented Programming through Java.

COURSE DESCRIPTION: Introduction to data structures, Linked Lists, Types of lists, Stacks, Queues, Trees, Binary search trees, AVL trees, Red-Black Trees, Searching algorithms, Sorting algorithms, Graphs, Minimum spanning trees, Hashing.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze linear data structures such as arrays, linked lists, stacks, queues for efficient data organization and manipulation.
CO2. Analyze data structures such as trees, graphs, hash tables for efficient search and retrieval of data.
CO3. Select and apply appropriate techniques for searching and sorting problems.
CO4. Apply knowledge to select appropriate data structures for modeling information in data.

DETAILED SYLLABUS:

UNIT I – LINKED LISTS (7 periods)

Overview of data structures and algorithms, Linear and non-linear data structures, Big O notation, Linked lists – Definition, Operations; Single linked lists, Circular linked lists, Doubly linked lists, Sorted lists, Linked lists efficiency, Applications of linked lists.

UNIT II – STACKS AND QUEUES (9 periods)

Stacks: Definition, Operations, Implementation using arrays and linked lists, Applications – Reversing a word, Delimiter matching, Parsing arithmetic expressions.
Queues: Definition, Operations, Applications, Implementation using arrays and linked lists, Circular queue, Double-ended queues, Priority queues.

UNIT III – BINARY TREES AND SEARCH TREES (11 periods)

Tree terminology, Binary trees, Trees represented as arrays, Binary search trees - Concepts, Advantages, Operations, Finding maximum and minimum values, Efficiency; Balanced and unbalanced trees, AVL search trees – Concepts, Operations; Red-Black trees – Concepts, Rotations, Inserting a node, Efficiency.

UNIT IV – SEARCHING AND SORTING (9 periods)

Searching: Linear search, Binary search.
Sorting: Bubble sort, Selection sort, Insertion sort, sorting objects, Shell sort, Partitioning, Quick sort, Merge sort, Heap sort.

UNIT V – GRAPHS AND HASHING (9 periods)

Graphs: Concepts, Representation, Operations, Depth-first search, Breadth-first search, Minimum spanning trees.
Hashing: Introduction, Open addressing, Separate chaining, Characteristics of good hash functions – Quick computation, Random and Non-random keys, Folding; Hashing efficiency.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOK(S):

1. Robert Lafore, *Data Structures and Algorithms in Java*, 2nd Edition, Pearson, 2007.

REFERENCE BOOKS:

1. Goodrich, Tamassia, Goldwasser, *Data structures and Algorithms in Java*, 6th Edition, Wiley, 2014.
2. John R. Hubbard, *Programming with Java*, 2nd Edition, McGraw Hill, 2009.
3. DebasisSamanta, *Classic Data Structures*, 2nd Edition, Prentice Hall, 2009.

ADDITIONAL LEARNING RESOURCES:

- http://www.nptel.ac.in/courses/106102064
- http://nptel.ac.in/courses/106106127/
- https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/lecture-videos

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2	2	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	2	2	2	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO4	2	2	3	2	2	-	-	-	-	-	-	-	-	-	3	-
Average	2	2.5	2.5	2	2	-	-	-	-	-	-	-	-	-	3	-
Level of correlation of the course	2	3	3	2	2	-	-	-	-	-	-	-	-	-	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - I Semester

(19BT31201) DISCRETE MATHEMATICAL STRUCTURES

(Common to CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Transformation Techniques and Linear Algebra.

COURSE DESCRIPTION: Mathematical Logic; Predicates; Relations; Algebra Structures; Mathematical Reasoning; Recurrence Relations; Graphs; Graph Theory and its Applications.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on mathematical logic and predicates.
CO2. Analyze sets using functions and relations.
CO3. Analyze properties of different algebraic structures.
CO4. Apply mathematical reasoning, recurrence relations, permutations and combinations to solve computational problems.
CO5. Apply concepts of graph theory and trees to implement computer applications.

DETAILED SYLLABUS:

UNIT I - MATHEMATICAL LOGIC AND PREDICATES (10 periods)

Mathematical Logic: Statements and notations, Connectives, Well-formed formulae, Truth tables, Tautology, Equivalence of formulae, Normal forms.

Predicates: Predicate calculus, Free and Bound variables, Rules of inference, Consistency, Proof of contradiction and Automatic Theorem Proving.

UNIT II - FUNCTIONS AND RELATIONS (09 periods)

Relations: Properties of binary relations, Equivalence relations, Compatibility relations, Partial ordering relations, Hasse diagram and related applications.

Functions: Inverse Functions, Composition of functions, Recursive functions, Lattice and its Properties.

UNIT III - ALGEBRAIC STRUCTURES (07 periods)

Algebraic System: Examples and General Properties, Semi Groups and Monoids, Groups, Subgroups, Homomorphism and Isomorphism.

UNIT IV - MATHEMATICAL REASONING AND RECURRENCE RELATIONS (10 periods)

Mathematical Reasoning: Methods of Proof, Mathematical Induction, Basics of counting, The Inclusion-Exclusion Principle, The Pigeon hole principle, Permutations and Combinations, Generalized Permutations and Combinations.

Recurrence Relations: Generating Functions of Sequences, Calculating coefficients of generating function, Recurrence relation, solving recurrence relations by substitution and Generating functions, Methods of Characteristic Roots, Solutions of Inhomogeneous Recurrence Relation.

UNIT V - GRAPH THEORY AND ITS APPLICATION (09 periods)

Graphs: Introduction to Graphs, Types of Graphs, Graph basic terminology and Special types of simple graphs, Representation of Graphs and Graph Isomorphism, Euler Paths and Circuits, Hamiltonian Paths and Circuits, Planar Graphs, Euler's Formula and Graph Coloring.

Trees: Introduction to Trees, Properties of Trees, Applications of Trees, Spanning Trees, Counting trees, Depth-First Search, Breadth-First Search, Minimum Spanning Trees, Kruskal's Algorithm and Prim's Algorithm.

Total Periods 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. J.P. Trembly and R. Manohar, *Discrete Mathematical Structures with Applications to Computer Science,*Tata McGraw Hill, 37thEdition, 2017
2. Kenneth H. Rosen,*Discrete Mathematics and its Applications,* Tata McGraw Hill, 6thEdition, 2007.

REFERENCE BOOKS:

1. Joe L. Mott and Abraham Kandel, *Discrete Mathematics for Computer Scientists and Mathematicians,* Prentice Hall of India Private Limited, 2nd Edition, 2004.
2. Ralph P. Grimaldi and B.V.Ramana, *Discrete and Combinatorial Mathematics- an Applied Introduction,* Pearson Education, 5th Edition, 2006.

ADDITIONAL LEARNING RESOURCES:

- https://www.maa.org/press/ebooks/resources-for-teaching-discrete-mathematics.
- https://www.quora.com/

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	1	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	1	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
Average	1.8	2.5	3	-	-	-	-	-	-	-	-	-	-	-	3	-
Level of correlation of the course	2	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. – I Semester
(19BT31202) **SOFTWARE ENGINEERING**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Concepts of Software Engineering; Software Process Models; Conventional and Agile Process Models; Software Requirements Engineering Process; System Analysis; Architectural Design; User Interface Design and Re-engineering; Software Testing; Risk and Quality Management.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Understand fundamental concepts of software engineering and analyze process models required to develop a software system.
CO2. Analyze software requirements and model requirements for the given scenario.
CO3. Apply design concepts and metrics for software development.
CO4. Apply testing strategies and techniques for quality software.
CO5. Analyze risks in software development life cycle and apply risk strategies to mitigate risks.

DETAILED SYLLABUS:

UNIT I: SOFTWARE ENGINEERING AND SOFTWARE PROCESS (11 periods)

A Generic view of process: The Nature of Software, Software Engineering- Software Engineering Layers; The Software Process, Software Engineering Practice, Software myths.

Process models: A Generic Process Model, Prescriptive Process Models-The Waterfall Model, Incremental Process Models, Specialized Process Models; The Unified Process, Agile Development-Agility, Agile Process, Extreme Programming (XP), Scrum, Dynamic System Development Method, Agile Modeling (AM), Agile Unified Process (AUP).

UNIT II: REQUIREMENTS ENGINEERING AND MODELING (07 periods)

Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specifications, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.

Requirements Modeling: Requirements Analysis, Data Modeling Concepts, Flow-Oriented Modeling, Scenario based Modeling, UML Models that supplement the Use Case, Case study on Requirements modeling for Web and MobileApps.

UNIT III: DESIGN ENGINEERING AND METRICS (09 periods)

Design using UML: Design concepts, Software Architecture, Architectural Styles, Class Diagram - Terms and concepts, Use case Diagram - Terms and concepts, Activity Diagrams - Terms and concepts, Interaction diagrams - Terms and concepts, Statemachine Diagram- Terms and concepts, Component Diagram- Terms and concepts, Deployment Diagram- Terms and concepts.

Process and Project Metrics: Metrics in the process and project domains, Software Measurement, Metrics for software quality.

UNIT IV: SOFTWARE TESTING STRATEGIES AND APPLICATIONS (08 periods)

Testing strategies: A strategic approach to software testing, Strategic issues, Test strategies for conventional software, Test strategies for object oriented software, Validation testing, System testing, The art of debugging.

Testing Conventional Applications: Software testing fundamentals, White box testing-Basis path testing, Control structure testing; Black box testing, Object oriented testing methods.

UNIT V: RISK, QUALITY MANAGEMENT AND REENGINEERING (10 periods)

Risk and Quality Management: Reactive and Proactive risk strategies, Software risks, Risk Mitigation Monitoring and Management (RMMM), RMMM plan, Formal Technical Reviews (FTR), Software Quality Assurance (SQA)-Tasks, Goals and Metrics; Software reliability.

Reengineering: Introduction, Business Process Reengineering (BPR), Software Reengineering, Restructuring, Reverse engineering, Forward engineering.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Roger S. Pressman, *Software Engineering - A Practitioner's Approach,* McGraw-Hill International Edition, 8th Edition, 2015.
2. Ian Sommerville, *Software Engineering***,** Pearson Education, 9th Edition, 2011.

REFERENCE BOOKS:

1. Grady Booch, James Rum Baugh and Ivar Jacobson, "The Unified Modeling Language User Guide," 2nd Edition, Pearson Education, 2009.
2. K. K. Aggarwal and Yogesh Singh, Software Engineering*,* New Age International Publishers, 3rd Edition, 2007.
3. Shely Cashman Rosenblatt, *Systems Analysis and Design*, Thomson Publications, 6th Edition, 2006.

ADDITIONAL LEARNING RESOURCES:

- https://nptel.ac.in/courses/106105087/
- https://nptel.ac.in/courses/106105182/

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	-	-	-	3	3	2	-	-	2	-	-	-	3	-
CO3	2	3	3	2	-	2	2	-	-	-	3	-	-	-	3	-
CO4	2	-	-	-	2	3	-	-	-	-	-	-	-	-	3	-
CO5	2	3	-	-	2	3	-	-	-	-	-	-	-	-	3	-
Average	2	3	3	2	2	2.7	2.5	2	-	-	2.5	-	-	-	3	-
Level of correlation of the course	2	3	3	2	2	3	3	2	-	-	3	-	-	-	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - I Semester

(19BT30531) DATA STRUCTURES LAB

(Common to CSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Data Structures.

COURSE DESCRIPTION: Hands on practice on implementation of Linked lists, Arrays, Stacks, Queues, Search algorithms, Sorting algorithms, Binary search tree representation and operations, Graph representation and operations, Hashing functions.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Implement linear data structures such as arrays, linked lists, stacks, queues for efficient data organization and manipulation.
CO2. Develop solutions using data structures such as trees, graphs, heaps, hash tables for efficient search and retrieval of data.
CO3. Select and apply appropriate techniques for searching and sorting problems.
CO4. Work independently and communicate effectively in oral and written forms.

LIST OF EXERCISES:

1. A college has N number of students and the following details of all the students are maintained – register number, name, branch, phone number. Write a program to store the details of the students using a singly linked list. Develop functions to perform the following operations on the data.
    a) Insert new student's details
    b) Display the details of the students
    c) Display the total number of students
    d) Delete a given student's information
2. Department of CSE has readers club named 'Aalochana'. Students can be granted membership in readers club on their request. Similarly, one may cancel their membership of the club. Members of the club can rent books from the club. Write a program to create data structure to maintain readers club members information (Hall ticket number, name) using singly linked list. In singly linked list, the header node should store details of head of readers club and last node should store details of in-charge of readers club. Develop functions to perform the following operations on the data.

    a) Store details of head and in-charge of the readers club
    b) Grant and cancel memberships of students
    c) Display total number of members
    d) Display the details of the members
    e) Display the sorted list of details of the members (sort based on their names in alphabetical order)
3. A company has N number of employees and it maintains the following details of each of its employees: ID, department, salary, phone number. Develop a menu driven program using doubly linked list to store the employees' data. Develop functions to perform the following operations on the data.

    f) Add and delete employees
    g) Display total number of employees
    h) Display details of employees with salary more than Rs. 50,000
    i) Display the phone number of the employee given the ID

4. a) Develop a menu driven program to perform the following operations on a stack of integers (Array and linked list implementations of stack with maximum size MAX)
    i) Push an element
    ii) Pop an element
    iii) Display the status
    iv) Demonstrate overflow and underflow situations (in array implementation)

   b) Write a program to check whether a string is palindrome or not using stack data structure.

   c) Mostly syntax errors in a computer program arise due to unbalanced braces (such as (), {}, []). Write a program using stack to check whether a given expression has balanced braces or not.

5. a) Develop a menu driven program to perform the following operations on a queue of characters (Array and linked list implementations of queue with maximum size MAX).
    i) Insert an element
    ii) Delete an element
    iii) Display the status
    iv) Demonstrate overflow and underflow situations (in array implementation)

   b) A restaurant based on its human resources can accept a maximum of N number of food orders. The food orders are served in first come first serve basis. The food orders once placed cannot be cancelled. Write a program to simulate the food ordering and serving system in the restaurant using circular queue.

6. Write a program to perform the following operations on the binary search tree.
    a) Construct binary search tree by inserting the values {6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2} in the given order.
    b) Display the nodes of the tree using inorder, preorder and postorder traversal techniques.
    c) Display the smallest number stored in the tree.
    d) Search the tree for a given number.
7. There are train paths between cities. If there is a train between city A and city B then there is a route between the cities. The cost of the route is the distance between city A and city B. Represent the train travel route information as a graph. The node can be represented by the name of the city. Write a program to perform the following operations.
    a) Store the details of train travel route information using adjacency list or adjacency matrix representation.
    b) Traverse the graph and display the details of all trains between the cities along with the cost using breadth-first method.
    c) Traverse the graph and display the details of all trains between the cities along with the cost using depth-first method.
8. Store register numbers of students who attended placement training program in a random order in an array. Write a function to search whether a student has attended placement training program or not using
    a) Linear search
    b) Binary search
9. Write a program to sort a given set of integers using
    a) Quick sort
    b) Shell sort

10. a) Write a program to sort a given set of integers using merge sort.

    b) Write a program to read the marks obtained by students in a mathematics examination and store the data using a heap data structure. Find out the maximum and minimum marks obtained by the students.

11. Write a program to implement the following hashing functions.
    a) Separate Chaining Method
    b) Open Addressing Method

12. Consider an online movie ticket booking system through which customers can book tickets to watch movies at theatres. The database stores the details of each transaction of ticket booking with the details - ID, customer name, customer phone number, movie name, theatre name, date of show, time of show, number of tickets booked, starting seat number, total amount. Write a menu driven program to perform create the database and given an ID, display a client's phone number. Use a hash table implementation to quickly search through the database.

REFERENCE BOOKS:

1. Robert Lafore, *Data Structures and Algorithms in Java*, 2nd Edition, Pearson, 2007.
2. Goodrich, TamassiaandGoldwasser, *Data structures and Algorithms in Java*, 6th Edition, Wiley, 2014.

SOFTWARE/TOOLS USED:

- Software: J2SDK 1.7
  - Eclipse or NetBeans
- Java compatible web browser

ADDITIONAL LEARNING RESOURCES:

- https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/lecture-videos
- http://nptel.ac.in/courses/106106127/
- http://www.nptel.ac.in/courses/106102064

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2	2	-	2	-	-	2	-	-	-	-	3	-
CO2	2	3	2	2	2	-	2	-	-	2	-	-	-	-	3	-
CO3	2	2	3	2	2	-	2	-	-	2	-	-	-	-	3	-
CO4	2	2	3	2	2	-	2	-	-	2	-	-	-	-	3	-
Average	2	2.5	2.5	2	2	-	2	-	-	2	-	-	-	-	3	-
Level of correlation of the course	2	3	3	2	2	-	2	-	-	2	-	-	-	-	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. – I Semester

(19BT31231) **IT WORKSHOP**

(IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITE:-

COURSE DESCRIPTION: Practice sessions on PC Hardware and Microsoft Office; Installation of Microsoft Windows software; Hands on practice in developing and executing simple programs using C Programming constructs such as Conditional statements, Loops, Arrays, Strings, Functions, Structures and Pointers.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on:
- Identification of functional parts of PC
- Installing Operating System.

CO2. Create documents, spreadsheets and presentations using MS Office.
CO3. Develop 'C' programs as per given specifications.
CO4. Work effectively as an individual for implementation of programs.
CO5. Write and present a substantial technical report effectively.

LIST OF EXPERIMENTS:

1 a) Identification of the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral.

b) Disassembling and assembling the PC back to working condition.

c) Introduction to Operating Systems as system software features of OS, need of OS, components of OS. Installation of Microsoft Windows 10 Operating Systems.

2 a) Introduction to MS-Word, Importance of Word as Word Processor, Overview of toolbars, Saving, Accessing files, Using help and resources. Create a word document using the features such as Formatting fonts, Drop cap, Applying text effects, Using character spacing, Borders and shading, Inserting headers and footers, Using date and time option.

b) Create a word document in MS-Word using the features such as Inserting tables, Bullets and numbering, changing text direction, Hyperlink, Images from files and Clipart, Drawing toolbar and Word art and create an invitation using Mail Merge in MS-Word

3 a) Introduction to MS-Excel as a Spreadsheet tool, Overview of toolbars, accessing, Saving excel files, Using help and resources. Create a spreadsheet using the features: Gridlines, Format cells, Summation, Auto fill, Formatting text, Formulae in Excel Charts.

b) Create a spreadsheet using the featuressuch as Split cells, Sorting, Conditional formatting, Freeze panes, Pivot tables, Data validation.

4 a) Introduction to MS-Power Point, Utilities, Overview of toolbars, PPT orientation, slide layouts, Types of views. Create a Power Point Presentation using the features: Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows.

b) Create a Power Point Presentation using the features such as Auto content wizard, Hyperlinks, Inserting images, Clip art, Audio, Video, Custom animation, Slide hiding, Tables and Charts.

5 a) Let a and b are two integer variables whose values are 10 and 13 respectively. Write a C program to evaluate the following arithmetic expressions.

i) a + b ii) a–b iii) a * b iv) a/b v) a % b

b) Write a C program to evaluate the following algebraic expressions after reading necessary values from the keyboard.
   i) (ax + b)/(ax – b)
   ii) 2.5 log x + Cos 320+ | x2 + y2|
   iii) pow(x,5)+10*pow(x,4)+8*pow(x,3)+4*(x)+2
   iv) a*exp(k*t)

6 a) A cashier has currency notes of denominations Rs.10, Rs. 50 and Rs. 100. If the amountto be withdrawn is input in hundreds, find the total number of notes of each denominationthe cashier will have to give to the withdrawer.

b) In a town, the percentage of men is 52. The percentage of total literacy is 48. Thetotalpercentage of literate men is 35 of the total population. Write a C program to find the totalnumber of illiterate men and women when the population of the town is 8000.

c) Write a C program that takes two integer numbers and one operator as input from the user. Perform the operation on two integer numbersbased on operator and then print the result. (Consider the operators +,-,*, /, %.Use switch statement).

7 a) To write a C-program to find the sum of individual digits of a positive number.

b) Display the following in triangular pattern.

```
*
*   *
*    *   *
*   *   *   *
*   *   *   *   *
```

8 Write a C program that uses functions to perform the following:

a) Largest number from a given list of integers.

b) Write a C program to perform:
i. Addition of two matrices.
ii. Multiplication of two matrices.

9 Write a C program that uses functions to perform the following operations:
   a) To insert a sub-string in main string at a specified position.
   b) To delete N characters from a given string from a specified position.
   c) Write a program to determine whether the given string is palindrome or not.
   d) Write a program to display the position or index in the main string S where thesub string T begins. Display -1 if S does not contain T
   e) Write a program to count the number of lines, words and characters in a giventext.

10 a) Write a C program to read list of student names and perform the following operationsusing functions.
   i. To print list of names
   ii. To sort them in ascending order
   iii. To print the list after sorting.

11 Write a C program to read list of student names and perform the following operations using array of character pointers.
   i) To insert a student name
   ii) To delete a name
   iii) To print the name

12 Write a C program to accept the elements of the structure include Employee-name, Basic payDisplay the same structure along with the DA, CCA and Gross salary for 5 employees.
   Note: DA=51% of Basic pay, CCA=Rs.100.consolidated.

REFERENCE BOOKS:

1. Steve Lambert, M. Dow Lambert and Joan Preppernau, *Step by Step Microsoft Office Access 2007*, Microsoft Press, 2007.
2. ITL Education, *Introduction to Information Technology*, Pearson Education, New Delhi, Second Edition, 2005.
3. Byron Gottfried and Jitender Kumar C, *Programming with C*, McGraw Hill Education (India) Pvt. Ltd, Third Edition, 2016.
4. PradipDey and ManasGhosh, *Programming in C*, Oxford University Press, Second Edition, 2007.

SOFTWARE/TOOLS USED:

- Windows 7
- VI Editor

ADDITIONAL LEARNING RESOURCES:

- https://www.javatpoint.com/ms-word-tutorial
- https://www.tutorialspoint.com/powerpoint/index.html
- https://www.guru99.com/c-loop-statement.html
- https://www.youtube.com/watch?v=7-EppTJK7WQ

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	-	2	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	2	-	2	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	2	-	2	-	-	-	-	-	-	-	-	-	2	-
CO4	2	2	2	-	2	-	-	-	-	-	-	-	-	-	2	-
CO5	2	2	2	-	2	-	-	-	-	-	-	-	-	-	2	-
Average	2	2	2	-	2	-	-	-	-	-	-	-	-	-	2	-
Level of correlation of the course	2	2	2	-	2	-	-	-	-	-	-	-	-	-	2	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. – I Semester
(19BT31232) **SOFTWARE ENGINEERING LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Software Engineering.

COURSE DESCRIPTION: Software Development Life Cycle activities-requirements specification, SRS preparation,Modeling case studies–Online Ticket Reservation system; Point of sales.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyse user requirements and prepare software requirements specifications.
CO2. Apply design principles of UML for software design.
CO3. Apply tools for developing UML diagrams.
CO4. Use cost estimation models for project evaluation.
CO5. Work effectively as an individual to design UML models.
CO6. Write and present a substantial technical report/document effectively.

LIST OF EXPERIMENTS:

1. Identify Functional and Non-Functional Requirements for:
   i) Online Ticket Reservation for Railways ii) Online Auction Sales
2. a) Construct a flow graph for Insertion sort algorithm.
   b) Write a program to find Cyclomatic complexity for the above flow graph
   (**Hint**: McCabe's cyclomatic matrices V(G) of a graph G with n vertices , e edges and P connected components is V(G)=e-n+2P)

CASE STUDIES:

Case studies given below should be Modeled using Visual Modeling tools in different views i.e. Use case view, logical view, component view, Deployment view.

CASE STUDY 1: ONLINE TICKET RESERVATION FOR RAILWAYS

Problem Statement: Computer plays an integral part of the day in today's life. It makes the entire job easier and faster, every job is computerized so as the ticket reservation we can book over the online ticket reservation system. During the booking of the ticket reservation passenger has to select origin, date of journey, destination, class of train etc. The reservation counter keeps track of passenger's information. Thus the system will have all the details about the trains and facilities provided by them. There are various trains with the different level of convenience for the passengers. The whole database will be maintained by database administrator. There are varieties of trains where the passengers can select the train according to the convenience for their destination journey. The journey could be within the state or across the India. Each train has the three types of classes i.e. Sleeper class, First class and the AC compartment. Design the application for the above problem description.

CASE STUDY 2: A POINT OF SALE (POS) SYSTEM

Problem Statement: A POS System is a computerized application used to record sales and handle payments; it is typically used in a retail store. It includes hardware components such as a computer and bar code scanner, and software to run the system. It interfaces to various service applications, such as a third-party tax calculator and inventory control. These systems must be relatively fault tolerant; that is, even if remote services and temporarily unavailable they must still be of capturing sales and handling at least cash payments. A POS system must support multiple and varied client – side terminals and interfaces such as browser, PDA's, touch – screens.

CASE STUDY 3: RECRUITMENT PROCEDURE FOR SOFTWARE INDUSTRY

Problem Statement: In the software industry the recruitment procedure is the basic thing that goes in the hand with the requirement as specified by the technical management team. HR first gives an advertisement in leading Newspapers, Journals, Weeklies and Websites. The job seekers can apply for it through by Post or by e-mail to the company. The technical skill and the experience of the candidates are reviewed and the short listed candidates are called for the interview. There may be different rounds for interview like the written test, technical interview, and HR interview. After the successful completion of all rounds of interview, the selected candidates' names are displayed. Meanwhile HR gives all the details about the salary, working hours, terms and conditions and the retirement benefit to the candidate.

CASE STUDY 4: ONLINE AUCTION SALES

Problem Statement: The online auction system is a design about a website where sellers collect and prepare a list of items they want to sell and place it on the website for visualizing. To accomplish this purpose the user has to access the site. Incase it's a new user he has to register. Purchaser's login and select items they want to buy and keep bidding for it. Interacting with the purchasers and sellers through messages does this. There is no need for customer to interact with the sellers because every time the purchasers bid, the details will be updated in the database. The purchaser making the highest bid for an item before the close of the auction is declared as the owner of the item. If the auctioneer or the purchaser doesn't want to bid for the product then there is fixed cutoff price mentioned for every product. He can pay that amount directly and own the product. The purchaser gets a confirmation of his purchase as an acknowledgement from the website. After the transition by going back to the main menu where he can view other items.

CASE STUDY 5: TWO FLOOR ELEVATOR SIMULATOR

Problem Statement: The elevator has the basic function that all elevator systems have, such as moving up and down, open and close doors, and of course, pick up passengers. The elevator is supposed to be used in a building having floors numbered from 1 to MaxFloor, where the first floor is the lobby. There are car call buttons in the car corresponding to each floor. For every floor except for the top floor and the lobby, there are two hall call buttons for the passengers to call for going up and down. There is only one down hall call button at the top floor and one up hall call button in the lobby. When the car stops at a floor, the doors are opened and the car lantern indicating the current direction the car is going is illuminated so that the passengers can get to know the current moving direction of the car. The car moves fast between floors, but it should be able to slow down early enough to stop at a desired floor. When an elevator has no requests, it remains at its current floor with its doors closed.

In order to certificate system safety, emergency brake will be triggered and the car will be forced to stop under any unsafe conditions.

CASE STUDY 6: HOME APPLIANCE CONTROL SYSTEM

Problem Statement: A home appliance control system (HACS) is a system which provides various services to remotely operate on home appliances, such as microwave oven, TV, and garage door etc through remote devices such as mobile phone, desktop and palm-top.A home appliance control system (HACS) is a system which is controlled by a remote system such as a mobile phone or a palm-top, and at the same time controls, monitors and coordinates home appliances such as air conditioner, microwave oven, garage doors, TV set, VCR, audio controller, indoor/outdoor lights, water sprinkler, home security system, bath tub controller, etc. In order to activate home appliances and to allow for different ways of cooking, the HACS needs mechanisms for communication between the different devices in the system, and for coordination among the various processes running on such devices. The system administrator of the HACS system has the ability to add a new appliance or delete an existing one. The system administrator has the ability to add a new remote device and configure it with HACS or delete an existing one when it is not used. Also the system administrator can create an account for a new user or delete existing account if it is no longer used.

REFERENCE BOOKS:

1. Grady Booch, James Rum Baugh and Ivar Jacobson, "The Unified Modeling Language User Guide," Second Edition, Pearson Education, 2009.
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons and David Fado, "UML 2 Toolkit," WILEY-Dreamtech India Pvt. Ltd., 2003.
3. Rajesh Naik and Swapna Kishore, "Software Requirements and Estimation," Tata McGraw Hill, New Delhi, 2001.

SOFTWARE/TOOLS USED:

- Visual Paradigm for modeling diagrams

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	-	2	-	-	-	-	-	2	-	-	3	-
CO2	2	-	2	3	-	-	2	-	-	-	-	-	-	-	3	-
CO3	2	-	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO4	2	-	2	-	2	-	-	2	-	-	2	-	-	-	3	-
CO5	-	-	-	-	-	-	-	-	3	-	-	-		-	3	-
CO6	-	-	-	-	-	-	-	-	-	3	-	-	-	-	3	-
Average	2.25	3	2.3	2.6	2	2	2	2	3	3	2	2	-	-	3	
Level of correlation of the course	3	3	3	3	2	2	2	2	3	3	2	2	-	-	3	

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. – I Semester

(19BT315AC) **DESIGN THINKING**

(Common to CSE, CSSEand IT)

(Audit Course)

L	T	P	C
2	-	-	-

PRE-REQUISITES: -

COURSE DESCRIPTION: Design thinking process, Design thinking phases, empathy tools; Idea generation, visualizing and empathizing; Fidelity for prototypes, prototyping; prototyping for physical products.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze design thinking concepts and principles to perform human centered design process for creative problem solving.
CO2. Create empathy maps to visualize user attitudes and behavior for gaining insights of customers.
CO3. Develop innovative products or services for a customer base using ideation techniques.
CO4. Build prototypes for complex problems using gathered user requirements.
CO5. Apply design thinking tools techniques to produce good design and relevant products or services for a specific target market.
CO6. Improve prototype by testing it with a specific set of users for making it sustainable by following ethics.

DETAILED SYLLABUS:

UNITI: INTRODUCTION TO DESIGN THINKING (6 Periods)

Design Thinking Process: Types of the thinking process, Common methods to change the human thinking process, Design thinking: Definition, Origin of design thinking, Importance of design thinking, Design Vs. Design thinking, Problem solving, Understanding design thinking and its process model, Design thinking tools.

UNIT II: EMPATHIZE (6 Periods)

Design thinking phases, How to empathize, Role of empathy in design thinking, purpose of empathy maps, Things to be done prior to empathy mapping, Activities during and after the session, Understanding empathy tools : Customer Journey Map, Personas.

UNIT III: IDEATION (6 Periods)

Challenges in idea generation, need for systematic method to connect to user, Visualize, Empathize, and Ideate method, Importance of visualizing and empathizing before ideating, Applying the method, Ideation Tools: How Might We (HMW), Story board, Brainstorming.

UNITIV: PROTOTYPING (6 Periods)

What is a prototype - Prototyping as a mindset, prototype examples, prototyping for products; Why we prototype? Fidelity for prototypes, Process of prototyping- Minimum Viable prototype

UNIT V: TESTING PROTOTYPES (6 Periods)

Prototyping for digital products: What's unique for digital, Preparation; Prototyping for physical products: What's unique for physical products, Preparation; Testing prototypes with users.

Total Periods: 30

Topics for self-study are provided in the lesson plan.

TEXTBOOK:

1. S.Salivahanan, S.Suresh Kumar, D. Praveen Sam, *Introduction to Design Thinking*,Tata Mc Graw Hill, First Edition,2019.
2. Kathryn McElroy, *Prototyping for Designers: Developing the best Digital and Physical Products*, O'Reilly,2017.

REFERENCE BOOKS

1. Michael G. Luchs, Scott Swan and Abbie Griffin,*Design Thinking – New Product Essentials from PDMA*, Wiley, 2015.
2. Vijay Kumar, *101 Design Methods: A Structured Approach for Driving Innovation in Your Organization*, 2012.

ADDITIONAL LEARNING RESOURCES:

1. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process
2. https://www.ibm.com/design/thinking/page/toolkit
3. https://www.interaction-design.org/literature/article/define-and-frame-your-design-challenge-by-creating-your-point-of-view-and-ask-how-might-we
4. https://www.culturepartnership.eu/en/article/ten-tools-for-design-thinking
5. https://nptel.ac.in/courses/109/104/109104109/
6. https://nptel.ac.in/courses/110106124/

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	1	-	-	3	1	-	-	-	-	-	-	-	-	-	3	-
CO4	-	3	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	1	2	3	-	-	-	-	-	-	-	3	-
CO6	1	3	1	-	-	-	1	1	-	-	-	-	-	-	3	-
Average	1	3	2	2.67	1	2	2	1	-	-	-	-	-	-	3	-
Level of correlation of the course	1	3	2	3	1	2	2	1	-	-	-	-	-	-	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - II Semester

(19BT40501) **COMPUTER NETWORKS**

(Common to CSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Operating Systems.

COURSE DESCRIPTION: Introduction to computer networks, Protocols of physical layer, data link layer, medium access control sub layer, network layer, transport layer, application layer.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze the types of network topologies, layers and protocols.
CO2. Evaluate subnetting and routing algorithms for finding optimal paths in networks.
CO3. Solve problems related to flow control, error control and congestion control in data transmission.
CO4. Assess the impact of wired and wireless networks in the context of network protocols Like DNS, SMTP, HTTP, and FTP.
CO5. Apply ethical principles and standards for developing network-based solutions.

DETAILED SYLLABUS:

UNIT I -INTRODUCTION AND PHYSICAL LAYER (9 periods)

Network hardware, Network software, Reference models-OSI, TCP/IP, Example networks – Internet; Wireless LANs - 802.11.

Physical Layer - Guided transmission media, Wireless transmission, Switching - Circuit switching, Packet switching.

UNIT II - DATA LINK LAYER AND MEDIUM ACCESS CONTROL SUBLAYER (9 periods)

Data Link Layer: Data link layer design issues, Error detection and correction - CRC, Hamming codes; Elementary data link protocols, Sliding window protocols.

Medium Access Control Sub layer: ALOHA, Carrier sense multiple access protocols, Collision free protocols, Ethernet, Data link layer switching - Repeaters, Hubs, Bridges, Switches, Routers, Gateways.

UNIT III - NETWORK LAYER (9 periods)

Network layer design issues, Routing algorithms - Shortest path algorithm, Flooding, Distance vector routing, Link state routing, Hierarchical routing, Broadcast routing, Multicast routing, Anycast routing; Congestion control algorithms, Network layer in the internet - The IP version 4 protocol, IP addresses, IP version 6, Internet control protocols, OSPF, BGP.

UNIT IV - TRANSPORT LAYER (9 periods)

UDP – Segment header, Remote procedure call, Real-time transport protocols; TCP – service model, Protocol, Segment header, Connection establishment, Connection release, Sliding window, Timer management, Congestion control.

UNIT V - APPLICATION LAYER (9 periods)

Domain Name System (DNS) - Name space, Domain resource records, Name servers; Electronic mail - Architecture and services, User agent, Message formats, Message transfer, Final delivery; The World Wide Web - Architectural overview, HTTP, FTP.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOK:

1. Andrew S. Tanenbaum and David J. Wetherall, *Computer Networks*, Pearson, 5th Edition, 2015.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, *Data Communications and Networking*, McGraw Hill, 5th Edition, 2013.
2. James F. Kurose and Keith W. Ross, *Computer Networking: A Top-Down Approach*, Pearson, 7th Edition, 2017.

ADDITIONAL LEARNING RESOURCES:

- https://www.cisco.com/c/en/us/solutions/small-business/resource-center/networking/ networking-basics.html
- https://memberfiles.freewebs.com/00/88/103568800/documents/Data.And.Computer.Communications.8e.WilliamStallings.pdf

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	2
CO2	3	2	-	3	-	-	-	-	-	-	-	-	-	3	-	2
CO3	3	2	-	2	-	-	-	-	-	-	-	-	-	3	-	2
CO4	-	-	-	-	-	2	-	-	-	-	-	-	-	3	-	2
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3	-	2
Average	3	2.3	2	2.5	-	2	-	3	-	-	-	-	-	3	-	2
Level of correlation of the course	3	3	2	3	-	2	-	3	-	-	-	-	-	3	-	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - II Semester

(19BT40502) DATABASE MANAGEMENT SYSTEMS

(Common to CSE, CSE (AI), CSE (DS), CSBS, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	1	-	4

PRE-REQUISITES: A Course on Data Structures.

COURSE DESCRIPTION: Introduction to database systems, Database design, Relational model, Relational algebra, SQL queries, Constraints and triggers, PL/SQL, Schema refinement and normal Forms, Transaction management, Concurrency control, Overview of storage and indexing.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Apply the concepts of ER-modeling and normalization to design viable data models for a given problem.
CO2. Formulate relational database schemas, apply suitable integrity constraints, for querying databases.
CO3. Use SQL to store, query, and manipulate data in relational databases.
CO4. Develop PL/SQL blocks to centralize database applications for maintainability and reusability.
CO5. Analyze transaction processing, concurrency control and storage methods for database management.

DETAILED SYLLABUS:

UNIT I - INTRODUCTION TO DATABASE SYSTEMS AND DATABASE DESIGN (8 periods)

Introduction to Database Systems: Database System Applications, Purpose of Database Systems, View of Data - Data Abstraction, Instances and schemas, Data models; Database Languages – Data Definition Language, Data Manipulation Language; Database architecture, Database users and administrators.

Introduction to Database design: Database design and ER diagrams, Entities, attributes and entity sets, Relationships and relationship sets, Additional features of ER model, Conceptual Design with ER model.

UNIT II - RELATIONAL MODEL AND RELATIONAL ALGEBRA (8 periods)

Relational Model: Creating and modifying relations, Integrity constraints over relations, Enforcing integrity constraints, Querying relational data, Logical database design, Introduction to views, Destroying/altering tables and views.

Relational Algebra: Preliminaries, Relational Algebra Operators.

UNIT III - SQL AND PL/SQL (10 periods)

SQL: Form of basic SQL query, Nested queries, Aggregate operators, Null values, Complex integrity constraints in SQL, Triggers and active databases.

PL/SQL: Generic PL/SQL block, PL/SQL data types, control structure, procedures and functions, cursors, database triggers.

UNIT IV - SCHEMA REFINEMENT AND TRANSACTIONS (10 periods)

Schema Refinement: Problems caused by redundancy, Decompositions, Problems related to decomposition, Functional dependencies, Reasoning about FDs, First normal form, Second normal form, Third normal form, Boyce-Codd normal form, Multivalued dependencies, Fourth normal form, Join dependencies, Fifth normal form.

Transactions: Transaction concept, Transaction atomicity and durability, Concurrent Executions – Serializability, Recoverability, Implementation of isolation, Testing for serializability.

UNIT V - CONCURRENCY CONTROL, STORAGE AND INDEXING (9 periods)

Concurrency Control: Lock Based Protocols – Timestamp Based Protocols- Validation Based Protocols – Multiple Granularity, Deadlock Handling.

Storage and Indexing: Data on external storage, File organizations and indexing – Clustered indexes, Primary and secondary indexes; Index data structures – Hash based indexing, Tree based indexing; Comparison of file organizations.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, McGraw Hill, 3rdEdition, 2014.
2. Abraham Silberschatz, Henry. F. Korth, and S. Sudarshan, *Database System Concepts*, McGraw Hill, 7th Edition, 2019.

REFERENCE BOOKS:

1. Ivan Bayross, *SQL, PL/SQL: The Programming Language of Oracle*, BPB publications, 4th Edition, 2017.
2. RamezElmasriandShamkant B. Navathe, *Fundamentals of Database Systems*, Pearson, 7th Edition, 2015.

ADDITIONAL LEARNING RESOURCES:

- https://swayam.gov.in/nd1_noc19_cs46/preview
- https://www.classcentral.com/course/swayam-introduction-to-database-systems-17660

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	1	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO4	1	2	3	2	-	-	-	-	-	-	-	-	3	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-	-
Average	2	2.2	3	2	-	-	-	-	-	-	-	-	3	-	-	-
Level of correlation of the course	2	3	3	2	-	-	-	-	-	-	-	-	3	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. – II Semester
(19BT31502)**OPERATING SYSTEMS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Computer Organization.

COURSE DESCRIPTION: Operating Systems Operations; Process Scheduling; Process Synchronization, Deadlocks; Paging and Segmentation, Disk Scheduling; File Concepts, I/O Interface; Concepts of Protection and Security.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze performance of CPU scheduling algorithms.
CO2. Design solutions for process synchronization problems by using semaphores and monitors.
CO3. Devise solutions for deadlocks using deadlock handling mechanisms.
CO4. Solve memory management problems using page replacement and disk scheduling algorithms.
CO5. Identify efficient file allocation methods for optimal disk utilization.
CO6. Analyze services of I/O subsystems and mechanisms of security and protection.

DETAILED SYLLABUS:

UNIT I: INTRODUCTION TO OPERATING SYSTEM AND PROCESS MANAGEMENT (8 periods)

INTRODUCTION: Definition, Operating System Structure and Services: Layered approach, Hybrid Systems:Mac OSX, iOS, Android, System Calls.
PROCESS MANAGEMENT: Process Scheduling, Process Control Block, Inter Process Communication, Threads, Multithreading Models, CPU Scheduling Criteria, Scheduling Algorithms, Multiprocessor Scheduling.

UNIT II: PROCESS SYNCHRONIZATION AND DEADLOCKS (10 periods)

PROCESS SYNCHRONIZATION: Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Synchronization Problems, Monitors.
DEADLOCKS: System Model, Deadlock characterization, Methods for handling deadlocks, Prevention, Detection, Avoidance, Recovery from deadlock.

UNIT III: MEMORY MANAGEMENT AND SECONDARY STORAGE (10 periods)

MEMORY MANAGEMENT: Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging.
VIRTUAL MEMORY: Demand Paging, Page Replacement Algorithms, Copy-on-Write, Thrashing.
SECONDARY STORAGE STRUCTURE: Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Disk Management.

UNIT IV: FILE AND I/O SYSTEMS (8 periods)

FILE SYSTEM: File concept, Access Methods, Directory Structure, File System Structure, i-node, File System Implementation, Directory Implementation, Allocation Methods.
I/O SYSTEM: I/O Hardware, Application I/O Interface, Kernel I/O subsystem

UNIT V – PROTECTION AND SECURITY (9 periods)

PROTECTION: Goals, Principles, Domain of Protection, Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights.
SECURITY: Security Problem, Program Threats, System and Network Threats, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and Networks, Computer-Security Classifications.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOK:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, *Operating System Concepts*, Wiley India Edition, 9th Edition, 2016.

REFERENCE BOOKS:

1. William Stallings, *Operating Systems, Internals and Design Principles*, Pearson Education, 7th Edition, 2013.
2. Andrew S. Tanenbaum, *Modern Operating Systems*, PHI, 3rd Edition, 2009.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2	2	-	-	-	-	-	-	-	-	-	3	-
CO2	2	2	3	-	2	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	-	2	-	-	-	-	-	-	-	-	-	3	-
CO4	2	2	3	-	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO6	2	3	-	3	-	-	-	-	-	-	-	-	-	-	3	-
Average	2	2.5	2.75	2.5	2	-	-	-	-	-	-	-	-	-	3	-
Level of correlation of the course	2	3	3	3	2	-	-	-	-	-	-	-	-	-	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. –II Semester

(19BT41501) THEORY OF COMPUTATION

(Common to CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Discrete Mathematical Structures.

COURSE DESCRIPTION: Finite automata; Nondeterministic Finite automata; Regular expressions; Applications of the pumping lemma; Context-Free Grammars; Normal forms for context-free grammars; pushdown automata; Chomsky hierarchy of languages; Turing machines.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1: Design finite state machines to recognize formal languages.
CO2: Analyze formal languages using automata.
CO3: Identify different types of grammars in formal languages.
CO4: Construct context free grammars for context free languages
CO5: Develop Turing machine for different computational problems.
CO6: Validate formal languages of automata by applying closure properties.

DETAILED SYLLABUS:

UNIT I -FINITE AUTOMATA (10 periods)

Introduction to Finite automata, the central concepts of automata theory, Deterministic finite automata, Nondeterministic Finite automata, the equivalence of DFA and NDFA, Finite automata with epsilon-transitions, Conversion of epsilon-NFA to NFA and DFA, Mealy and Moore models.

UNIT II - REGULAR EXPRESSIONS AND LANGUAGES (9 periods)

Regular expressions, Identity rules, Finite automata and Regular expressions, Applications of regular expressions, Pumping lemma for regular languages, Applications of the pumping lemma, Closure properties of regular languages, Equivalence of two regular expressions, Equivalence of two finite automata and minimization of automata.

UNIT III - CONTEXT-FREE GRAMMARS (9 periods)

Context-Free Grammars, Parse trees, Applications of context free grammars, Ambiguity in grammars and languages, Normal forms for context-free grammars, the pumping lemma for context-free languages.

UNIT IV - PUSH DOWN AUTOMATA (8 periods)

Definition of the pushdown automaton, the languages of a PDA, Equivalence of PDA's and CFG's, Deterministic pushdown automata, Chomsky hierarchy of languages, the model of linear bounded automaton, Recursive and recursively enumerable languages (REL), properties of recursive and recursively enumerable languages.

UNIT V - TURING MACHINE (9 periods)

Turing machine model, Representation of Turing machine, Language acceptability by Turing machine, Design of Turing machine, Techniques for Turing machine construction, Variants of Turing machines, Universal Turing machine, Undecidability.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOK:

1. K.L.P. Mishra and N.Chandrasekaran, *Theory of Computer Science: Automata Languages and Computation*, PHI Learning, 3rd Edition, 2009.

REFERENCE BOOKS:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D Ullman, *Introduction to Automata Theory, Languages and Computation*, Pearson Education, 3rd Edition, 2011.
2. John C Martin, *Introduction to Languages and the Theory of Computation*, TMH, 4thEdition, 2010.

ADDITIONAL LEARNING RESOURCES:

- https://nptel.ac.in/courses/106/104/106104148/

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	3	3	-	1	-	-	-	-	-	-	-	-	3	3
CO6	2	3	-	-	-	-	-	-	-	-	-	-	-	-	3	
Average	2.5	2.8	2.7	2.5	-	1	-	-	-	-	-	-	-	-	3	3
Level of correlation of the course	3	3	3	3	-	1	-	-	-	-	-	-	-	-	3	3

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. – II Semester

(19BT4HS01) **BANKING AND INSURANCE**

(Common to CE, ME, CSE, CSSE, and IT)
(Open Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE REQUISITE: -

COURSE DESCRIPTION: Scope, Objectives and Elements of cost Accounting; Cost Sheet and Tender quotations; Variance Analysis: Material variances, Labor variances; Meaning and Scope, Liquidity, Profitability Ratios: concept of Risk and Return on Investment.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1: Demonstrate knowledge in concepts and functions of Banking and Insurance, RBI, bank and customer relationship, types of accounts, types of loans and advances, types of insurance and risk.

CO2: Develop skills to provide solutions in electronic payment system, business models and insurance claims.

DETAILED SYLLABUS:

UNIT I -INTRODUCTION TO BANKING (9 periods)

Meaning - Importance of banking - Functions of banking - **Reserve Bank of India**: Functions – Role of RBI in sustainable development.

UNIT II -BANK-CUSTOMER RELATIONSHIP (9 periods)

Debtor-creditor relationship, deposit products or services, payment and collection of cheques. Accounts – Types of accounts, procedure for opening and closing an account - Loans and Advances- Principles of lending and types of loans.

UNIT III -ELECTRONIC PAYMENT SYSTEM & BUSINESS MODELS (9 periods)

Introduction to Online Banking - types of e-payment system, e-cash, NEFT, RTGS, Credit cards, Debit cards and Electronic Wallet - Business models: B2B, B2C, C2C and B2G.

UNIT IV -INTRODUCTION TO RISK AND INSURANCE (9 periods)

Concept of risk, risk Vs. uncertainty. **Insurance**: Definition, Insurance as risk mitigation mechanism, elements of insurance.

UNIT V -INSURANCE OVERVIEW (9 periods)

Principles and Functions of Insurance - Types of Insurance - LIC and GIC - IRDA - Insurance Players in India.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. RanganadhaChary,A.V. and Paul, R.R., *Banking and Financial system*, Kalyani Publisher, New Delhi, 3rd edition, 2016.
2. Sharma,R.K., Shashi K. Gupta and Jagwant Singh, *Banking and Insurance*, Kalyani Publishers, New Delhi, 17th edition, 2014.

REFERENCES BOOKS:

1. *Indian Institute of Banking &Finance,Digital Banking*, Taxmann Publications Pvt. Ltd., 2016
2. JyotsnaSethi and Nishwan Bhatia, *Elements of Banking and Insurance*, PHI Learning Pvt. Ltd., 2nd edition, 2012.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	1	2	-	-	3	2	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	2	3	3	-	-	1	-	-	-	-
Average	-	1	2	-	-	3	2	3	3	-	-	2	-	-	-	-
Level of correlation of the course	-	1	2	-	-	3	2	3	3	-	-	2	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. – II Semester

(19BT4HS03) COST ACCOUNTING AND FINANCIAL MANAGEMENT

(Common to CE, ME, CSE, CSSE, and IT)
(Open Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE REQUISITE: -

COURSE DESCRIPTION: Scope, Objectives and Elements ofcost Accounting; Cost Sheet and Tender quotations; Variance Analysis: Material variances, Labor variances; Meaning and Scope, Liquidity, Profitability Ratios: concept of Risk and Return on Investment.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge in Costing, Material, Labor, Overheads, Cost control, risk and return, security analysis and portfolio management.

CO2. Design solutions for effective investment decisions, cost analysis, tenders, quotations, variance analysis, ratio analysis and capital budgeting techniques.

DETAILED SYLLABUS:

UNIT I - COST ACCOUNTING (9 periods)

Meaning of Cost and Cost Accounting, Objectives, Scope, Advantages and disadvantages – Cost Accounting *Vs* Management Accounting – Elements of Costing – Installation of costing system – Material Control, Labour Control, Overhead Control.

UNIT II - COST SHEET AND PREPARATION OF COST SHEET (9 periods)

Analysis of Cost – Importance of Costing while pricing the products - Preparation of cost sheet, estimate, tender and quotation (Simple problems).

UNIT III - STANDARD COSTING AND VARIANCE ANALYSIS (9 periods)

Introduction to Standard Costing and Variances – Variance Analysis: Material variances, Labour variances (Simple Problems).

UNIT IV - FINANCIAL MANAGEMENTAND RATIO ANALYSIS (9 periods)

Meaning, Objectives - Nature and Scope, Importance of FM – **Ratio Analysis:** Solvency ratios, Liquidity ratios, Profitability ratios, Financial Statement Analysis through ratios (Simple Problems).

UNIT V - INTRODUCTION TO INVESTMENT (9 periods)

Investment – Meaning and Definition- concept of risk and returns-Investment Alternatives- Capital budgeting techniques – Security Analysis and Portfolio Management (Basic concepts).

Total periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. S.P. Jain and K. L. Narang,*Cost Accounting*, Kalyani Publishers, Ludhiana, 10th edition, 2016.
2. I.M. Pandey, *Financial Management*, Vikas Publishing House Pvt. Ltd., 14th edition, 2016.

REFERENCE BOOKS:

1. The Institute of Company Secretaries of India, *Cost and Management Study Material*, New Delhi.
2. CA SaravanaPrasath, *Cost Accounting and Financial management*, Wolters Kluwer India Pvt. Ltd., New Delhi, 2018.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	-	-	-	-	-	-	-	1	-	-	-	-	-
CO2	2	-	3	-	3	-	-	-	-	2	1	-	-	-	-	-
Average	2.5	3	2.5	-	3	-	-	-	-	2	1	-	-	-	-	-
Level of correlation of the course	3	3	3	-	3	-	-	-	-	2	1	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - II Semester

(19BT4HS05)**GENDER AND ENVIRONMENT**

(Common to CE, ME, CSE, CSSE, and IT)
(Open Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Gender and the environment relationship, Gendered Roles in the family and community, Gender and sustainable development, Gender in environmental justice, Gender and environmental security.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Apply the knowledge of gender and environment connections, key issues and topics within global environmental politics in environmental decision-making.
CO2. Comprehend the concepts of gender and sustainable development through debates, and policy documents.
CO3. Analyze the concept of environmental security and justice by identifying the sources of insecurity.

DETAILED SYLLABUS

UNIT I - GENDER ANDENVIRONMENT RELATIONSHIP (9 Periods)

Introduction–Gender and Environment–Development of gender roles–Society, gender and environment – Understanding environmental politics – Gender-environment connections– Eco-feminism - Cultural eco-feminism–Social eco-feminism - Feminist political ecology

UNIT II - GENDERED ROLES IN THE FAMILY AND COMMUNITY (9 Periods)

Organization of the household – Domestic division of labour - Food: growing, harvesting, shopping, preparing, and cooking
Gender and Power- Planning – Politics – NGO – Gendering of environmental protest – Environmental decision-making

UNIT III - GENDER ANDSUSTAINABLE DEVELOPMENT (9 Periods)

Concept of sustainability and its achievement – Concept of sustainable development – Ecological Modernization – Gender and sustainability debates – Gender and sustainable development debates - Gender in policy documents – Gender, poverty and equity in sustainable development

UNIT IV - GENDER IN ENVIRONMENTAL JUSTICE (9 Periods)

Normative Concerns (Fairness, Inequality and Justice) - Making sense of Environmental justice – Ecological debt, Transnational harm, and human rights – Ecological justice – Gender and Environmental Justice – Gender, Vulnerability and risk – Women in environmental justice movements – Knowledge and participation – Gender, sustainability and justice as guiding concepts.

UNIT V - GENDER AND ENVIRONMENTAL SECURITY (9 Periods)

Connections between security and the environment – **Gender, environment and security:** Sustainability as security - poverty and insecurity – Insecurity as injustice – Competing ways of thinking security – Reflecting on sources of insecurity – **Case Study** – Food Security -**Case Study** – The impacts of natural disasters

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Nicole Detraz, *Gender and the Environment*, Polity Press, Cambridge, UK, 2017
2. Susan Buckingham- Hatfield, *Gender and Environment*, Routledge, London, 2000.

REFERENCE BOOKS:

1. Promillakapur, *Empowering Indian Women*, Publication Division, Government of India, New Delhi, 2000.
2. Ronnie Vernooy, *Social and gender Analysis Natural Resource Management: Learnning studies and lessons from Aisa*, Sage Publications, New Delhi,2006
3. Swarup, Hemlata and Rajput, Pam, *Gender Dimensions of Environmental and Development Debate: The Indian Experience*, In SturatS.Nagel, (ed). "India"s Development and Public Policy".Ashgate, Burlington, 2006.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	3	3	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	2	3	1	-	2	-	-	-	-	-	-
CO3	3	-	-	-	-	3	3	-	-	-	-	2	-	-	-	-
Average	3	-	-	-	-	2.6	3	1	-	2	-	2	-	-	-	-
Level of correlation of the course	3	-	-	-	-	3	3	1	-	2	-	2	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. – II Semester

(19BT4HS07) INDIAN ECONOMY

(Common to CE, ME, CSE, CSSE, and IT)
(Open Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Introduction; Time Value of Money; Elementary Economic Analysis; Value Analysis/Value Engineering; Economic Planning.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Understand the basic concepts of economics, economic analysis, economic planning and strate

CO2. Demonstrate knowledge in capital budgeting, evaluation of engineering projects, depreciation policy and familiarize with the concepts of value analysis vs. value engineering.

DETAILED SYLLABUS:

UNIT I - INTRODUCTION (9 Periods)

Economics - Flow in an Economy, Law of Supply and Demand; Micro and Macro Economics; Relationship between Science, Engineering, Technology and Economic Development; Concept of Engineering Economics-Types of Efficiency, Definition and Scope of Engineering Economics.

UNIT II - ELEMENTARY ECONOMIC ANALYSIS (9 Periods)

Economic Analysis – Meaning, Significance, Simple Economic Analysis; Material Selection for a Product, Substitution of Raw Material; Design Selection for a Product; Material Selection-Process Planning, Process Modification.

UNIT III - ECONOMIC PLANNING (9 Periods)

Introduction - Need For Planning in India, Five year plans(1951-2012), NITI Aayog (from 2014 onwards); Inclusive Growth-Meaning, Significance, Need for inclusive growth in India, Strategy for more inclusive growth, Challenges and Prospects; Employment and Inclusive Growth in India, Role of engineers in sustaining inclusive growth.

UNIT IV - TIME VALUE OF MONEY (12 Periods)

Concepts and Application; Capital Budgeting-Traditional and Modern Methods; Simple and Compound Interest, Cash Flow Diagram, Principle of Economic Equivalence; Evaluation of Engineering Projects – Present Worth Method, Future Worth Method, Annual Worth Method, Internal Rate of Return Method, Cost-benefit Analysis in Public Projects; Depreciation Policy-Depreciation of Capital Assets, Causes of Depreciation, Straight Line Method and Declining Balance Method.

UNIT V - VALUE ANALYSIS/VALUE ENGINEERING (6 Periods)

Introduction - Value Analysis, Value Engineering, Functions, Aims; Value Analysis vs Value Engineering; Value Engineering Procedure- Advantages, Application Areas.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Panneerselvam. R., *Engineering Economics*, PHI Learning Private Limited, New Delhi, 2nd edition, 2013
2. Jain. T. R., V. K. Ohri, O. P. Khanna,*Economics for Engineers*, VK Publication, 1st Edition, 2015

REFERENCE BOOKS:

1. DuttRudar and Sundhram K. P. M., *Indian Economy*, S. Chand, New Delhi, 62nd revised edition, 2010.
2. Misra. S. K. and V. K. Puri., *Indian Economy*: Its Development Experience, Himalaya Publishing House, Mumbai, 32nd edition, 2010.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	2	-	-	-	-	-	2	-	-	-	-
Average	3	-	-	-	-	2	-	-	-	-	-	2	-	-	-	-
Level of correlation of the course	3	-	-	-	-	2	-	-	-	-	-	2	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. – II Semester

(19BT4HS09) **LIFE SKILLS**

(Common to CE, ME, CSE, CSSE, and IT)

(Open Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Positive attitude; Self-discovery-Interpersonal relationships; Cross-cultural communication; Core thinking-Problem solving and Decision making; Business presentations and Public speaking.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge in strategies involved in developing positive attitude, process of knowing oneself and managing effective interpersonal relationships.

CO2. Analyse problem solving strategies in Decision Making and SWOT analysis.

CO3. Communicate effectively with Engineering Community and Society by demonstrating presentation skills in professional arena.

DETAILED SYLLABUS:

UNIT I - POSITIVE ATTITUDE (9 Periods)

Introduction, Features of attitudes, Formation of attitudes, Ways of changing attitude in a person, Attitude in a work place, developing positive attitude, Obstacles in developing positive attitude, measuring attitude.

UNIT II - SELF DISCOVERY AND INTERPERSONAL RELATIONSHIPS (9 Periods)

Importance of knowing yourself, Process of knowing yourself, SWOT Analysis, Elements of attitude in interpersonal relationships, Methods to deal with different types of interpersonal relationship skills.

UNIT III - CROSS-CULTURAL COMMUNICATION (9 Periods)

Different Communication Styles, Cultural variables, communication sensitivity and variables of national culture, Individual Cultural Variables, Cross-cultural Communication Strategies, Potential hot spots in cross-cultural communication, Cross-cultural communication – Basic Tips.

UNIT IV - CORE THINKING, PROBLEM SOLVING AND DECISION MAKING (9 Periods)

Process of developing core thinking skills, Categories of thinking: Critical & Creative, Understanding problem solving, Cause of problems, Stages of problem solving, Methods of problem solving, Types of decision making.

UNIT V - BUSINESS PRESENTATIONS AND PUBLIC SPEAKING (9 Periods)

Business presentations and speeches, structuring the material, Types of delivery, Guidelines for delivery, Effective sales presentation, Controlling nervousness and stage fright.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Dr. K. Alex, Soft Skills, S. Chand and Company Limited, New Delhi, 2018
2. Manmohan Joshi, Soft Skills, bookboon.com, Bangalore, 2017

REFERENCE BOOKS:

1. Meenakshi Raman and Prakash Singh, Oxford University Press, New Delhi, 2013
2. Jeff Butterfield, Soft Skills for Everyone, Cengage Learning India Private Limited, Delhi, 2011

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-
CO2	-	3	-	-	3	-	-	-	3	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-
Average	1.5	3	-	-	3	-	-	-	3	3	-	-	-	-	-	-
Level of correlation of the course	2	3	-	-	3	-	-	-	3	3	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. – II Semester

(19BT4HS11)**PROFESSIONAL ETHICS**

(Common to CE, ME, CSE, CSSE, and IT)
(Open Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Engineering Ethics; Professional Ideals and Virtues; Engineering as Social Experimentation; Responsibilities and Rights; Global Issues.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge in Engineering Ethics, Responsibilities and Rights.
CO2. Analyze the concepts of Engineering in Social Experimentation and Global Issues.
CO3**.** Apply the nuances of professional ideals at work place and in social context.

DETAILED SYLLABUS:

UNIT - I: ENGINEERING ETHICS (9 periods)
Scope and aim of engineering ethics, Senses of engineering ethics, Variety of moral issues, Types of inquiry, Moral dilemmas, Moral autonomy-Kohlberg's theory, Gilligan's theory, Consensus and controversy.

UNIT - II: PROFESSIONAL IDEALS AND VIRTUES (8 periods)
Theories about virtues, Professions, Professionalism, Characteristics, Expectations, Professional responsibility, Integrity, Self-respect, Sense of responsibility, Self-interest, Customs and religion, Self-interest and ethical egoism, Customs and ethical relativism, Religion and divine command ethics, Use of ethical theories, Resolving moral dilemmas and moral leadership.

UNIT - III: ENGINEERING AS SOCIAL EXPERIMENTATION (10 periods)
Engineering as experimentation, Similarities to standard experiments, Learning from the past and knowledge gained, Engineers as responsible experimenters, Conscientiousness, Moral autonomy and accountability, The challenger case, Codes of ethics and limitations, Industrial standards, Problems with the law of engineering.

UNIT - IV: RESPONSIBILITIES AND RIGHTS (9 periods)
Collegiality and loyalty, Respect for authority, Collective bargaining, Confidentiality, Conflict of interests, Occupational crime, Rights of engineers, Professional rights, Whistle-blowing, The BART case, Employee rights and discrimination.

UNIT - V: GLOBAL ISSUES (9 periods)
Multinational corporations, Professional ethics, Environmental ethics, Computer ethics, Engineers as consultants, Witnesses, Advisors and Leaders, Engineers as Managers, Managerial ethics applied to Engineering Profession, moral leadership.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, *Ethics in Engineering*, Tata McGraw-Hill, 3rd edition, 2007.
2. Govindarajan, M., NataGovindarajan, M., Natarajan, S. and Senthilkumar, V. S., *Engineering Ethics*, Prentice Hall of India, 2004.

REFERENCE BOOKS:

1. S. Kannan and K. Srilakshmi, *Human Values and Professional Ethics*, Taxmann Allied Services Pvt Ltd., 2009.
2. Edmund G. Seebauer and Robert L. Barry, *Fundamental of Ethics for Scientists and Engineers*, Oxford University Press, 2001.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	-	-	3	-	-	-	-	-	-	-	-	-	-	-
Average	1.6	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Level of correlation of the course	2	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. – II Semester

(19BT4HS13)INDIAN TRADITION AND CULTURE

(Common to CE, ME, CSE, CSSE, and IT)
(Open Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Basic traits of Indian Culture; Humanistic Reforms under Jainism and Buddhism; Culture in the medieval period; Socio Religious reforms in Indian Culture; Reform movements for harmonious relations.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate the knowledge in Vedic culture, cultural aspects of Buddhism, Jainism and cultural conditions in the medieval period.
CO2. Understandthe impact ofsocio religious reforms and movements on Indian tradition and culture to improve harmonious relations within society.

DETAILED SYLLABUS:

UNIT I: BASIC TRAITS OF INDIAN CULTURE (9 Periods)

Meaning and definition and various interpretations of culture, Culture and its features.The Vedic and Upanishadic culture and society.Human aspirations and values in these societies.Chaturvidhapurushardhas, Chaturashrma and Chaturvarna theory.

UNIT II: HUMANISTIC REFORMS UNDER JAINISM AND BUDDHISM (9 Periods)

Salient features of Jainism - contributions of Jainism to Indian culture. Contributions of Aachaarya and Mahaapragya.Buddhism as a humanistic culture.The four noble truths of Buddhism.Contributions of Buddhism to Indian culture.

UNIT III: CULTURE IN THE MEDIEVAL PERIOD (9 Periods)

Unifications of India under Mouryas and Guptas and their cultural achievements.Cultural conditions under satavahanas.Contributions to pallavas and cholas to art and cultural achievements of vijayanagara rulers.

UNIT IV: SOCIO RELIGIOUS REFORMS IN INDIAN CULTURE (9 Periods)

Western impact on India, Introductin of western education, social and cultural awakening and social reform movements of Rajaramohan Roy - DayanandhaSaraswathi- Anne Besant (theosophical society).

UNIT V: REFORM MOVEMENTS FOR HARMONIOUS RELATIONS (9 Periods)

Vivekananda, Eswarchandravidyasagar and Veeresalingam - emancipation of women and struggle against caste. Rise of Indian nationalism. Mahatma Gandhi- Non-violence and satyagraha and eradication of untouchability.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. ValluruPrabhakaraiah, Indian Heritage and Culture, Neelkamal Publications Pvt. Ltd. Delhi, 1st Edition, 2015.

REFERENCE BOOKS:

1. L. P. Sharma, *History of Ancient India*, Konark Publishers, Pvt. Ltd. New Delhi, 2010.
2. L. P. Sharma, *History of Medieval India*, Konark Publishers, Pvt. Ltd. New Delhi, 2010.
3. L. P. Sharma, *History of Modern India*, Konark Publishers, Pvt. Ltd. New Delhi, 2010.
4. The Cultural Heritage of India Vol-I, II, III, IV, V, The Ramakrishna Mission Institute of Culture, Calcutta.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
Average	2.5	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-
Level of correlation of the course	3	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - II Semester

(19BT40106)DISASTER MITIGATION AND MANAGEMENT

(Common to CE, ME, CSE, CSSE, and IT)
(Open Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Disasters; Earthquakes; Floods; Cyclones; Droughts; Landslides; Disaster management.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyse the vulnerability of an area to natural and man-made disasters/hazards as per the guidelines to solve complex problems using appropriate techniques ensuring safety, environment and sustainability.
CO2. Propose appropriate mitigation strategies for earthquake and tsunami impacts as per code of practice using suitable techniques ensuring safety, environment and sustainability besides communicating effectively in graphical form.
CO3. Analyse the causes and impacts of floods, cyclones and droughts using appropriate tools and techniques and suggest mitigation measures ensuring safety, environment and sustainability besides communicating effectively in graphical form.
CO4. Analyse the causes and impacts of landslides using appropriate tools and techniques and suggest mitigation measures ensuring safety, environment and sustainability.
CO5. Design disaster management strategies to solve pre, during and post disaster problems using appropriate tools and techniques following the relevant guidelines and latest developments ensuring safety, environment and sustainability besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT- I: DISASTERS (09 Periods)

Types of disasters - Natural disasters; Impact of disasters on environment, infrastructure and development; Concepts of hazards and vulnerability analysis, Hazard Assessment, Guidelines for hazard assessment and vulnerability analysis, Basic principles and elements of disaster mitigation.

UNIT- II: EARTHQUAKES (09 Periods)

Introduction to earthquake, Intensity scale (MSK–64), Seismic zones and activity in India, Action plan for earthquake disaster preparedness, Elements at risk, Recovery and rehabilitation after earthquake, Concepts of Earthquake resistant design and construction of buildings; Tsunami – Onset, Types and causes,Warning, Elements at risk, Typical effects, Specific preparedness and mitigation strategies, Case studies.

UNIT- III: FLOODS, CYCLONES AND DROUGHTS (11 Periods)

Floods and Cyclones: Onset, Types, Causes, Warnings, Elements at risk, Typical effects, Indian floods and cyclones, Hazard zones, Potential for reducing hazards, Mitigation strategies and community based mitigation, Case studies.

Droughts:Onset, Types and warning; Causes, Impact, Early warning and response mechanisms, Mitigation strategies, Droughts in India, Case studies.

UNIT- IV: LANDSLIDES (08 Periods)

Onset, Types and warning; Causes, Elements at risk, Indian landslides, Hazards zones, Typical effects, Mitigation strategies and community based mitigation, Case studies.

UNIT- V: DISASTER MANAGEMENT (08 Periods)

Disaster management organization and methodology, Disaster management cycle, Disaster management in India – Typical cases and Cost–benefit analysis, Disaster management programs implemented by NGOs and Government of India, Usage of GIS and Remote sensing techniques in disaster management, Leadership and Coordination in Disaster management, Emerging trends in disaster management.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. V. K. Sharma, *Disaster Management,* Medtech Publishing, 2nd Edition, 2013.
2. Anand S. Arya, Anup Karanth, and Ankush Agarwal, *Hazards, Disasters and Your Community: A Primer for Parliamentarians*, GOI–UNDP Disaster Risk Management Programme, Government of India, National Disaster Management Division, Ministry of Home Affairs, New Delhi, Version 1.0, 2005.

REFERENCE BOOKS:

1. Donald Hyndman and David Hyndman, *Natural Hazardsand Disasters*, Cengage Learning, 3rd Edition, 2011.
2. *Disaster Management in India,*AStatus Report, Ministry of Home Affairs, Govt. of India, May 2011.
3. Rajendra Kumar Bhandari, *Disaster Education and Management: A Joyride for Students, Teachers, and Disaster Managers*, Springer India, 2014.
4. R. B. Singh, *Natural Hazards and Disaster Management*, Rawat Publications, 2009.

ADDITIONAL LEARNING RESOURCES:

1. Tushar Bhattacharya, *Disaster Science and Management*, McGraw Hill, 2014.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	2	2	2	2	2	-	-	-	-	-	-	-	-
CO2	3	3	3	3	2	2	1	2		2	-	-	-	-	-	-
CO3	3	3	-	2	2	2	2	-	-	2	-	-	-	-	-	-
CO4	3	3	-	3	2	2	2	-	-	-	-	-	-	-	-	-
CO5	3	2	3	2	2	2	1	2		1	3	2	-	-	-	-
Average	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Level of correlation of the course	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - II Semester

(19BT40107) SUSTAINABLE ENGINEERING

(Common to CE, ME, CSE, CSSE, and IT)
(Open Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Principles of sustainability; Sustainability metrics and assessment tools; Sustainable engineering practices; Sustainable engineering applications; Sustainable urbanization and industrialization.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

- CO1 Analyze the principles of sustainability to solve complex environmental problems following relevant standards/protocols considering society, health, safety and environment.
- CO2 Analyze sustainability metrics and assessment tools to solve complex environmental problems following relevant standards and emerging trends considering society, health, safety, environment and economics besides communicating effectively in graphical form.
- CO3 Analyze sustainable engineering practices to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.
- CO4 Design sustainable engineering applications to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.
- CO5 Analyzesustainable urbanization and industrialization principles to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT – I: PRINCIPLES OF SUSTAINABILITY (09 periods)

Emerging challenges, Sustainability and sustainable engineering; Environmental concerns; Social, economic and legal issues; Availability and depletion of natural resources, Disaster resiliency; Multilateral environmental agreements – Basel convention, Clean development mechanism (CDM), Montreal and Kyoto protocols.

UNIT – II: SUSTAINABILITY METRICS AND ASSESSMENT TOOLS (09 periods)

Sustainability indicators, metrics and assessment tools, Material flow analysis and material budget, Carbon footprint analysis, Life cycle assessment, Streamlined life-cycle assessment (SLCA), Economic input output-life cycle analysis, Environmental health risk assessment, Other emerging assessment tools.

UNIT – III: SUSTAINABLE ENGINEERING PRACTICES (09 periods)

Sustainable energy engineering, Sustainable waste management, Green and sustainable buildings and infrastructure, Sustainable civil infrastructure, Sustainable remediation of contaminated sites, Climate geoengineering.

UNIT – IV: SUSTAINABLE ENGINEERING APPLICATIONS (09 periods)

Environmental and chemical engineering projects, Materials engineering projects, Infrastructure engineering projects – Background, Methodology, Goal and Scope, Study area, Technical design, Environmental sustainability, Life cycle assessment, Economic

sustainability, Social sustainability, Rating systems – ENVISION, LEED, GRIHA, IGBC; Conclusions.

UNIT – V: SUSTAINABLE URBANIZATION AND INDUSTRIALIZATION **(09 periods)**

Sustainable urbanization and industrialization, United Nations sustainable development goals – Right to education, Poverty eradication, Social and technological changes; Industrial Processes - Material selection, Energy efficiency, Pollution prevention and control techniques, Industrial Ecology, Industrial symbiosis.

Total Periods: *45*

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Reddy, K.R., Cameselle, C., and Adams, J.A., *Sustainable Engineering: Drivers, Metrics, Tools, and Applications*, John Wiley &Sons, Inc., Hoboken, New Jersey, 2019.
2. Allen, D. T. and Shonnard, D. R., *Sustainability Engineering: Concepts, Design and Case Studies*, Pearson Education, 1st Edition, 2012.

REFERENCE BOOKS:

1. Bradley. A.S; Adebayo,A.O., Maria, P.,*EngineeringApplications in Sustainable Design and Developmen*t, Cengage Learning, 1st Edition, 2016.
2. Purohit, S. S., *Green Technology: An Approach for Sustainable Environment*, Agrobios Publication, 1st Edition, 2016.
3. *Energy Conservation Building Code (ECBC) 2007*, Bureau of Energy Efficiency, Govt. of India, New Delhi.
4. Twidell, J. W. and Weir, A. D., *Renewable Energy Resources*, Routledge, Taylor & Francis Group, 3rd Edition, 2015.

ADDITIONAL LEARNING RESOURCES:

1. Daniel A. Vallero and Chris Brasier, *Sustainable Design: The Science of Sustainability and Green Engineering*, Wiley-Blackwell, 1st Edition, 2008.
2. Jorge A. Vanegas, *Sustainable Engineering Practice: An Introduction*, Committee on Sustainability, American Society of Civil Engineers,https://doi.org/10.1061/9780784407509, 2004.
3. Mackenthun, K.M., *Basic Concepts in Environmental Management*, CRC Press, Taylor & Francis Group, 1st Edition, 1999.
4. *Environment Impact Assessment Guidelines*, Notification of Government of India, 2006.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	-	2	3	2	-	-	-	-	-	-	-	-
CO2	3	3	-	2	2	2	2	2	-	1	2	1	-	-	-	-
CO3	3	3	-	2	2	2	2	2	-	1	2	-	-	-	-	-
CO4	3	3	3	2	2	2	2	2	-	1	2	-	-	-	-	-
CO5	3	3	-	2	2	2	2	2	-	1	2	-	-	-	-	-
Average	3	3	3	2.2	2	2	2	2	-	1	2	1	-	-	-	-
Level of correlation of the course	3	3	3	2	2	2	2	2	-	1	2	1	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - II Semester

(19BT40108) CONTRACT LAWS AND REGULATIONS

(Common to CE, ME, CSE, CSSE, and IT)
(Open Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Construction contracts; Tenders; Arbitration; Legal requirements; Labour regulations.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Develop construction contracts to solve complex contract related problems by following laws and regulations considering project schedule, cost, quality and risk.
CO2. Prepare tenders as per the specifications by following latest developments, laws and regulations to solve complex tender problems considering project schedule, cost, quality and risk.
CO3. Analyze arbitration problems to address the contract disputes following the laws and regulations in the context of society.
CO4. Analyze legal issues pertaining to contracts and tenders considering society.
CO5. Analyze labour regulations to address labour safety issues.

DETAILED SYLLABUS:

UNIT – I: CONSTRUCTION CONTRACTS (09 Periods)

Indian contracts act, Elements of contracts, Types of contracts, Features, Suitability, Design of contract documents, International contract document and laws, Standard contract document, Law of torts.

UNIT – II: TENDERS (09 Periods)

Prequalification, Bidding, Accepting; Evaluation of tender from technical, contractual and financial points of view; Two cover system, Preparation of the documentation, Contract formation and interpretation, Potential contractual problems, Price variation clause, Comparison of actions and laws, Subject matter, Violations, Latest developments in tendering.

UNIT–III: ARBITRATION (09 Periods)

Arbitration, Comparison of actions and laws, Agreements, Appointment of arbitrators, Conditions of arbitration, Powers and duties of arbitrator, Rules of evidence, Enforcement of award, Arbitration disputes, Dispute review board.

UNIT – IV: LEGAL REQUIREMENTS (09 Periods)

Legal requirements for planning, Property law, Agency law, Tax laws – Income tax, Sales tax, Excise and custom duties, Local government approval, Statutory regulations, Insurance and bonding, Laws governing purchase and sale, Use of urban and rural land, Land revenue codes, EMD, Security deposits, Liquidated damages.

UNIT – V:LABOUR REGULATIONS (09 Periods)

Social security, Welfare legislation; Laws relating to wages, bonus and industrial disputes; Labour administration, Insurance and safety regulations, Workmen's compensation act, Maternity benefit act, Child labour act, Other labour laws.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS

1. SubbaRao, G.C.V., *Law of Contracts I & II*, S. Gogiaand Co., 11th Edition, 2011.
2. Jimmie Hinze, *Construction Contracts,* McGraw Hill, 3rd Edition, 2011.

REFERENCES

1. Kishore Gajaria, *GT Gajaria, Law Relating to Building and Engineering Contracts in India*, Lexis NexisButterworths India, 4th Edition, 2000.
2. Patil, B. S., *Civil Engineering Contracts and Estimates*, University Press (India) Private Ltd., 4thEdition, 2015.
3. Joseph T. Bockrath, *Contracts and the Legal Environment for Engineers and Architects*, McGraw Hill Education, 7th Edition, 2010.
4. AkhileshwarPathak, *Contract Law*, Oxford University Press, 2011.

ADDITIONAL LEARNING RESOURCES:

- P.C. Markanda, Naresh Markanda, Rajesh Markanda, *Building and Engineering Contracts- Law and Practice*, Vol-I and II, 5th Edition, LexisNexis Publication.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	3	-	3	-	2	1	-	-	-	-	-
CO2	3	3	3	3	-	3	-	3	-	2	1	2	-	-	-	-
CO3	2	2	-	3	-	3	-	3	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	3	-	3	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	3	-	3	-	-	-	-	-	-	-	-
Average	2	2	3	3	-	3	-	3	-	2	1	2	-	-	-	-
Level of correlation of the course	2	2	3	3	-	3	-	3	-	2	1	2	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - II Semester

(19BT40306) GLOBAL STRATEGY AND TECHNOLOGY

(Common to CE, ME, CSE, CSSE, and IT)
(Open Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PREREQUISITES: -

COURSE DESCRIPTION: Introduction to strategic management; Strategic management process; Principles of good strategy; Globalization strategies; Research and Development strategies; Technology Management and Transfer; Elements of Transfer Process; Corporate Governance in the Indian scenario

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate the knowledge on strategic management, its approaches, and tools through ethical decision making.
CO2. Analyze the globalization challenges for scrupulous selection of globalization strategies.
CO3. Apply the R&D strategies and trends to enhance the technological breakthroughs for new products and applications.
CO4. Demonstrate the knowledge on technology management and transfer that strengthen the economy and accelerate the application of technology and resources.
CO5. Analyze the challenges of corporate governance in Indian scenario for the effective development of value oriented organizations.

DETAILED SYLLABUS:

UNIT - I: STRATEGIC MANAGEMENT (09 periods)

Introduction, Classes of decisions, Levels of strategy, Core competence, Strategic intent and stretch, Approaches to strategy making, Roles of different strategists, Strategic management-Process, Benefits, Limitations; Ethics in strategic decision making, Principles of good strategy, Strategic Management in India; Common managerial strategy formulation tools.

UNIT - II: GLOBALIZATION (09 periods)

Definition, Stages, Essential conditions for globalization, Globalization strategies, Competitive advantage of Nations and regions, Factors affecting Globalization, Globalization of Indian business.

UNIT - III: RESEARCH AND DEVELOPMENT STRATEGIES (09 periods)

Concept, Evolution of R and D Management, R and D as a business, Rand D as competitive advantage, Elements of R and D strategies, Integration of R and D, Selection and implementation of R and D strategies, R and D trends and challenges

UNIT - IV: TECHNOLOGY MANAGEMENT AND TRANSFER (09 periods)

Technology Management: Introduction, Technology-Definition, Components, Classification Features; Technology Management-Concept, Nature; Drivers of Management of Technology-Significance, Scope, Responding to technology challenges.

Technology Transfer: Introduction, Definition, Classification, Significance, Elements of process, Types of Technology Transfer, Package, Modes of Transfer, Routes, Channels and Effectiveness of Technology Transfer.

UNIT – V: CORPORATE GOVERNANCE: THE INDIAN SCENARIO (09 periods)

Emergence of corporate governance in India-Landmarks, Models, Codes and status in India, Role and Responsibilities of Regulators, The Board of Directors; Corporate Governance- Specific issues in India, Family owned Business, Corporate Governance and the Indian ethos.

Total periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Francis Cherunilam, *Strategic Management*, Himalaya Publishing House, 3rdEdition, 2002.
2. C.S.G.Krishnamacharyulu and LalithaRamakrishnan, *Management of Technology*, Himalaya Publishing House, 2nd Edition, 2012.

REFERENCE BOOKS:

1. White and Bruton, *The Management of Technology and Innovation:A Strategic Approach*, Cengage Learning, 1stEdition, 2007.
2. S.K.Mandak, *Ethics in Business and Corporate Governance*, TMH, 2ndEdition, 2012.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	-	1	1	-	1	-	-	1	-	-	-	-	-
CO2	3	2	1	-	1	1	-	-	-	-	1	-	-	-	-	-
CO3	3	2	1	-	1	1	-	-	-	-	1	-	-	-	-	-
CO4	3	2	1	-	1	1	-	-	-	-	1	-	-	-	-	-
CO5	3	2	1	-	1	1	-	1	-	-	1	-	-	-	-	-
Average	3	2	1	-	1	1	-	1	-	-	1	-	-	-	-	-
Level of correlation of the course	3	2	1	-	1	1	-	1	-	-	1	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - II Semester

(19BT40307) MANAGEMENT SCIENCE

(Common to CE, ME, CSE, CSSE, and IT)
(Open Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Concepts of Management; Concepts Related to ethics and social responsibility; Human Resource Management; Operations Management; Statistical Process Control; Inventory Management; Marketing; Project Management; Project Crashing.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1: Demonstrate the concepts of management, its functions and processes used in optimum resource utilization within the context of ethics and social responsibility.
CO2: Apply the concepts of HRM for selection and management of human resources.
CO3: Analyze different operations management problems using quality management tools to produce effective, efficient and adoptable products/services.
CO4: Identify different marketing strategies to maximize enterprise profitability and customer satisfaction within the realistic constraints.
CO5: Develop network models in time-cost tradeoff for effective project management.

DETAILED SYLLABUS:

UNIT- I: MANAGERIAL FUNCTION AND PROCESS (10 periods)

Concept and foundations of management, Evolution of management thought; Managerial functions – Planning, Organizing, Directing and Controlling; Decision-making; Role of manager, managerial skills; Managing in a global environment, Flexible systems management; Social responsibility and managerial ethics; Process and customer orientation; Managerial processes on direct and indirect value chain.

UNIT-II: HUMAN RESOURCE MANAGEMENT (08 periods)

Human Resource challenges; Human Resource Management functions; Human Resource Planning; Job analysis; Job evaluation, Recruitment and selection; Training and Development; Promotion and transfer; Performance management; Compensation management and benefits; Employee morale and productivity; Human Resource Information System.

UNIT- III: OPERATIONS MANAGEMENT (10 periods)

Fundamentals of Operations Management, Services as a part of operations management; Facilities location and layout; Line balancing; Quality management – Statistical Process Control, Total Quality Management, Six sigma; Role and importance of materials management, Value analysis, Make or Buy decision, Inventory control, Materials Requirement Planning, Enterprise Resource Planning, Supply Chain Management.

UNIT- IV: MARKETING MANAGEMENT (08 periods)

Concept, evolution and scope; Marketing strategy formulation and components of marketing plan; Segmenting and targeting the market; Positioning and differentiating the market offering, Analyzing competition; Product strategy; Pricing strategies; Designing and managing marketing channels; Integrated marketing communications.

UNIT- V: PROJECT MANAGEMENT (09 periods)

Project management concepts; Project planning – Work Breakdown Structure, Gantt chart; Project scheduling – Critical Path Method, Program Evaluation and Review Technique, Crashing the project for time-cost trade off; Resource Levelling.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. MartandT.Telsang, *Industrial Engineering and Production Management*, S. Chand, 2nd Edition, 2006.
2. Koontz and Weihrich, *Essentials of Management*,TMH, 6th Edition, New Delhi, 2007.

REFERENCE BOOKS:

1. O.P. Khanna, Industrial Engineering and Management, DhanpatRai and Sons,2010.
2. N.D. Vohra, *Quantitative Techniques in Management*, TMH, 2nd Edition, New Delhi.
3. L.M. Prasad, Principles and practice of Management, S. Chand and Sons, 2006.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	-	-	1	-	2	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	1	-	1	-	-	-	-	-	-	-	-
CO3	3	3	2	1	1	1	-	-	-	-	-	-	-	-	-	-
CO4	3	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	1	-	1	-	-	-	-	3	-	-	-	-	-
Average	3	2	1.6	1	1	1	-	1.5	-	-	3	-	-	-	-	-
Level of correlation of the course	3	2	2	1	1	1	-	2	-	-	3	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - II Semester

(19BT40504) CYBER LAWS AND SECURITY

(Common to CE, ME, CSE, CSSE, and IT)
(Open Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Evolution of Cyberspace, Jurisdiction in the borderless Cyberspace, E-Contracting, Models of E-Commerce, Modes of Electronic signatures, E-Money, Intellectual Property Rights, Cybercrimes, Privacy and data security.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on jurisdiction in cyberspace and the impact of cybercrime to protect privacy on the Internet.
CO2. Analyze the Indian cyber laws on E-Contracting, E-Commerce, E-signatures and E-money to promote digital law enforcement.
CO3. Apply the knowledge of digital rights in Indian context to protect intellectual properties in electronic world.
CO4. Practice ethics and cyber law regulations for leading electronic transactions on the Internet.

DETAILED SYLLABUS:

UNIT I–EVOLUTION OF CYBERSPACE AND JURISDICTION IN BORDERLESS CYBERSPACE (9 periods)

The Evolution of Cyberspace: Significance of information technology, Drawbacks in information technology, the digital divide, E-governance, Origin of cyberspace, Legal issues in cyberspace, regulating the Internet.

Jurisdiction in the Borderless Cyberspace: Meaning of jurisdiction, Three pre-requisites of jurisdiction, Jurisdictional theories in jurisdiction to prescribe, Tests to determine jurisdiction in Internet law cases, Indian laws to determine personal jurisdiction, Jurisdiction clauses in click wrap agreement.

UNIT II –ELECTRONIC CONTRACTING AND ELECTRONIC COMMERCE (9 periods)

Electronic Contracting: Formation of offline contracts under English common law, Fundamental requirements of an offline contract, Forming an E-contract through website, E-mail contracting, The Indian approach of E-contracts, Contract formation on the Internet and Information Technology Act 2000, B2C E-contracts.

Electronic Commerce: Models, Advantages, Restricted activities, Laws, India's information Technology Act2000, Online customer protection in India(B2B, B2C).

UNIT III – ELECTRONIC SIGNATURES AND ELECTRONIC MONEY (9 periods)

Electronic Signatures: The role of signatures, Significance of electronic signatures, Modes of electronic signatures, UNCITRAL model law on electronic signatures 2001, Cryptography, Role of certifying authority in PKI, The Indian Information Technology Act and electronic signatures- Electronic signatures, Prescribed authentication mechanisms, Secure electronic record.

Electronic Money: E-Money, RBI's guidelines on mobile banking and payments, The current E-payment systems, Earlier E-payment systems, Credit cards, Use of SET in online payment system.

UNIT IV – INTELLECTUAL PROPERTY RIGHTS AND THE INTERNET WORLD (9 periods)

Protecting copyright in the E-world, International organizations protecting Intellectual Property, Copyright issues on the Internet, Digital rights management, Patent protection

and computer software, India and copyright protection for computer software, Business method patents- Position of Business methods patents in India, Trademark protection on the Internet, Cyber squatting, The Indian trademark law and legal remedies, Hyper linking and framing.

UNIT V – CYBERCRIMES AND PROTECTING PRIVACY ON INTERNET (9 periods)

Cybercrimes: What is cybercrime, Categories, Different kinds of cybercrime, Cybercrimes and Information Technology Act, 2000 - Territorial scope and applicability, India's national cyber security policy.

Protecting Privacy on the Internet: Meaning of privacy, Threat to privacy on the Internet, Use of cookies and web bugs, Terms of use and privacy policy, Government right to interception, Employee privacy rights, Indian legal framework for data protection and privacy, Challenges to right of privacy in India.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOK:

1. Karnika Seth, *Computers Internet and New technology Laws*, LexisNexis, 2013.

REFERENCE BOOKS:

1. Sarika Gupta, Gaurav Gupta, *Information Security and Cyber Laws*, Khanna Publishing, 2019.
2. VivekSood, *Cyber Law Simplified*, McGraw Hill, 2018.
3. PavanDuggal, *Textbook on Cyber Law*, Universal LexisNexis, 2019.

ADDITIONAL LEARNING RESOURCES:

- https://swayam.gov.in/nd2_cec20_cs09/preview
- https://swayam.gov.in/nd2_nou19_cs08/preview

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	3	-	-	-	-	-	-	-	3	-	-
CO2	3	2	-	-	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	-	-	-	-	3	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	3	-	-
Average	3	2	-	-	-	3	-	3	-	-	-	-	-	3	-	-
Level of correlation of the course	3	2	-	-	-	3	-	3	-	-	-	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. – II Semester

(19BT50208) INTELLECTUAL PROPERTY RIGHTS

(Common to CE, ME, CSE, CSSE, and IT)
(Open Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Introduction to Intellectual Property; Trade Marks; Law of Copy Rights; Law of Patents; TradeSecrets; Unfair Competition; New Development of Intellectual Property.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Understand the concepts of intellectual property right and new amendmentsenforced in filling intellectual property right.
CO2. Understand the processes and principles of trade mark registration and apply them for registering trade mark.
CO3. Understand the process and principles of copy rights for registration and judicial consequences for violating laws of copyright/patents.
CO4. Understand the process and principles of trade secrets and judicial consequences for coping trade secrets.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO INTELLECTUAL PROPERTY (10 periods)

Introduction and the need for intellectual property rights (IPR); types of intellectual property- Design, Geographical Indication; International organizations, agencies and treaties.

UNIT-II: TRADEMARKS (08 Periods)

Introduction to trademark, Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT-III: LAW OF COPYRIGHTS (09 Periods)

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

UNIT-IV: TRADESECRETS (09 periods)

Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

UNIT-V: NEW DEVELOPMENT OF INTELLECTUAL PROPERTY (09 periods)

New developments in: trade mark law, copy right law, patent law, intellectual property audits. International overview on intellectual property; international - trade mark law, copy right law, international patent law, international development in trade secrets law.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Deborah, E. Bouchoux, *Intellectual property: The law of Trademarks, Copyright, Patents, and Trade Secrets,* cengage learning, 4th edition, 2013.
2. PrabuddhaGanguli, *Intellectual property right - Unleashing the knowledge economy*, Tata McGraw Hill Publishing Company Ltd.

REFERENCE BOOKS:

1. Neeraj P and Khusdeep D. Intellectual Property Rights. India, IN: PHI learning Private Limited. 1st edition 2019.

ADDITIONAL LEARNING RESOURCES:

- Subramanian, N and Sundararaman, M. (2018). *Intellectual Property Rights – An Overview*. (http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf)
- World Intellectual Property Organization. (2004). *WIPO Intellectual property Handbook*.(https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf)
- Cell for IPR Promotion and Management (http://cipam.gov.in/)
- World Intellectual Property Organization (https://www.wipo.int/about-ip/en/)
- Office of the Controller General of Patents, Designs and Trademarks (http://www.ipindia.nic.in/)

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	3	-	3	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	2	-	2	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	3	-	2	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	3	-	2	-	-	-	-	-	-	-	-
Average	2.25	-	-	-	-	2.75	-	2.25	-	-	-	-	-	-	-	-
Level of correlation of the course	3	-	-	-	-	3	-	3	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - II Semester

(19BT50409) GREEN TECHNOLOGIES

(Common to CE, ME, CSE, CSSE, and IT)
(Open Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Principles of green engineering; Green communications; Green energy; Green computing; Green construction; Green manufacturing

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze energy efficient communication systems such as Telecommunication systems, ICT, Wireless networks and cellular networks by understanding the principles of green communications.
CO2. Understand the impact of conventional energy sources on environment, and realize the significance and principles of green energy sources for sustainability.
CO3. Understand the environmental impacts of IT and approaches for Green IT.
CO4. Analyze concepts of sustainable green construction using appropriate tools and techniques following latest developments and considering safety and environment besides communicating effectively in graphical form.
CO5. Demonstrate the environmental impact of traditional manufacturing and explore the need for green manufacturing process promoting sustainability.

DETAILED SYLLABUS:

UNIT I– PRINCIPLES OF GREEN ENGINEERING AND GREEN COMMUNICATIONS **(9 periods)**

Principles of Green Engineering: Introduction, Definition of green engineering, Principles of green engineering

Green Communications: Introduction, Origin of Green Communications, Energy Efficiency in Telecommunication systems, Telecommunication system model and energy Efficiency, Energy saving concepts, Quantifying energy efficiency in ICT, Energy efficiency metrics of green wireless networks, Embodied energy of communication devices- Introduction, The extended energy model, Embodied/Operating Energy of a BS in Cellular network- A Case study; Energy efficient standards for wireline communications.

UNIT II – GREEN ENERGY **(9 periods)**

Introduction, green energy systems - composition, adverse impacts, Green energy and sustainability, the target and solution, Diversification and localization of energy systems, green energy and sustainable development, Energy sources and their availability. Green energy sources - solar energy, wind energy, geothermal energy, ocean energy, biomass and biogas.

UNIT III – GREEN IT **(9 periods)**

Introduction, Awareness to Implementation: Green IT Trends, Green Engineering, Greening by IT: Using RFID for Environmental Sustainability, Smart Grids, Smart Buildings and Homes, Green Supply Chain and Logistics, Enterprise-Wide Environmental Sustainability, A Seven-Step Approach to Creating Green IT Strategy: Balancing the Costs and Benefits of Going Green, Research and Development Directions.

UNIT IV – GREEN CONSTRUCTION **(9 periods)**

Green Building: Concept, Necessity, Characteristics, Benefits, Requisites for green building construction, Sustainability, Concept of REDUCE, REUSE, RECYCLE, RETHINK, REPLENISH AND REFUSE (6 R's), Sustainable construction focus point – Site selection, Planning, Water, Energy, Material, Indoor air quality, Construction procedures, case studies of residential and commercial green buildings.

Vastu: Concept, History, scientific approach, elements of vastu for selecting a plot.
Indian Green Building Council: Introduction to IGBC green homes, Benefits of IGBC, IGBC green home rating system, Introduction to USGBC, LEED rating system, Procedure to get IGBC certification, GRIHA Rating.

UNIT V – GREEN MANUFACTURING (9 periods)

Green Manufacturing - Introduction, Background and Definition; Impact of traditional manufacturing in environmental ecology, Need for green manufacturing, Motivation and barriers to green manufacturing, Advantages and Limitations of green manufacturing, Green manufacturing strategies,Green manufacturing and sustainability, Green manufacturing through clean energy supply, Green packaging and Supply chain.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. KonstantinosSamdanis, Peter Rost, Andreas Maeder, MichelaMeo, Christos Verikoukis, Green Communications: Principles, Concepts and Practice, John Wiley & Sons, 2015.
2. G.D. Rai, Non-conventional Energy Sources, KhannaPublishers, Delhi, 5th Edition,2011.
3. San Murugesan, G.R. Gangadharan, Harnessing Green IT – Principles and Practices, John Wiley & Sons Ltd., 2008.
4. Tom Woolley, Sam Kimmins, Paul Harrison and Rob Harrison, Green Building Handbook, Volume 1, E & FN Spon, an imprint of Thomson Science & Professional.
5. J Paulo Davim, Green Manufacturing: Processes and Systems, Springer, 2012.
6. David A Dornfeld, Green Manufacturing: Fundamentals and Applications, Springer, 2013.

REFERENCE BOOKS:

1. Soli J. Arceivala, *Green Technologies for a better future,* McGraw Hill Education (India) Pvt. Ltd, 2014.
2. Marty Poniatowski, *Foundation of Green Information Technology, Prentice Hall, 2009.*
3. Athanasios V Alavanidis, ThomaisVlachogianni, *Green Chemistry and Green Engineering*, SynchronaThemata, 2012.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	-	-	-	2	-	-	-	-	-	-	-	-	-	2
CO2	3	1	-	-	-	2	3	-	-	-	-	-	-	-	-	3
CO3	3	-	-	-	-	2	3	-	-	-	-	-	-	-	-	3
CO4	3	3	-	2	2	-	-	-	-	-	-	-	-	-	-	3
CO5	3	2	-	-	-	-	3	-	-	-	-	-	-	-	-	3
Average	2.8	2.25	-	2	2	2	3	-	-	-	-	-	-	-	-	2.8
Level of correlation of the course	3	3	-	2	2	2	3	-	-	-	-	-	-	-	-	3

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - II Semester

(19BT3HS31)**SOFT SKILLS LAB**

(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: -

COURSE DESCRIPTION: Body Language; Assertiveness; Goal Setting; Thinking Skills; Team Building; Conflict Management; Technical Report Writing; Résumé Writing; Group Discussions; Interview Skills; Interpersonal Skills; Etiquette.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge of career skills by examining and applying the styles and strategies of Goal Setting, Thinking Skills, and Etiquettes.

CO2. Analyze the limitations and possibilities of favourable situations by applying the skills of Body Language and demonstrate through Assertiveness, and Interpersonal Skills.

CO3. Apply appropriate soft skills by analyzing the problem situations that arise in professional career through demonstrating remedies in Conflict Management.

CO4. Demonstrate ability to function effectively as an individual and as a member in diverse teams examining and applying soft skills in Interviews, Group Discussion and Team Building.

CO5. Apply appropriate speaking and writing techniques in preparing documents and to communicate effectively by examining and demonstrating knowledge in Technical Report Writing and Résumé Writing.

LIST OF EXERCISES:

*First TEN exercises are mandatory among the following:

1. **Body Language**
   Types of Body Language – Parts of Body – Facial Expressions – Eye Contact Insights – Good Posture
2. **Assertiveness**
   Communications Styles – Benefits – Being Unassertive – Role Playing
3. **Goal Setting**
   Seven Steps of Goal Setting – Self Motivation – Personal Goal Setting – Setting Career Goals
4. **Thinking Skills**
   Positive Thinking – Creative Thinking – Lateral Thinking – Logical Thinking – Intitutive Thinking
5. **Team Building**
   Learning Activities – Management Essentials – Team Building Scenarios
6. **Conflict Management**
   Ways of Resolving Conflict – Personality Types and Conflict – Conflict Resolution Process – Team Conflict
7. **Technical Report Writing**
   Objectives – Formats – Writing Styles
8. **Résumé Writing**
   Structure and Presentation – Planning – Defining Career Objectives – Projecting One's Strengths and Skills – Cover Letter – Formats and Styles
9. **Group Discussions**
   Types of GD – Dos and Don'ts – Dynamics of GD – Intervention – Summarization Techniques
10. **Interview Skills**
    Planning – Opening Strategies – Answering Strategies – Tele Conferencing – Video Conferencing

11. Interpersonal Skills

Starting a Conversation – Responding to a Conversation – Conversation Examples – Body Language – Role Play

12. Etiquette

Basic Social Etiquette – Telephone Etiquette – Dinning Etiquette – Conference Etiquette

TEXT BOOK:

1. Soft Skills Lab Manual, SVEC.

REFERENCE BOOK:

1. R. C. Sharma & Krishna Mohan, *Business Correspondence and Report Writing*, Tata McGraw-Hill Publishing Company Limited, 3rd edition, New Delhi, 2012.

SUGGESTED SOFTWARES:

- KVAN SOLUTIONS
- Learning to Speak English 8.1, The Learning Company – 4 CDs.
- English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- Language in Use 1, 2 & 3.
- Cambridge Advanced Learner's Dictionary - 3rd Edition.
- Let's Talk English, Regional Institute of English South India.

ADDITIONAL LEARNING RESOURCES

- http://www.career.vt.edu/interviewing/TelephoneInterviews.html
- http://job-search-search.com/interviewing/behavioral_interviews
- https://goo.gl/laEHOY (dealing with complaints)
- http://www.adm.uwaterloo.ca/infocecs/CRC/manual/resumes.html
- https://goo.gl/FEMGXS

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	2	-	-	-	3	2	-	-	-	-	-	-
CO5	1	1	-	-	2	-	-	-	-	3	-	-	-	-	-	-
Average	2.2	2	-	-	1.8	-	-	-	3	2.5	-	-	-	-	-	-
Level of correlation of the course	3	2	-	-	2	-	-	-	3	3	-	-	-	-	-	-

- **Level of Correlation: 3 - High 2 - Medium 1 - Low**

II B. Tech. - II Semester

(19BT40531) **COMPUTER NETWORKS LAB**

(Common to CSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Computer Networks.

COURSE DESCRIPTION: Hands on practice with NS-3, Packet Tracer network simulation tools, Simulation of network topologies, ARP protocol, CSMA/CD protocol, Distance Vector/Link State Routing protocols, Transmission errors, Sliding window protocol, TCP, UDP.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Apply mathematical foundations to solve computational problems in computer networks.
CO2. Select and apply network simulation tools like NS-3, Packet Tracer to simulate networking protocols.
CO3. Simulate and analyze network topologies, network protocols to provide efficient networking solutions.
CO4. Work independently and communicate effectively in oral and written forms.

LIST OF EXERCISES:

1. a) Study of network devices and network IP in detail.
   b) Simulate a peer to peer topology of a computer network.
   c) Simulate IPv4 addressing in a computer network (give IP Address of different classes in given Network id).

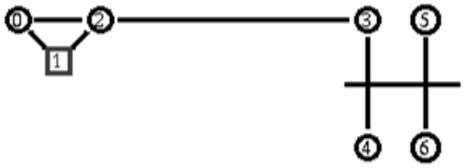
Exercises on Packet Tracer Simulator Tool:

2. Introduction to Packet Tracer
3. a) Study of basic network commands and network configuration commands.
      i) ping ii) nslookup iii) netstat iv) ifconfig
   b) Create a network topology and configure a networktopology with four PCs, two switches, and two routers.

Exercises on NS3 Simulator Tool:

4. a) Introduction to NS3 tool.
   b) Create a network with three nodes namely 0, 1 and 2. Establish a TCP connection between node 0 and node 2 such that node 0 will send TCP packets to node 2 via node 1.
5. a) Create a simple topology of two nodes (Node1, Node2) separated by a point-to-point link. Setup a UDP Client on one Node1 and a UDP Server on Node2. Consider a fixed data rate Rate1.
      i) Measure end to end throughput whilst varying the latency of the link.
      ii) Add another client application to Node1 and a server instance to Node2. What do you need to configure to ensure that there is no conflict?
      iii) Repeat step 3 with the extra client and server application instances. Show screenshots of pcap traces which indicate that delivery is made to the appropriate server instance.
   b) Simulate a Local Area Network. Consider a local area network formed by nodes 3, 4, and 5. This LAN communicates with the external world through a router denoted by node 2. There are two servers connected to the router and represented by nodes 0 and 1. Node 0 is running an application over TCP, which is accessed by node 4. Node 1 is running an application on UDP, which is accessed by node 5. Analyze the trace file.

6. Simulate link errors. Presence of link errors causes one or more packets to be retransmitted. Consider the following topology.



Node #2 act as a router. Any traffic to or from the LAN passes through it. Consider node #1 running a FTP server, and node #5 is downloading a file of size 4 MB. However, the link between node #2 and #3 is fault. It drops packets with a fixed probability of 0.2. Implement a link error model to reflect this. Try different values of the simulation time to ensure that the file has been entirely transferred. Has the plot of bytes received a linear curve or non-linear? Why?

7. Simulate Address Resolution Protocol (ARP) to associate a logical address with a physical address and Reverse Address Resolution Protocol (RARP) allows a host to discover its Internet address when it knows only its physical address.

8. Simulate packet transmission over a CSMA/CD based LAN with NS3. Consider the LAN with seven nodes to be an isolated one i.e. not connected to the Internet. Node #0 in the LAN acts as a UDP traffic source, and node #6 is the destination node. Assume CBR traffic to be flowing between the nodes. The simulation lasts for 25 seconds. In Ethernet a packet is broadcasted in the shared medium, and only the destination node accepts the packet. Other nodes simply drop it. What should be the number of hops a packet from node #0 to node # 6 travel? Verify this from the "Hop Count" plot.

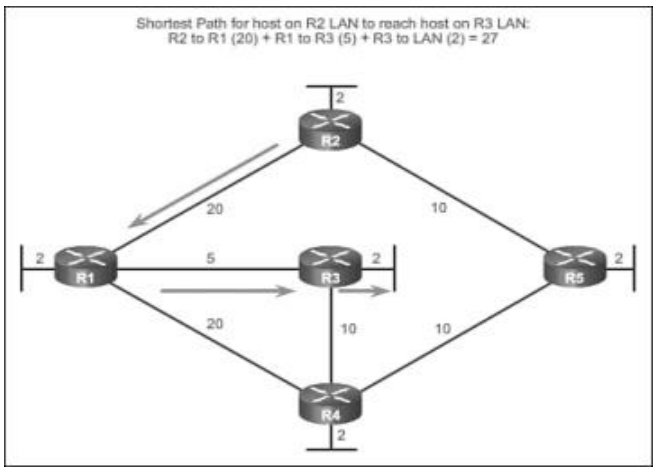
9. a) UDP uses a simple connectionless communication model with a minimum of protocol mechanism. The implementation provides checksums for data integrity, and port numbers for addressing different functions at the source and destination of the datagram. Simulate half duplex chat User Datagram Protocol.

   b) TCP model supports a full bidirectional TCP with connection setup and close logic. Simulate full duplex chat Transmission Control Protocol.

10. a) In a typical FTP session, the user is sitting in front of one host (the local host) and wants to transfer files to or from a remote host. Implement File Transfer Protocol to move files between local and remote file systems.

    b) Sliding window protocol supports reliable and efficient transmission between nodes and it also obtains higher throughput than that of stop-n-wait protocol. Simulate sliding window protocol normal operation and timeout operations.

11. Configure the following network to find shortest path between R2 LAN to R3 LAN using Distance Vector / Link State Routing Protocol.



REFERENCE BOOKS:

1. Andrew S. Tanenbaum and David J. Wetherall, *Computer Networks*, Pearson, 5th Edition, 2015.
2. A. Jesin, *Packet Tracer Network Simulator*,Packt Publishing, 2014.
3. Jack L. Burbank, *An Introduction to Network Simulator 3,* Wiley, 2018.

SOFTWARE/TOOLS USED:

- Network simulator tools - NS3, Packet Tracer
- Virtual Labs (Computer Networks Lab – http://vlabs.iitb.ac.in/vlabs-dev/labs_local/ computer-networks/ labs/explist.php)
- Virtual Labs (Advanced Network Technologies Virtual Lab - http://vlabs.iitkgp.ernet.in/ant)

ADDITIONAL LEARNING RESOURCES:

- https://www.itprc.com/packet-tracers/
- https://www.nsnam.org/docs/tutorial/html/
- http://www.tcpipguide.com/free/t_OSIReferenceModelLayers.htm

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	-	-	-	-	3	-	-	-	-	-	-	-	-	3	-	-
CO3	1	3	3	3	3	-	-	2	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	3	3	-	-	-	-	3	-	-
Average	2	3	3	3	3	-	-	2.5	3	3	2	-	-	3	-	-
Level of correlation of the course	3	2	3	3	3	-	-	3	3	3	2	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. - II Semester

(19BT40532) DATABASE MANAGEMENT SYSTEMS LAB

(Common to CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Database Management Systems.

COURSE DESCRIPTION: Design of an ER Models, Hands-on experience on - DDL, DML commands, Query processing using operators, Joins, Views, Synonyms, Indexes, Single row functions, Group functions and Set functions; PL/SQL programming - Basic programs, Exception handling, Triggers, Functions, Cursors and Stored procedures.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to*:**

CO1. Analyze the requirements of a given database problem and design viable ER-Models for implementation of database.
CO2. Create database schemas, select and apply suitable integrity constraints for querying databases using SQL interface.
CO3. Develop and interpret PL/SQL blocks to centralize database applications for maintainability and reusability.
CO4. Develop database applications for societal applications such as ticket reservation system, employee payroll system using modern tools.
CO5. Work independently and communicate effectively in oral and written forms.

LIST OF EXERCISES:

1. Design and analyse an ER Model for the following use case.
   Roadway Travels" is in business since 1977 with several buses connecting different places in India. Its main office is located in Hyderabad. The company wants to computerize its operations in the following areas:
   - Reservations
   - Ticketing
   - Cancellations

   Reservations:
   Reservations are directly handled by booking office. Reservations can be made 60 days in advance in either cash or credit. In case the ticket is not available, await listed ticket is issued to the customer. This ticket is confirmed against the cancellation.

   Cancellation and Modification:
   Cancellations are also directly handed at the booking office. Cancellation charges will be charged. Waitlisted tickets that do not get confirmed are fully refunded.

2. a) Implement Data Definition Language commands -Create, Alter, Drop, Truncate and Rename.
   b) Implement Data Manipulation Language commands - Insert, Select, Update, and Delete.
   c) Implement Single Row functions - Character, Numeric and Date functions.
3. Implement various types of integrity constraints - NOT NULL constraint, DEFAULT constraint, UNIQUE constraint, PRIMARY key, FOREIGN key, CHECK constraint.
4. a) Implement group functions with different operators such as aggregate operators, group by, having and order by.
   b) Implement nested and correlated nested queries using set operators and set comparison operators.
5. a) Creation of views, synonyms, sequence, indexes and save point.
   b) Implement various types of joins - outer join and inner join.

Basic PL/SQL:

6. Construct PL/SQL block for the following.
   a) To determine whether a number is palindrome
   b) To determine whether a number is an Armstrong number
   c) To find greatest of three numbers
   d) To display Fibonacci series

Control Structures:

7. a) Write a program in PL/SQL to update the salary of a specific employee by 8% if the salary exceeds the mid-range of the salary against this job and update up to mid-range if the salary is less than the mid-range of the salary, and display a suitable message.
   b) Write a PL/SQL program to display the description against a student's grade using CASE statement.

Exception Handling:

8. a) Develop a PL/SQL program that displays the name and address of a student whose ID is given. If there is no student with the given student ID in the database, the program should raise a run-time exception NO_DATA_FOUND, which should be captured in the EXCEPTION block.
   b) Construct the user-defined exceptions to get the salary of an employee and check it with the job's salary range. If the salary is below the range, raise an exception BELOW_SALARY_RANGE. If the salary is above the range, raise the exception ABOVE_SALARY_RANGE.

Functions:

9. a) Write a function that accepts two numbers A and B and performs the following operations.
      - Addition
      - Subtraction
      - Multiplication
      - Division
   b) Write a PL/SQL block that updates salary of an employee in Employee table by using incr function which takes employee number as argument and calculates increment and returns increment based on the following criteria.
      If salary <= 3000, increment = 30% of salary
      If salary > 3000 and <= 6000, increment = 20% of salary
      else increment = 10% of salary

Procedures:

10. a) Write a procedure that accepts two numbers and displays their sum.
    b) Write procedures to demonstrate IN, IN OUT and OUT parameters.

Cursors:

11. a) Write a block in PL/SQL to create a Cursor that displays the employee name and number of jobs he or she has done in the past.
    b) Write a program in PL/SQL to create a cursor to display the name and salary of each employee in the EMPLOYEES table whose salary is less than that specified by a passed-in parameter value.

Triggers:

12. Develop a suitable student database application by considering appropriate attributes.

Couple of attributes to be maintained is the attendance of a student in each subject for which he/she has enrolled and internal assessment Using TRIGGERS for the following

a) Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the concerned head of the department.

b) Whenever, the marks in an internal assessment test are entered, check if the marks are less than 40%; if so, and notify the concerned head of the department.

REFERENCE BOOKS:

1. SatishAnsani, *Oracle Database 11g: Hands-on SQL and PL/SQL*, PHI, 2010.
2. Pranab Kumar Das Gupta and P. Radha Krishna, *Database Management System Oracle SQL and PL/SQL*, PHI, 2nd Edition, 2009.

SOFTWARE/TOOLS USED:

- Oracle 11g

ADDITIONAL LEARNING RESOURCES:

- https://mrcet.com/pdf/Lab%20Manuals/CSE%20II-II%20SEM.pdf
- https://www.inspirenignite.com/jntuh/jntuh-b-tech-2016-2017-r16-detailed-syllabus-database-management-systems-lab/
- http://www.cittumkur.org/ise/DBMS%20MANUAL-2017%20ISE.pdf

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	1	3	1	2	3	-	-	-	-	-	-	-	3	-	-	-
CO3	1	2	3	2	3	-	-	-	-	-	-	-	3	-	-	-
CO4	2	3	3	3	3	2	-	-	-	-	-	-	3	-	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-	3	-	-	-
Average	1.25	2.5	2.5	2.3	3	2	-	-	3	3	-	-	3	-	-	-
Level of correlation of the course	2	3	3	3	3	2	-	-	3	3	-	-	3	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. – II Semester
(19BT31532) **OPERATING SYSTEMS LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Operating Systems.

COURSE DESCRIPTION: Hands-on practice in simulating algorithms for CPU Scheduling, Memory Management, I/O Management, Deadlock Handling mechanisms; Implementing Synchronization problems.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to*:**

CO1. Analyze process scheduling problems by applying contextual knowledge on CPU scheduling algorithms.
CO2. Apply memory management and disk scheduling algorithms to attain optimal solutions.
CO3. Devise solution for deadlock avoidance using banker's algorithm.
CO4. Design solutions for process synchronization problems using semaphores and monitors.
CO5. Apply file allocation strategies to achieve optimal disk utilization.
CO6. Work independently and in team to solve problems with effective communication

LIST OF EXPERIMENTS:

1 Simulate the following
   a) Process System Calls.
   b) I/O System Calls.

2 Simulate multi-level queue scheduling algorithm by considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. The priority of each process ranges from 1 to 3. Use fixed priority scheduling for all the processes.

3 Demonstrate File Permissions.

4 Simulate the following CPU Scheduling Algorithms:
   a) FCFS b) SJF (Preemptive) c) Priority d) Round Robin

5 Design solutions for the following synchronization problems:
   a) Producer Consumer Problem b) Dining Philosophers Problem.

6 Design Banker's Algorithm for Deadlock Avoidance. Find the safe sequence. If Maximum request of any one process is changed, detect whether a deadlock has occurred or not. Consider the number of resources is three and Jobs are five.

7 Simulate the following Algorithms:
   a) First Fit b) Best Fit c) Worst Fit

8 Simulate the following Page Replacement Algorithms
   a) FIFO b) LFU c) LRU d) Optimal

9 Simulate the following Disk Scheduling Algorithms
   a) FCFS b)SSTF c) SCAN d) CSCAN

10 Simulate the following file allocation strategies:
   a) Contiguous Allocation b) Linked Allocation

REFERENCE BOOKS:

1. Herbert Schildt, *Java the Complete Reference*, Oracle Press, 9th Edition, 2014
2. SachinMalhotra and SaurabChoudhary, *Programming in Java*, Oxford University Press, 2nd Edition, 2014

SOFTWARES/TOOLS USED:

- Software: J2SDK 1.7
  - Eclipse or NetBeans
- Java compatible web browser

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2	2	-	-	-	-	-	-	-	-	-	3	-
CO2	2	2	3	-	2	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	-	2	-	-	-	-	-	-	-	-	-	3	-
CO4	2	1	3	-	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	3	-	-	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	-	3	3	2	-	-	-	3	-
Average	2.2	2.2	2.6	2	2.2	-	-	-	3	3	2	-	-	-	3	-
Level of correlation of the course	2	2	3	2	2	-	-	-	3	3	2	-	-	-	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B.Tech. - II Semester

(19BT3MC01) ENVIRONMENTAL SCIENCE

(Common to CSE, CSSE, IT, CE and ME)
(Mandatory Course)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	-	40	2	-	-	-

PRE-REQUISITES: A Course on Engineering Chemistry.

COURSE DESCRIPTION: Natural resources; Ecosystems; Biodiversity; Environment pollution and control; Social issues and environment; Human population and environment.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to*:**

- CO1 Analyze natural resourcesto solve complex environmental problems andnatural resource management considering society, environment and sustainability.
- CO2 Analyzeecosystemsand biodiversity to solve complex environmental problems by following environmental ethics considering society, environment and sustainability besides communicating effectively in graphical form.
- CO3 Analyze various types of pollution and their control measures to solve environmental problemsthrough appropriate tools and techniques following latest developmentsconsidering society, ethics, environment and sustainability.
- CO4 Analyzesocial issues and its impact on environment, environmental acts to solve complex environmental problems considering society, environment and sustainability besides communicating effectively in graphical form.
- CO5 Analyze human population and its impact on environment to solve complex environmental problems through team work and using appropriate tools and techniques considering ethics, society, environment and sustainability.

DETAILED SYLLABUS:

UNIT - I: NATURAL RESOURCES (07 periods)

Multidisciplinary nature of environment; Natural Resources: Renewable and non-renewable resources; Forest, Water, Mineral, Food and Energy resources -Causes, Effects, Remedies, Case studies; Role of an individual in conservation of natural resource and equitable use of resources for sustainable lifestyles.

UNIT - II: ECOSYSTEMS AND BIODIVERSITY (07 periods)

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem - Producers, Consumers, Decomposers; Food chains, Food webs, Ecological pyramids – Types; Characteristic features, Structure and functions of forest ecosystem, Desert ecosystem, Aquatic ecosystem.

Biodiversity: Concept and value of biodiversity,Role of biodiversity in addressing new millennium challenges, Hot spots of biodiversity, Threats to biodiversity, Man-wild life conflicts, Endemic, Endangered and extinct species of India, Conservation of biodiversity – In-situ and ex-situ.

UNIT - III: ENVIRONMETAL POLLUTION AND CONTROL (06 periods)

Causes, Adverse effects and control measures of pollution - Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear pollution, Solid waste management – Urban waste, industrial waste; Latest developments in pollution control, Hazards and disaster management – Floods, Earthquakes, Tsunamis, Case studies.

UNIT - IV: SOCIAL ISSUES AND THE ENVIRONMENT (06 periods)

Sustainable development, Urban problems related to energy, Environmental ethics – Issues, Solutions; Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and case studies, Wasteland reclamation, Consumerism and waste products, Concept of

green technologies,Environment justice: National Green Tribunal and its importance; Environment protection act, Air act, Water act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation, Public environmental awareness.

UNIT - V: HUMAN POPULATION AND THE ENVIRONMENT (04 periods)

Population growth, Population characteristics and variation among nations, Population explosion, Family welfare programme, Environment and human health, Human rights, Value education, HIV/AIDS, Women and child welfare, Role of information technology in environment and human health; Case studies - Field Work/Assignment/Seminar on Environmental assets – Water bodies/Forest/Grassland/Hill/Mountain.

Total Periods: 30

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. AnubhaKaushik and C. P. Kaushik, *Perspectives in Environmental Studies*, New Age International (P) Ltd. Publications, 6th Edition, 2018.
2. ErachBarucha, *Environmental Studies,* Orient Blackswan, 2nd Edition, 2013.

REFERENCE BOOKS:

1. Cunningham W.P. and Cunningham M.A., *Principles of Environmental Science*, Tata McGraw-Hill Publishing Company, New Delhi, 8th Edition,2016.
2. Benny Joseph, *Environmental Studies*, Tata McGraw-Hill, 2nd Edition, 2009.
3. M. Anji Reddy, *Text Book of Environmental Sciences and Technology*, BS Publications, 2014
4. R. Rajagopalan, *Environmental Studies*, Oxford University Press, 2nd Edition, 2011.

ADDITIONAL LEARNING RESOURCES:

- B. S. Chauhan, *Environmental Studies*, University Science Press, 2nd Edition, 2018.
- Botkin and Keller, *Environmental Science: Earth as a Living Planet*, John Wiley & Sons, 8th International Student Edition, 2011.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	2	-	1	1	-	-	-	1	-	-	-	-	-
CO2	3	3	-	2	-	1	1	1	-	1	-	-	-	-	-	-
CO3	3	3	-	2	1	1	1	1	-	-	-	1	-	-	-	-
CO4	3	3	-	3	-	1	1	1	-	1	-	-	-	-	-	-
CO5	3	3	-	2	1	1	1	1	1	-	-	-	-	-	-	-
Average	3	3	-	2.7	1	1	1	1	1	1	1	1	-	-	-	-
Level of correlation of the course	3	3	-	3	1	1	1	1	1	1	1	1	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. - I Semester

(19BT40503) DESIGN AND ANALYSIS OF ALGORITHMS

(IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Data Structures.

COURSE DESCRIPTION: Algorithms and asymptotic notations; Algorithm performance analysis; Amortized analysis; Recurrences; Disjoint sets; Divide and Conquer; Dynamic programming; Greedy algorithms; Back tracking; Branch and bound; NP-hard and NP-complete problems.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze the complexity of algorithms by applying the knowledge of asymptotic notations and recurrence methods.
CO2. Analyze the given problem and identify appropriate algorithm design technique for problem solving.
CO3. Perceive and apply different algorithm design paradigms to find solutions for computing problems.
CO4. Apply the knowledge of NP-hard and NP-Complete complexity classes to classify decision problems.

DETAILED SYLLABUS:

UNIT- I: INTRODUCTION TO ALGORITHMS (10 Periods)

Algorithm, Algorithm pseudocode conventions, Performance analysis - Space complexity, Time complexity, Asymptotic notations; Amortized analysis – Aggregate analysis, Accounting method, Potential method; Recurrences - Substitution method, Recursion-tree method, Master method.

UNIT- II: DISJOINT SETS, DIVIDE AND CONQUER (8 Periods)

Disjoint Sets: Operations, Union and Find algorithms.
Divide and Conquer: General method, Defective chess board, Binary search, Finding maximum and minimum, Merge sort, Strassen's matrix multiplication.

UNIT- III: DYNAMIC PROGRAMMING (9 Periods)

General method, Matrix-chain multiplication, All pairs shortest path, Optimal binary search trees, 0/1 Knapsack problem, Traveling salesperson problem, Flow shop scheduling.

UNIT- IV: GREEDY METHOD, BACKTRACKING (10 Periods)

Greedy Method: General method, Knapsack problem, Job sequencing with deadlines, Huffman codes, Single source shortest paths, Optimal merge patterns.
Backtracking: General method, 8–Queens problem, Sum of subsets, Graph coloring, Hamiltonian cycles.

UNIT- V: BRANCH AND BOUND, NP-HARD AND NP-COMPLETE PROBLEMS (8 Periods)

Branch and Bound: LC search, LC branch and bound, FIFO branch and bound, 0/1 knapsack problem, Traveling salesperson problem.
NP Hard And NP-Complete Problems: Nondeterministic algorithms, NP-hard and NP-complete classes, Cook's theorem, NP-hard scheduling problems – Scheduling identical processors.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahni, and SanguthevarRajasekaran*, Fundamentals of Computer Algorithms,* 2nd Edition, Universities Press, 2008.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, *Introduction to Algorithms*, 3rd Edition, MIT Press, 2009.

REFERENCE BOOKS:

1. Michael T. Goodrich and Roberto Tamassia*, Algorithm Design and Applications,* Wiley, 2014.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, *The Design and Analysis of Computer Algorithms*, Pearson, 2006.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/106/106/106106131/

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
Average	2.7	2.7	3	-	-	-	-	-	-	-	-	-	-	-	3	-
Level of correlation of the course	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester
(19BT51201)DATA WAREHOUSING AND DATA MINING
(IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Database Management Systems.

COURSE DESCRIPTION: Data Mining Fundamentals; Data Preprocessing; Operational Database Systems and Data Warehouses; Mining Frequent Patterns; Classification and Prediction; Clustering; Data warehousing and Mining tools, New Trends and Research Frontiers.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to*:**

CO1. Demonstrate knowledge on Data Warehousing architecture, Multidimensional models and OLAP operations.
CO2. Apply data preprocessing techniques to produce refined data.
CO3. Apply Association rules and classification techniques for data categorization.
CO4. Apply clustering techniques for grouping similar data items and identify outliers.
CO5. Demonstrate knowledge on Data Mining trends and applications.

DETAILED SYLLABUS:

UNITI: DATAWAREHOUSINGANDONLINEANALYTICAL PROCESSING (9 periods)

Data Warehouse, Operational Database Systems versus Data Warehouses,AMultitiredArchitecture,AMultidimensionalDataModel, Stars, Snowflakes and Fact Constellations: Schemas, RoleofConcepthierarchies,Measures,OLAPOperations,From online Analytical processing to Multidimensional Data Mining, Indexing OLAPData.

UNIT II: DATA MINING AND DATA PREPROCESSING (8 periods)

Introduction to Data Mining, kinds of data, kinds of patterns, majorissuesinDataMining,DataPre-processing,DataCleaning, Data Integration, Data Reduction, Data Transformation and Discretization.

UNIT III: ASSOCIATIONS AND CLASSIFICATION (10 periods)

Basic Concepts, Frequent itemset Mining Methods, pattern evaluation methods- From Association Mining to Correlation Analysis, Classification, Decision Tree Introduction, Bayesian Classification Methods, Rule Based Classification, Prediction: Linear Regression.

UNIT IV: CLUSTERANALYSIS (9 periods)

Cluster Analysis: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, PartitioningMethods-k-MeansandK-Medoids, Hierarchicalmethods-Agglomerative anddivisivemethod,Density-BasedMethod-DBSCAN,Grid-Based Method-STING, OutlierAnalysis.

UNITV: DATAMININGTRENDS (9 periods)

MiningComplexDataTypes: Mining sequence data, mining other kind so fdata: Spatial, Text, Multimedia and Webdata.

Data MiningTrends: Mining Complex Data Types, Methodologies of Data Mining, Data Mining Applications, Data Mining and Society, Data Mining Trends.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Jiawei Han, Micheline Kamber and Jian Pei, *Data Mining: Concepts and Techniques,* Elsevier, 3rdEdition, 2013.

REFERENCE BOOKS:

1. K.P. Soman, Shyam Diwakar and V. Ajay, *Insight into Data mining Theory and Practice*, Easter Economy Edition, Prentice Hall of India, 2006.
2. G. K. Gupta, *Introduction to Data Mining with Case Studies*, Easter Economy Edition, Prentice Hall of India, 2006.
3. Tan P.N, Steinbach M. and Kumar V., *Introduction to Data Mining*, Addision-Weseley, 2006.

CO-PO-PSO Mapping Table CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	2
CO2	1	2	3	3	1	-	-	-	-	-	-	-	3	-	-	2
CO3	1	2	3	3	1	-	-	-	-	-	-	-	3	-	-	2
CO4	1	2	3	3	1	-	-	-	-	-	-	-	3	-	-	2
CO5	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	2
Average	1.8	2	3	3	1	-	-	-	-	-	-	-	3	-	-	2
Level of correlation of the course	2	2	3	3	1	-	-	-	-	-	-	-	3	-	-	2

Correlation Level: 3- High 2-Medium 1- Low

III B. Tech. – I Semester
(19BT51202) WEB TECHNOLOGIES
(Common to CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Object Oriented Programming through Java.

COURSE DESCRIPTION: Hyper Text Markup Language (HTML); Features of HTML5; Cascading Style Sheets (CSS); JavaScript; JQuery; Bootstrap; Hypertext Preprocessor (PHP); MySQL.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on web page design elements, dynamic content and database connection.
CO2. Analyze user requirements to develop web applications
CO3. Design client-server applications using web technologies.
CO4. Demonstrate problem solving skills to develop enterprise web applications.
CO5. Apply HTML, CSS, JavaScript, JQuery, Bootstrap and PHP technologies for device independent web application development
CO6. Apply web technologies to develop interactive, dynamic and scalable web applications for societal needs.

DETAILED SYLLABUS:

UNIT-I: HTML (09 periods)

Introduction: Fundamentals of HTML, Working with Text, Organizing Text in HTML, Working with Links and URLs, Creating Tables, Working with Images, Canvas, Forms, Frames and Multimedia.

HTML5: Introduction, HTML5 Document Structure, Creating Editable Content, Checking Spelling Mistakes, Exploring Custom Data Attributes, Client-Side Storage, Drag and Drop Feature, Offline Web Applications, Web Communications, Cross-Document Messaging and Desktop Notifications.

UNIT-II: CSS AND JAVASCRIPT (10 periods)

CSS: Introduction, CSS Selectors, Inserting CSS in an HTML document, Backgrounds, Fonts, and Text Styles, Creating Boxes, Displaying, Positioning and Floating Elements, Features of CSS3, Media Queries.

Javascript: Overview of JavaScript, JavaScript Functions, Events, Image Maps and Animations, JavaScript Objects, Working with Browser and Document Objects, JQuery**-** Introduction, JQuery Selectors, Events, Methods to access HTML elements and attributes, Introduction to AJAX.

UNIT-III: BOOTSTRAP (09 periods)

Getting Started with Bootstrap, Creating Responsive Layouts Using Bootstrap CSS - Basic HTML structure for Bootstrap, Responsive classes, Rendering images, The grid system, Constructing data entry forms, Packaged Components in Bootstrap - The page header, Glyphicons, The navigation bar, Badges, Alerts, Toolbars and button groups, Panels.

UNIT-IV: INTRODUCTION TO PHP (09 periods)

Introduction, Data Types, Variables, Constants, Expressions, String Interpolation, Control Structures, Functions, Arrays, Embedding PHP Code in Web Pages, Object Oriented PHP.

UNIT-V: PHP WEB FORMS AND MYSQL (08 periods)

PHP Web forms: PHP and Web Forms, Sending Form Data to a Server, Working with Cookies and Session Handlers

PHP with MySQL: Interacting with the Database, Prepared Statement, Database Transactions.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Kogent Learning Solutions Inc, *HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQuery***,** Dreamtech Press, 1st Edition, 2011.
2. W. Jason Gilmore, *Beginning PHP and MySQL***,** APress, 4th Edition, 2011.

REFERENCE BOOKS:

1. Snig Bahumik, *Bootstrap Essentials,* PACKT Publishing, 1st Edition, 2015 (e-book).
2. Thomas A. Powell, *The Complete Reference: HTML and CSS,* Tata McGraw Hill, 5th Edition, 2010.
3. Andrea Tarr, *PHP and MySQL,* Willy India, 1st Edition, 2012.

CO-PO-PSO Mapping Table

Course Outcome	Program Outcomes						Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	3	-
CO2	1	3	-	-	-	-	-	-	3	-
CO3	2	1	3	-	3	-	-	-	3	-
CO4	2	2	2	3	3	-	-	-	3	-
CO5	2	1	2	2	3	-	-	-	3	-
CO6	2	2	2	2	1	3	-	-	3	-
Average	2	1.8	2.3	2.3	1.75	3	-	-	3	-
Level of correlation of the course	2	2	3	3	2	3	-	-	3	-

Correlation Levels: 3- High 2- Medium 2- Low

III B. Tech. - I Semester

(19BT60502) MACHINE LEARNING

(IT)

(Professional Elective-I)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Numerical Methods, Probability and Statistics, Discrete Mathematical Structures.

COURSE DESCRIPTION: Concept learning, General to specific ordering, Decision tree learning, Support vector machine, Artificial neural networks, Multilayer neural networks, Bayesian learning, Instance based learning, reinforcement learning.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze the concept learning algorithms to automatically infer a general description for a given learning problem.
CO2. Analyze the underlying mathematical models within machine learning algorithms and learning tasks.
CO3. Evaluate and apply suitable machine learning algorithms for various types of learning tasks.
CO4. Design efficient neural architectures to model patterns for a given learning problem.
CO5. Select and apply machine learning algorithms to solve societal problems such as face recognition, text classification.

DETAILED SYLLABUS:

UNIT–I: CONCEPT LEARNING AND GENERAL-TO-SPECIFIC ORDERING(9 periods)

Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning, Concept learning task, Conceptlearning as search, FIND-S, Versionspaces and candidate elimination algorithm, Inductive bias.

UNIT–II: DECISION TREE LEARNING AND KERNEL MACHINES (9 periods)

Decision Tree Learning: Decision tree representation, Problems for decision tree learning, Decision tree learning algorithm, Hypothesisspace search, Inductive bias in decision tree learning, Issues in decision tree learning.

Kernel Machines: Support vector machines – SVMs for regression, SVMs for classification, Choosing C, A probabilistic interpretation of SVMs.

UNIT–III: ARTIFICIAL NEURAL NETWORKS 9 periods)

Neural network representations, Appropriate problems for neural network learning, Perceptrons, Multilayer networks and Backpropagation algorithm, Convergence and local minima, Representational power of feedforward networks, Hypothesis space search and inductive bias, Hidden layer representations, Generalization, Overfitting, Stopping criterion, An Example -Face Recognition.

UNIT–IV: BAYESIAN LEARNING (10 periods)

Bayes theorem and concept learning, Maximum likelihood and least-squared error hypothesis, Maximum likelihood hypotheses for predicting probabilities, Minimum Description Length principle, Bayes optimal classifier, Gibbsn algorithm, Naive Bayes classifier, An Example – Learning to classify text; Bayesian belief networks, EMAlgorithm.

UNIT–V: INSTANCE-BASED LEARNING AND REINFORCEMENT LEARNING (8 periods)

Instance-Based Learning: k-Nearest Neighbor learning, Locally weighted regression, Radial basis functions, Case-based reasoning.

Reinforcement Learning: The learning task, Q-learning, Nondeterministic rewards and actions, Temporal difference learning, Generalizing from examples, Relationship to dynamic programming.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Tom M. Mitchell, *Machine Learning*, McGrawHill, 2013.
2. Kevin P. Murphy, *Machine Learning*: *A Probabilistic Perspective*, MIT Press, 2012.

REFERENCE BOOKS:

1. EthemAlpaydin, *Introduction to Machine Learning*, MIT Press, 4th Edition, 2020.
2. Shai Shalev Shwartz, Shai Ben David, *Understanding Machine Learning: From Theory to Algorithms,* Cambridge University Press, 2014.

ADDITIONAL LEARNING RESOURCES:

1. https://swayam.gov.in/nd1_noc19_cs52/preview
2. https://www.udemy.com/course/machinelearning/

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	1	-	-	-	-	-	-	-	-	-	3	-	-
CO5	2	3	2		-	2	-	-	-	-	-	-	-	3	-	-
Average	2.4	2.8	2.3	1	-	2	-	-	-	-	-	-	-	3	-	-
Level of correlation of the course	3	3	3	1	-	2	-	-	-	-	-	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester
(19BT60503)CRYPTOGRAPHY AND NETWORK SECURITY

(IT)

(Professional Elective – 1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Computer Networks.

COURSE DESCRIPTION: Concepts of cryptographic algorithms, Substitution techniques, Symmetric ciphers, Block cipher operations, Cryptographic data integrity algorithms, Key management and distribution, User authentication, Transport level security, Electronic mail security, IP security.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Apply the knowledge of concepts of network security, symmetric and public key cryptosystems to identify the potential threats in networks.
CO2. Analyze hash functions, message authentication codes, digital signatures for providing data integrity in information security applications.
CO3. Use key management and distribution techniques, user authentication techniques for assuring mutual trust among users.
CO4. Demonstrate knowledge on network and Internet security techniques for addressing the security threats.

DETAILED SYLLABUS:

UNIT–I: INTRODUCTION (9 periods)

Cybersecurity, information security and network security, Security objectives, Security attacks, Security services, Security mechanisms, Cryptography, Network security, Trust and trustworthiness, Symmetric cipher model, Substitution techniques – Mono-alphabetic ciphers and Polyalphabetic ciphers.

UNIT–II: SYMMETRIC CIPHERS (7 periods)

Stream ciphers and block ciphers, Data Encryption Standard(DES), Advanced Encryption Standard (AES) - Structure, Transformation Functions; Block Cipher Operation - Multiple encryption and triple DES, Cipher block chaining mode, Cipher feedback mode, Output feedback mode, Counter mode.

UNIT–III: PUBLICKEY CRYPTOGRAPHY AND CRYPTOGRAPHIC DATA INTEGRITYALGORITHMS (9 periods)

Public-Key Cryptography: RSA, Diffie-Hellman key exchange, Elgamal cryptographic system.

Cryptographic Data Integrity Algorithms: Hash Functions -Simple hash functions, Secure Hash AlgorithmSHA-512;Message Authentication Codes– Requirements, Functions, Security of MACs, HMAC; Digital signatures- Schnorr Digital signature scheme.

UNIT–IV: MUTUAL TRUST (10 periods)

Key Management and Distribution: Symmetric key distribution usingsymmetric and asymmetric encryption, Distribution of public keys, X.509 certificates, Public key infrastructure.

User Authentication: Remote user authentication principles, Kerberos, Personal identity verification.

UNIT–V: NETWORK AND INTERNET SECURITY (10 periods)

Transport Level Security: Web security considerations, Transport layer security, HTTPS.
Electronic Mail Security: S/MIME, Pretty Good Privacy, DNSSEC.
IP Security: Overview, Policy, Encapsulating security payload.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. William Stallings, *Cryptography and Network Security: Principles and Practice*, 8th Edition, Pearson, 2020.

REFERENCE BOOKS:

1. William Stallings, *Network Security Essentials: Applications and Standards*, 6th Edition, Pearson, 2018.
2. Douglas R. Stinson, Maura B. Paterson, *Cryptography: Theory and Practice*, 4th Edition, CRC Press, 2018.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	-	-	-	3	-	-	-	-	-	3	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
Average	3	2.7	-	3	-	-	-	3	-	-	-	-	-	3	-	-
Level of correlation of the course	3	3	-	3	-	-	-	3	-	-	-	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT51505) SOFTWARE TESTING

(Common to CSSE and IT)
(Professional Elective – 1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Software Engineering.

COURSE DESCRIPTION:
Evolution of Software Testing; Software Testing Life Cycle; Verification and Validation; White Box Testing, Black Box Testing and Regression Testing; Testing Process; Test Management, Software Metrics; Automation Testing and Testing Tools.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***
CO1. Analyze the functionality of software by using software testing methodologies.
CO2. Examine end user requirements by applying functional testing techniques**.**
CO3. Design test cases to verify the functionality of the software by using test management techniques**.**
CO4. Evaluate the performance of software using Testing Metrics.
CO5. Analyze test metrics and testing tools to measure the quality of software in real time applications.
CO6.Understand the concepts of static and dynamic testing tools for test design and development.

DETAILED SYLLABUS:

UNIT- I: INTRODUCTION TO SOFTWARE TESTING (9 periods)
Introduction, Evolution of Software Testing, Myths and Facts, Goals and Psychology of Testing, Definitions, Model for Software Testing, Effective vs Exhaustive Testing, Testing as a Process, Terminology, Software Testing Life Cycle, Software Testing Methodology, Static vs Dynamic Testing.
VERIFICATION AND VALIDATION: Verification and Validation Activities, Verification of High-Level Design and Low-Level Design.

UNIT -II: WHITE BOX TESTING and BLACK BOX TESTING (9 periods)
Introduction to Testing Techniques, Need of White-Box Testing, Logic Coverage Criteria, Basis Path Testing, Graph Matrices, Loop Testing, Mutation Testing.

BLACK BOX TESTING: Introduction, Boundary Value Analysis (BVA), Equivalence Class Testing, State Table-Based Testing, Decision Table-Based Testing, Error Guessing.

UNIT- III: TESTING PROCESS
(10Periods)
Test planning –test policy, contents, strategy, test plan, Quality plan, test plan template, guidelines, test administration and estimation, standards, building test data, test cases, scenarios, templates for test cases, test scripts, effective test cases, building test data, generation of test data, test process monitoring.

UNIT- IV: REGRESSION TESTING AND TEST METRICS (8 periods)
REGRESSION TESTING: Introduction, Progressive vs. Regressive Testing, Regression Testing Produces Quality Software, Regression Testability, Objectives of Regression Testing, Regression Testing Types, Defining Regression Test Problem, Regression Testing Techniques.

TEST METRICS: Definition of Software Metrics, Classification of Software Metrics, Size Metrics.

UNIT- V: TEST MANAGEMENT AND AUTOMATION (9 periods)

TEST MANAGEMENT: Test Organization, Structure of Testing Group, Test Planning, Detailed Test Design, Test Specifications.

AUTOMATED AND TESTING TOOLS: Need for Automation, Categorization of Testing Tools, Selection of Testing Tools, Costs Incurred in Testing Tools, Guidelines for Automated Testing, Overview of Some Commercial Testing Tools.

Case Study: Income Tax Calculator

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXTBOOKS:

1. Naresh Chauhan, *Software Testing: Principles and Practices*, Oxford University Press, 2nd Edition, 2016.
2. M. G. Limaye, *Software Testing: Principles and Techniques and Tools*, Tata McGraw – Hill Education, 1st Edition, 2012

REFERENCE BOOKS:

1. Boris Beizer, *Software Testing Techniques*, DreamTech Press, 2nd Edition, 2004.
2. Dr. K. V. K. K. Prasad, *Software Testing Tools*, Dreamtech, 2004.
3. Srinivasan Desikan and Gopala swamy Ramesh, *Software Testing – Principles and Practices*, Pearson Education, 2006.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes						Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3	-	-	2	-	-	-	2	-
CO2	2	3	-	-	2	-	-	-	3	-
CO3	2	2	3	2	2	-	-	-	2	-
CO4	2	3	-	2	2	-	-	-	3	-
CO5	2	3	-	-	2	1	-	-	3	-
CO6	3	-	-	-	-	-	-	-	3	-
Average	2.2	2.7	3	2	2	1	-	-	2.6	-
Level of correlation of the course	3	3	3	2	2	1			3	-

Correlation Levels: **3- High** **2-Medium** **1- Low**

III B. Tech. – I Semester
(19BT51203) ADVANCED DATABASES
(IT)
(Professional Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Database Management Systems and Computer Networks.

COURSE DESCRIPTION: Parallel Databases; Object Based Databases; Distributed Databases; XML; Emerging Database Technologies and Applications.

COURSE OUTCOMES: ***After successful completion of the course, students will be able to*:**
CO1. Design parallel databases for efficient data access.
CO2. Apply object oriented concepts to design object based databases.
CO3. Design distributed databases by analyzing various data fragmentations.
CO4. Create XML databases for web based applications.
CO5. Demonstrate knowledge on emerging database technologies: mobile, multimedia and NoSQL databases.

DETAILED SYLLABUS:

UNIT-I: PARALLEL DATABASES (09 periods)
Introduction, I/O Parallelism, Inter query Parallelism, Intra query Parallelism, Intra operation Parallelism, Interoperation Parallelism, Query Optimization, Design of Parallel Systems, Parallelism on Multicore Processors.

UNIT-II: OBJECT-BASED DATABASES (09 periods)
Overview, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multi set Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R Features, Persistent Programming Languages, Object-Relational Mapping, Object-Oriented versus Object-Relational.

UNIT-III: DISTRIBUTED DATABASES (09 periods)
Features of Distributed versus Centralized Databases, Reference Architecture for Distributed Databases, Types of Data Fragmentation, Integrity Constraints in Distributed databases, Distributed Database Design

UNIT-IV: XML (09 periods)
Structure of XML data, XML Document Schema, Querying and Transformation, Application Program Interfaces to XML, Storage of XML Data, XML Applications

UNIT-V: EMERGING DATABASE TECHNOLOGIES AND APPLICATION (09 periods)
Mobile Database, Geographic Information Systems, Genome Data Management, Multimedia Database; NoSQL-An Overview of NoSQL, Characteristics of NoSQL, NoSQL Storage Types

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. A. Silberschatz, H. F. Korth and S. Sudarshan, *Database System Concepts*, Tata McGraw hill , 7th Edition, 2019.
2. StefandCeri and Giuseppe Pelagatti, *Distributed Databases Principles and Systems*, McGraw hill, 1st Edition, 2008.

REFERENCE BOOKS:

1. RameaElmasri and ShamkantB.Navathe, *Fundamentals of database Systems*, Pearson Education, 5thEdition,2007.
2. Gaurav Vaish, *Getting Started with NoSQL*, Packt Publishing, 1st Edition, 2013. (e-book)

CO-PO-PSO Mapping Table

Course Outcome	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	1	-	3	-	1	-	-	-	-	-	-	-	3	-	-	-
CO3	1	2	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO4	1	1	1	3	2	-	-	-	-	-	-	-	3	-	-	-
CO5	3	-	-	-	2	-	-	-	-	-	-	-	3	-	-	-
Average	1.6	1.5	1.75	3	1.6	-	-	-	-	-	-	-	3	-	-	-
Level of correlation of the course	2	2	2	3	2	-	-	-	-	-	-	-	3	-	-	-

Correlation Level: 3- High 2-Medium 1- Low

III B. Tech. – I Semester

(19BT51204) LINUX PROGRAMMING

(Common to CSE and IT)
(Professional Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITE: A course on Operating Systems.

COURSE DESCRIPTION: Concepts on Linux Programming; Basic Commands in Linux; Shell Programming; Process, Signals and File System Structure; Inter process Communications and Socket Programming for Client-Server Interaction.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to*:**

CO1. Demonstrate knowledge on Basic commands, Program arguments and Environment Variables.
CO2. Design interactive shell scripts related to Linux Environment for solving specified computational problems.
CO3. Analyze system calls related to standard I/O library, formatted input, output, file and directory maintenance.
CO4. Apply system calls for process management and signal handling.
CO5. Apply inter process communication and socket programming for developing client - server applications.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO LINUX AND LINUX ENVIRONMENT (10 periods)

The GNU project and the Free Software Foundation, Linux distributions, Programming Linux - Linux programs, Text editors, The C Compiler; Basic commands -cat, tail, head, sort, nl, uniq, grep, cut, paste, join, tee, pg, comm, cmp, diff, cp, mv, ln, rm, unlink, tty, clear, date , cal, mkdir, rmdir, du, df, find, umask, ps, who, sed; Program arguments - getopt, getopt_long. Environment variables - Use of environment variables, The environ variable, Time and Date, User information, Host information.

UNIT-II: SHELL PROGRAMMING (8 periods)

Necessity of shell programming, Pipes and redirection - Redirecting output, Redirecting input, Pipes, The Shell as a programming language - Interactive programs, Creating a script, Making a script executable, Shell syntax – Variables, Conditions, Control structures, Functions, Commands, Command execution.

UNIT-III: FILE SYSTEM STRUCTURE AND SYSTEM CALLS (9 periods)

Linux File Structure and Commands: File structure - Directories, Files and devices, System calls and Device drivers; Library functions - Low-level file access, write, read and open commands, Initial permissions, Other system calls for managing files; File and directory maintenance commands - chmod, chown, unlink, link, symlink, mkdir, rmdir, chdir, getcwd.

Input-Output Commands: The standard I/O library commands -fopen, fread, fwrite, fclose, fflush, fseek, fgetc, getc, and getchar, fputc, putc and putchar, fgets and gets; Formatted input and output commands - printf, fprintf, sprintf, scanf, fscanf, sscanf.

UNIT-IV: PROCESS AND SIGNALS (9 periods)

Process structure - Process table, Viewing processes, System processes, Process scheduling; Starting new processes - Waiting for a process, Zombie processes, Input and output redirection, Threads; Signals -Sending signals, Signal sets.

UNIT-V: INTER-PROCESS COMMUNICATION AND SOCKETS (9 periods)

Inter-Process Communication: Pipe definition, Process pipes, Sending output to popen -Passing more data, popen, implementation, The pipe call; Parent and child processes - Reading closed pipes, pipes used as standard input and output; Named pipes – FIFOs, Accessing a FIFO, Client/Server using FIFOs.

Socket Connections: Socket attributes, Creating a socket, Socket addresses, Naming a socket, Creating a socket queue, Accepting connections, Requesting connections, Closing a socket, Socket communications, Host and network byte Ordering.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Neil Matthew and Richard Stones, *Beginning Linux Programming*, Wiley Dreamtech, 4th Edition, 2008.
2. Sumitabha Das, *Your UNIX: The Ultimate Guide*, Tata McGraw-Hill, 2007.

REFERENCE BOOKS:

1. Richard Petersen, *Linux: The Complete Reference*, Tata McGraw-Hill, 6th Edition, 2007.
2. YashwanthKanitkar, *UNIX Shell programming*, BPB Publications, 1stEdition.

CO-PO-PSO Mapping Table

Course Outcome	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	1	-	-	-	-	-	-	-	-	-	3	-
CO2	2	2	-	3	1	1	-	1	-	-	-	-	-	-	3	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	2	2	3	3	1	1	-	1	-	-	-	-	-	-	3	-
Average	2.4	2.3	3	3	1	1	-	1	-	-	-	-	-	-	3	-
Level of correlation of the course	3	3	3	3	1	1	-	1	-	-	-	-	-	-	3	-

Correlation Level: 3- High 2-Medium 1- Low

III B. Tech. – I Semester

(19BT50441)MICROPROCESSORS AND INTERFACING

(Common to CSE and IT)
(Interdisciplinary Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Digital Logic Design.

COURSE DESCRIPTION: INTEL 8086 & 8051- Architectures; Instruction set; Programmable Interfacing Concepts; ADC, DAC, 8255, 8257,8259 ,8279,8251, Advanced peripheral Interfacing; Applications.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1: Analyze architecture of Intel 8086 microprocessor.

CO2: Develop programs for various control applications using Assembly language by analyzing Instruction set and addressing modes of Intel 8086.

CO3: Design a Microcomputer based system with external peripherals by analyzing various Interfacing techniques Using 8086

CO4: Develop programs for Intel 8051 Microcontroller by analyzing its Architecture, Instruction set and On-chip resources.

DETAILED SYLLABUS:

UNIT I – INTEL 8086 ARCHITECTURE AND PROGRAMMING (09 periods)

Evolution of Microprocessors, Architecture of 8086 microprocessor, Register organization, Physical Memory Organization, Signal description of 8086, General Bus Operation Minimum and Maximum mode operation of 8086, Timing diagram, Addressing modes.

UNIT II – ASSEMBLY LANGUAGE PROGRAMMING WITH 8086 AND INTERRUPTS (10 periods)

Instruction set of 8086, Assembler directives and Operators; Interrupts and Interrupt service routines, Interrupt Cycle of 8086, Non Maskable interrupt, Maskable interrupt (INTR), Interrupt Programming, Passing Parameters to procedures, MACROS.

UNIT III–BASIC PERIPHERALS AND THEIR INTERFACING WITH 8086 (08 periods)

Semiconductor memory Interfacing, Dynamic RAM interfacing, Interfacing I/O ports, Programmable Input-Output Port (PIO) 8255, Modes of operations of 8255, Interfacing analog to digital and digital to analog converters, stepper motor interfacing.

UNIT IV – SPECIAL PURPOSE PROGRAMMABLE PERIPHERAL DEVISES (09 periods)

Programmable Interrupt Controller 8259A; The keyboard/Display Controller 8279-Architecture, Signal Description, Modes of operations; Programmable Communication Interface 8251 USART; DMA Controller 8257, DMA Transfers and Operations.

UNIT V – AN INTRODUCTION TO 8051 MICROCONTROLLER (09 periods)

Microprocessors Vs Microcontrollers, The 8051 Architecture: Introduction, 8051 Microcontroller Hardware, input/output pins, Ports and circuits, External Memory, , Counters and Timers, Serial Data Input / Output, Interrupts; Addressing Modes, Instruction set of 8051, simple programs on arithmetic operations using 8051.

Total Periods: 45

Topics for Self Study are provided in the Lesson Plan

TEXT BOOKS:

1. A.K. Ray &K.M.Bhurchandi, A*dvanced Microprocessors and Peripherals-Architecture, Programming and Interfacing,* TMH, 2nd Edition, 2002 reprint.
2. Kenneth J. Ayala, *The 8051 Microcontroller-Architecture, Programming & Applications,* Cengage learning, 3rdEdition, June 2004.

REFERENCE BOOKS:

1. Douglas V.Hall, *Microprocessors and Interfacing: Programming and Hardware,* TMH, revised 2ndEdition, 2003.
2. Mazidi and Mazidi, *The 8051 Microcontroller and Embedded Systems*, PHI, 2nd Edition, 2000.

CO-PO-PSO Mapping Table:

Course outcome	Program Outcomes												Program specific outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	2	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	2	1	-	-	-	-	-	-	-	-	1	-
CO4	3	2	3	2	1		-	-	-	-	-	-	-	-	1	-
Average	3	2.2	3	2	1.5	1	-	-	-	-	-	-	-	-	1	-
Course Correlation Level	3	2	3	2	2	1	-	-	-	-	-	-	-	-	1	-

Correlation Levels: **3- High** **2-Medium** **1- Low**

III B. Tech. – I Semester

(19BT60407) IMAGE PROCESSING

(Common to CSSE and IT)
(Interdisciplinary Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Image Fundamental, Image Transforms, Image enhancement in spatial and frequency domains, Restoration of images corrupted by noise, Image Compression models with coding, Segmenting images based on properties and Color image processing.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1: Apply various transformations on images by analyzing basic operations on images.
CO2: Apply various image enhancement techniques in spatial and frequency domains
CO3: Apply restoration techniques based on noise models and degradation function to restore the images, pertaining to health and societal applications.
CO4: Analyze various coding techniques for compression to reduce redundancies in images.
CO5: Analyze various segmentation techniques on images for societal applications.
CO6: Analyze various color models for different types of images.

DETAILED SYLLABUS:

UNIT-I: IMAGE FUNDAMENTALS (10 Periods)

Fundamental steps in Image Processing, Image sampling & quantization, some basic relationships between pixels, Arithmetic operations, Logical operations, Spatial operations,

IMAGE TRANSFORMS: 2D-DFT, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar-Transform, Slant Transform and KL Transform, properties of image transforms.

UNIT-II: IMAGE ENHANCEMENT (11 Periods)

Basic Intensity transformation functions, Histogram processing, Fundamentals of Spatial Filtering, Smoothing spatial filters, Sharpening spatial filters, Combining spatial Enhancement methods.

Basics of filtering in frequency domain, Correspondence between filtering in the spatial and frequency domains, Image smoothing using frequency domain filters, Image sharpening using frequency domain filters, Homomorphic filtering.

UNIT-III: IMAGE RESTORATION (07 Periods)

Image degradation/Restoration model, Noise models, Restoration in the presence of Noise only-spatial filtering - mean, order- statistic and adaptive filters.Estimating the degradation function, Inverse filtering, Weiner filtering, Constrained least squares filtering.

UNIT-IV: IMAGE COMPRESSION (08 Periods)

Classification of redundancy in Images, Image Compression models, Run length coding, Arithmetic coding, Dictionary based compression, bit-plane coding, Transform based coding, Fidelity Criteria, JPEG 2000.

UNIT-V: IMAGE SEGMENTATION AND COLOR IMAGE PROCESSING (09 Periods)

Detection of discontinuities- Point, line and edge Detection.Thresholding- global thresholding, adaptive thresholding.Region based Segmentation. Color image fundamentals - RGB, HSI models, conversions, Pseudo Color Image Processing, Color transformations.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Rafael C. Gonzalez & Richard E. Woods, *Digital Image Processing*, Pearson Education,3rd Edition, 2008
2. Anil K.Jain, *Fundamentals of Digital Image processing*, Prentice Hall, 2007.

REFERENCE BOOKS:

1. S Jayaraman, S Esakkirajan, T Veerakumar, Digital Image Processing, Tata McGraw Hill Education, Second Edition, 2020.
2. Vipula Singh, Digital Image Processing with MATLAB & LabVIEW, Elsevier, 2019.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	2	3	-	-	-	-	-	-	-	-	-	-	2
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-	-	2
CO3	3	2	-	2	3	2	2	-	-	-	-	-	-	-	-	2
CO4	3	3	2	2	2	2	2	2	-	-	-	-	-	-	-	2
CO5	3	3	2	2	2	2	2	-	-	-	-	-	-	-	-	2
CO6	3	3	-	-	2	-	-	-	-	-	-	-	-	-	-	2
Average	3	2.5	2	2	2.5	2	2	2	-	-	-	-	-	-	-	2
Course Correlation Level	3	3	2	2	3	2	2	2	-	-	-	-	-	-	-	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT51205) MOBILE COMPUTING

(IT)

(Inter Disciplinary Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Computer Networks.

COURSE DESCRIPTION: Overview of Mobile computing and Second-Generation Architecture; Wireless Medium Access Control, CDMA, 3G, WIMAX, 4G and 5G Networks; Mobile IP Network Layer; Mobile Transport Layer; Wireless LAN and Personal Area Network Protocols.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to*:**

CO1. Demonstrate knowledge on the characteristics of mobile computing, GSM and GPRS.

CO2. Analyze the mobility, scalability, and Medium characteristics of 3G, WiMAX, 4G and 5G networks.

CO3. Analyze the services and protocols of Mobile IP Network Layer and Transport Layer.

CO4. Demonstrate knowledge on wireless LAN and personal area network protocols.

DETAILED SYLLABUS:

UNIT-I: OVERVIEW OF MOBILE COMPUTING AND SECOND-GENERATION ARCHITECTURE (10 periods)

Mobile Computing Architecture: An Overview: Mobile Computing, Mobile Computing Operating System, Mobile Computing Architecture, Design Considerations for Mobile Computing, Mobile Computing and the Apps, Limitations of Mobile Devices, Security Issues

Second-generation Architecture-GSM, GPRS, and Others: GSM Services, GSM System Architecture, Space Division Multiple Access, Time Division Multiple Access, and Frequency Division Multiple Access, Call Routing, Public Land Mobile Network (PLMN) Interface, GSM Subscriber Addresses and Identities, Protocols, Localization, Call Handling, Handover, Security, Introduction to SMS, General Packet Radio Service, High-speed Circuit-switched Data, Digital Enhanced Cordless Telecommunications, WLL Application

UNIT-II: WIRELESS MEDIUM ACCESS CONTROL, CDMA, 3G, WIMAX, 4G AND 5G NETWORKS (10 periods)

Modulation, Medium Access Control, Exposed and Hidden Terminal Problem, Near and Far Terminal Problem, and Power Control for Medium Access, MAC Algorithms, WLAN and CAMA/CA Wireless Protocols, SDMA, TDMA, FDMA and CDMA, Direct Sequence Spread Spectrum, Frequency Hopping Spread Spectrum, Code Division Multiple Access

3G: Applications of 3G Mobile Services, 3G Mobile Services: IMT2000 and UMTs, CDMA 2000: 3G, WCDMA 3G, OFDM, High-speed Packet Access, Mimo in HSPA, Long-term Evolution and WiMax 16E, Ultra-wide Band and Broadband Wireless Access

4G Networks: HS-OFDM, LTE Advanced and WiMax 16M, Upcoming 5G Network Features

UNIT-III: MOBILE IP NETWORK LAYER (9 periods)

Functioning of OSI Layers, and TCP/IP, IP, UDP and ICMP Protocols, Mobile IP, Packet Delivery and Handover Management, Location Management, Registration, IP Header: Encapsulation and Routes Optimization, Mobility Binding, Tunneling, and Reverse

Tunneling, Dynamic Host Configuration Protocol, Cellular IP, Mobile IP with IPv6, Voice over IP, IP Security

UNIT-IV: MOBILE TRANSPORT LAYER (8 periods)

Conventional Transport Layer Protocols: UDP and TCP, Indirect TCP, Snooping Transmission Control Protocol, Mobile TCP, Other Transmission Methods at TCP Layer for Mobile Networks, TCP over 2.5G/3G Mobile Networks

UNIT-V: WIRELESS LAN AND PERSONAL AREA NETWORK PROTOCOLS (8 periods)

Wireless LANs, Wireless Application Protocol, Wireless Markup Language, Bluetooth, WiMax, ZigBee and Wi-Fi, Bluetooth, and ZigBee Features

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Rajkamal, *Mobile Computing*, OXFORD University Press, 3rd Edition, 2019.

REFERENCE BOOK:

1. Jochen Schiller, *Mobile Communications*, Pearson Education, 2nd Edition, 2009.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	2	-	-	-	-	-	-	-	-	3	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
Average	2.5	3	-	-	2	-	-	-	-	-	-	-	-	3	-	-
Level of correlation of the course	3	3	-	-	2	-	-	-	-	-	-	-	-	3	-	-

Correlation Level: 3- High 2-Medium 1- Low

III B. Tech. – I Semester
(19BT51206)WIRELESS NETWORKS

(IT)
(Inter Disciplinary Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Computer Networks.

COURSE DESCRIPTION: Generations of Wireless Networks; Voice and Data Processing; Wireless Network Topology; GSM; TDMA; CDMA; Wireless LANs; Wireless WANs; Wireless PAN.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on:
- Different generations of wireless networks
- Wireless Medium Access methods.

CO2. Analyze the Cellular topology, Cellular hierarchy and Wireless Network Architectures.
CO3. Develop Home Access Networks using wireless LAN technologies.
CO4. Analyze GSM and GPRS Architectures to develop Voice and Mobile Data Networks.
CO5. Demonstrate knowledge on Wireless ATM and Wireless PAN.

DETAILED SYLLABUS:

UNIT-I: OVERVIEW OF WIRELESS NETWORKS & WIRELESS MEDIUM ACCESS ALTERNATIVES (8 periods)

Overview of Wireless Networks: Different generations of wireless networks.
Wireless Medium Access Alternatives: Fixed assignment access for voice-oriented networks – Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA); Random access for data-oriented networks – Access methods for wireless LANs; Integration of voice and data traffic.

UNIT-II: NETWORK PLANNING & WIRELESS NETWORK OPERATIONS (10 periods)

Network Planning: Wireless network topologies – Infrastructure of network topology, Ad hoc network topology; Cellular topology, Cellular concept, Cellular hierarchy; Cell fundamentals, Network planning for CDMA systems.
Wireless Network Operations: Mobility management – Location management, Handoff management, Mobile IP; Security in wireless networks – Security requirements for wireless networks, Overview of network security, Identification schemes.

UNIT-III: INTRODUCTION TO WIRELESS LANS & IEEE 802.11 Wireless LANS (9 periods)

Introduction to Wireless LANs: Historical overview of the LAN industry, Wireless home networking-Home Access Networks (HAN), Needs of HAN, HAN technologies.
IEEE 802.11 WLANs: IEEE 802.11 – Overview of IEEE 802.11, Reference architecture, Layered protocol architecture; The PHY Layer – FHSS, DSSS; MAC sublayer – General MAC frame format; MAC management sublayer – Registration, Handoff, Security.

UNIT-IV: GSM TECHNOLOGY & MOBILE DATA NETWORKS (10 periods)

GSM Technology: GSM – GSM Services, Reference architecture; Mechanisms to support a mobile environment – Registration, Call establishment, Handoff, Security; Communications in the infrastructure - Physical Layer, TDMA Frame Hierarchy, Logical Channels.
Mobile Data Networks: GPRS and Higher data rates –GPRS network services, Reference architecture in GPRS, Mobility support in GPRS, Protocol layers in GPRS;

SMS – Overview of SMS Operation; Mobile application protocols – Wireless application protocol, i-Mode.

UNIT-V: WIRELESS ATM AND WIRELESS PAN (8 periods)

Wireless ATM: Wireless ATM – Reference model, Protocol entities, PHY and MAC layer alternatives, Mobility support;

Wireless PAN: IEEE 802-15 WPAN, Home RF – Architecture; Bluetooth – Overall architecture, Protocol stack, Physical connection, Security.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Kaveh Pahlavan and Prashant Krishna Murthy, *Principles of Wireless Networks*, PHI Learning Pvt. Ltd., 2009.

REFERENCE BOOKS:

1. William Stallings, *Wireless Communications and Networks*, Pearson Education, 2nd Edition, 2012.
2. C. Sivaram Murthy and B.S. Manoj, *Ad-hoc Wireless Networks Architectures and Protocols*, Pearson Education, 2nd Edition, 2007.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	1	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	-	-	-	2	-	-	-	-	-	-	-	-	3	-	-
Average	2.2	2.6	3	-	2	-	-	-	-	-	-	-	-	3	-	-
Level of correlation of the course	2	3	3	-	2	-	-	-	-	-	-	-	-	3	-	-

Correlation Level: 3- High 2-Medium 1- Low

III B. Tech. –I Semester

(19BT51231) DATA WAREHOUSING AND DATA MINING LAB

(IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A course on Data Warehousing and Data Mining.

COURSE DESCRIPTION: Hands-on experience on Data preprocessing techniques; Mining frequent patterns; classificationandclusteringtechniquesusingWeka, andRapidminerStudiotools.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to*:**

CO1. Demonstrate knowledge on pre-processing techniques, descriptive and predictive mining tasks.
CO2. Identify data mining algorithms to mine knowledge from real-time datasets.
CO3. Perform classification, clustering and prediction on given dataset.
CO4. Prepare data analytical reports suitable for societal requirements.
CO5. Work independently or in teams to solve problems with effective communication.

LIST OF EXPERIMENTS:

I. Experiments on Weka:

1. Create a dataset using ARFF and CSV formats and load into the Weka Explorer.
2. Perform the following preprocessing filters on 'Weather' dataset.
   (i) Add (ii) Remove (iii) Discretize
   (iv) Replace Missing values (v) Normalize
3. List all the categorical attributes and the real-valued attributes separately in 'German credit' data set.
4. Generate strong Association rules by using Apriori algorithm on 'German_credit' dataset with Min_Sup=60% and Min_Conf=80%.
5. (i) Implement the Classification using Decision Tree algorithm on 'Weather' dataset. Draw the confusion matrix and report the model with accuracy.
   (ii) Implement Bayesian Classification and analyze the results on 'iris' Dataset.
6. (i) Implement Simple Linear Regression on an 'Employee' dataset.
   (ii) Demonstrate the simple k-Means clustering algorithm on 'iris' dataset.
7. (i) Rank the performance of j48, PART and oneR Algorithms on 'Weather' dataset using Experimenter.
   (ii) Build a Knowledge Flow model using Weka tool.

II. Experiments using Rapid Miner

8. (i) Implement the Classification using Decision Tree algorithm on 'Weather' dataset. Draw the confusion matrix and report the model with accuracy.
   (ii) Implement Bayesian Classification and analyze the results on 'iris' Dataset.
9. (i) Implement Simple Linear Regression on an 'Employee' dataset.
   (ii) Demonstrate the simple k-Means clustering algorithm on 'iris' dataset.
10. (i) Rank the performance of j48, PART and oneR Algorithms on 'Weather' dataset using Experimenter.
    (ii) Build a Knowledge Flow model using Rapid Miner tool.
11. Mini Project

REFERENCE BOOKS/LABORATORY MANUALS:

1. Ian. H. Witten and Eibe Frank, *Data Mining: Practical Machine Learning Tools and Techniques,* Elsevier Publication, 2nd Edition, 2005.
2. Pang-Ning Tan, Vipin Kumar and Michael Steinbach, *Introduction to Data Mining,* Pearson Education, 2006.
3. Jiawei Han and Micheline Kamber, *Data Mining: Concepts and Techniques,* Morgan Kaufmann Publishers, 2nd Edition, 2006.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1	2	-	-	-	-	-	-	-	3	-	-	2
CO2	2	1	2	-	3	1	-	-	-	-	-	-	3	-	-	2
CO3	1	2	1	3	2	-	2	2	-	-	-	-	3	-	-	2
CO4	1	2	2	3	-	2	-	2	-	-	-	2	3	-	-	2
CO5	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	
Average	1.75	1.75	1.5	2.33	2.33	1.5	2	2	3	3	-	2	3	-	-	2
Level of correlation of the course	2	2	2	3	3	2	2	2	3	3	-	2	3	-	-	2

Correlation Level: 3- High 2-Medium 1- Low

III B. Tech. – I Semester
(19BT51232) WEB TECHNOLOGIES LAB
(Common to CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: Courses on Object Oriented Programming through Java and Web Technologies.

COURSE DESCRIPTION: Hands-on experience on HTML, HTML5, CSS, JavaScript, JQuery, Bootstrap, PHP and MySQL.

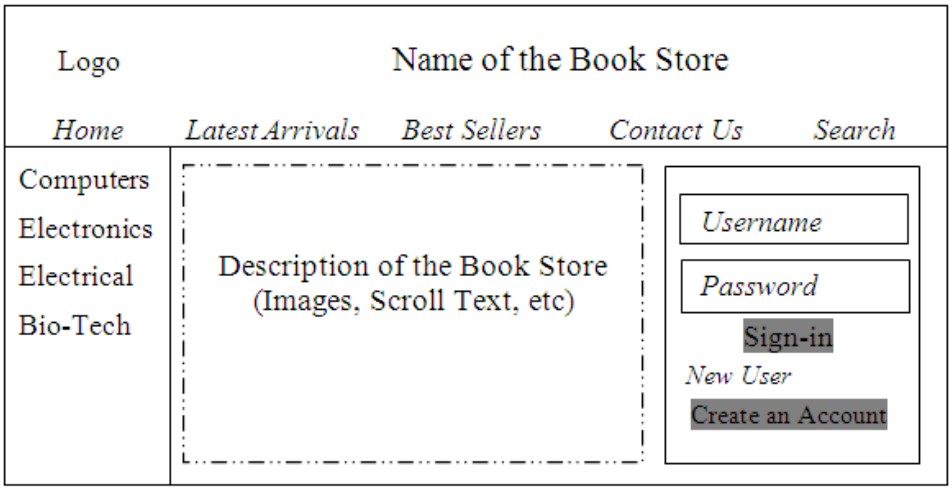
COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on web page design elements, dynamic content and database connection.
CO2. Analyze user requirements to develop web applications.
CO3. Design client-server applications using web technologies.
CO4. Demonstrate problem solving skills to develop enterprise web applications.
CO5. Apply HTML, CSS, JavaScript, JQuery, Bootstrap and PHP technologies for device independent web application development.
CO6. Apply web technologies to develop interactive, dynamic and scalable web applications for societal needs.
CO7. Work independently or in teams to solve problems with effective communication.

LIST OF EXPERIMENTS:

1. Design the following static web pages of an online book store web application.

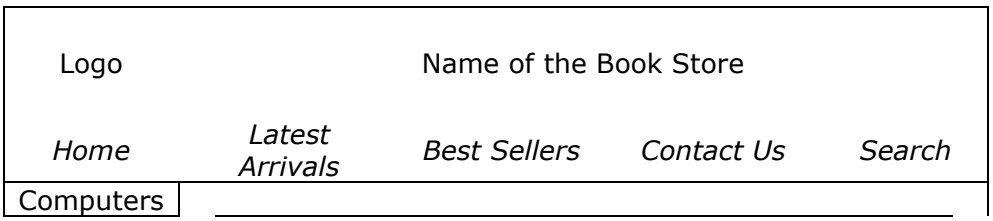
a. Home Page:

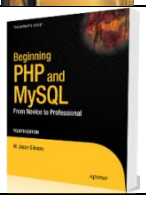


b. Catalogue Page:

The catalogue page should display the following details of available books.

i. Snap shot of cover page ii. Title of the text book iii. Author name
iv. Publisher v. Price vi. More details link.



Electronics Electrical Bio-Tech		**HTML5 Black Book** Kogent Learning Solutions Dreamtech Press Rs. 570/-	More Details
		**Beginning PHP and MySQL** 4th Edition W Jason Gilmore Apress Rs. 520/-	More Details

c. Registration Page:
Design the Registration page with the following fields and navigate it with create an account link.

i. First Name ii. Last Name iii. Gender
iv. Date of Birth v. Username vi. Password
vii. Confirm Password viii. Address ix. Postal Code
x. Mobile No. xi. Email-Id

2. a. Design a web page to store username and password information using the local storage concept.
b. Design a web page to store employee information including Name, Emp. Id, Department, Salary and Address on a client's machine using a real SQL database.

3. Apply the following styles to all web pages of online book store web application.
a. Fonts and Styles: font-family, font-style, font-weight and font-size
b. Backgrounds and colors: color, background-color, background-image and background-repeat
c. Text: text-decoration, text-transformation, text-align and text-indentation, text-align
d. Borders: border, border-width, border-color and border-style
e. Styles for links: A: link, A: visited, A:active, A:hover
f. Selectors, Classes, Layers and Positioning elements.

4. Write a JavaScript/JQuery code to validate the following fields of the Registration web page.
a. First Name/Last Name - should contain only alphabets and the length should not be less than 8 characters.
b. Username - It should contain combination of alphabets, numbers and underscore. It should not allow spaces and special symbols.
c. Password - It should not less than 8 characters in length and it contains one uppercase letter and one special symbol.
d. Date of Birth - It should allow only valid date; otherwise display a message stating that entered date is invalid. Ex. 29 Feb. 2009 is an invalid date.
e. Postal Code: It must allow only 6 digit valid number.
f. Mobile No. - It should allow only numbers and total number of digits should be equal to
g. e-mail id - It should allow the mail id with the following format:
Ex. mailid@domainname.com

5. Design a web page with the following features using HTML5, JavaScript and JQuery
a. Displaying of images with Custom animated effects
b. Playing of selected video from the list of videos
c. Showing the animated text in increasing and decreasing font size
d. Changing the size of the area in a web page using DIV tag
e. Hiding and Showing elements in a web page.

6. Design a web page with the following features using Bootstrap and Media Query.

a. Components
b. Responsive tables
c. Responsive images and videos
d. Toolbars, Buttons and Lists

7. a. Deploy and navigate web pages of online book store using WAMP/XAMPP web server.
b. Write a PHP program to read user name and favorite color from the HTML form. Display the name of the user in green color and sets user favorite color as a background for the web page.

8. Write a PHP code to read the username and password entered in the Login form of the online book store and authenticate with the values available in cookies. If user enters a valid username and password, welcome the user by username otherwise display a message stating that, entered details are invalid.

9. Write a PHP code to read user details entered through the registration web page and store the same into MySQL database.

10. Write a PHP code for storing books details like Name of the book, author, publisher, edition, price, etc into MySQL database. Embed a PHP code in catalogue page of the online book store to extract books details from the database.

11. **Mini Project**

REFERENCE BOOKS:

1. Kogent Learning Solutions Inc, *HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQuery,* Dreamtech Press, 1st Edition, 2011.
2. W. Jason Gilmore, *Beginning PHP and MySQL*, APress, 4th Edition, 2011.
3. Snig Bahumik, *Bootstrap Essentials*, PACKT Publishing, 1st Edition, 2015. (e-book).

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes								Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO7	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	-	3	-	-	-	-	-	3	-
CO4	2	2	2	3	3	-	-	-	-	-	3	-
CO5	2	1	3	2	3	-	-	-	-	-	3	-
CO6	2	2	2	2	3	3	-	-	-	-	3	-
CO7	-	-	-	-	-	-	3	3	-	-		-
Average	2.16	2	2.5	2.3	3	3	3	3	-	-	3	-
Level of correlation of the course	2	2	3	3	3	3	3	3	-	-	3	-

Correlation Levels: 3- High 2 Medium 1- Low

III B.Tech. - I semester
(19BT51233)**SOCIALLY RELEVANT PROJECT-I**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	-	1

PREREQUISITES: --

COURSE DESCRIPTION: Identification of topic for the socially relevant project; Literature survey; Collection of preliminary data; Identification of implementation tools and methodologies; Performing critical study and analysis of the topic identified; Time and cost analysis; Implementation of the socially relevant project; Preparation of thesis and presentation.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1: Create/Design engineering systems or processes to solve complex societal problems using appropriate tools and techniques following relevant standards, codes, policies, regulations and latest developments.

CO2: Consider environment, sustainability, economics and project management in addressing societal problems.

CO3: Perform individually or in a team besides communicating effectively in written, oral and graphical forms on socially relevant project.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	-	3	-	-	-	3	3	3	3	3
CO2	-	-	-	-	-	-	3	-	-	-	3	-	3	3	3	3
CO3	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Average	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Level of correlation of the course	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT5MC01)UNIVERSAL HUMAN VALUES

(Mandatory Course)
(Common to CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	-	40	2	-	-	-

PRE-REQUISITES: -

COURSE DESCRIPTION: Process for Value Education; Harmony in the Human Being - Harmony in Myself!; Harmony in Family and Society- Human Relationship; Harmony in the Nature and Existence – Coexistence; Implications of Holistic Understanding of Harmony on Professional Ethics.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Understand Values and skills for sustained happiness and prosperity.
CO2. Analyserealistic implications of a Holistic understanding of ethical human conduct, trustful and mutually fulfilling human behaviour.
CO3**.** Apply holistic approach in personal life and profession through a positive understanding of the Human reality and existence.

DETAILED SYLLABUS:

UNIT I: VALUE EDUCATION (8 Periods)

Human Values-Introduction; Self-Exploration - Natural Acceptance and Experiential Validation; Human Aspirations- Right understanding- the current scenario: understanding and living in harmony.

UNIT II: HUMAN BEING AND SELF (9 Periods)

Understanding human being - I' and the material 'Body'; needs of Self ('I')and 'Body'- happiness and physical facility; Body as an instrument of 'I' - characteristics and activities of 'I' and harmony in 'I'; harmony of I with the Body; Sanyam and Health.

UNIT III: FAMILY, THE SOCIETY AND THE NATIONS (9Periods)

Values in human relationship (nine universal values) - foundational values of relationship; Difference between intention and competence; Difference between respect and differentiation; harmony in the society and with the nations; comprehensive Human Goals; universal harmonious order in society.

UNIT IV: HARMONY WITH THE NATURE (9 Periods)

Harmony in the Nature; Interconnectedness and mutual fulfilment - the four orders of nature - Recyclability and Self-regulation; Existence as Co-existence; Holistic perception of harmony and existence.

UNIT V: HARMONY WITH PROFESSIONALETHICS (10 Periods)

Acceptance of human values; Ethical Human Conduct; Basis for Humanistic Education, Constitution and Universal Order; Competence in professional ethics; Case studies: Holistic technologies, Management Models and Production Systems; Transition from the present state to Universal Human Order: socially and ecologically responsible engineers, technologists and managers - enriching institutions and organizations.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010

REFERENCE BOOK:

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-	3	2	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	3	3	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	3	3	2	-	-	-	-	-	-	-	-
Average	2.67	-	-	-	-	3	2.67	2	-	-	-	-	-	-	-	-
Level of correlation of the course	3	-	-	-	-	3	3	2	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT4BS01)**MATERIAL SCIENCE**

(Open Elective-1)

(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES:-

COURSE DESCRIPTION: Introduction to material science and engineering; properties, processing and applications of composite materials; smart materials; nano and biomimetic materials; emerging materials.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Attain the basic knowledge on biomaterials, smart materials, composites and nanomaterials.

CO2. Understand the basic properties of electro-rheostatic, magneto-rheostatic and shape memory alloys used in device applications.

CO3**.** Attain essential information about structure and properties of various composites used in various engineering applications.

CO4. Accomplish the basic knowledge in nanomaterials to familiarize various nano structured device applications.

CO5. Understand the fundamental concepts about functionally graded materials used in robotics, rockets and missiles.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO MODERN MATERIALS (10 Periods)

Introduction to material science and engineering, classification of materials (metals, ceramics, polymers and composites), modern materials (biomaterials, smart materials, composite materials and nanomaterials), need of modern materials - biomaterials and applications of biomaterials.

UNIT-II: SMART MATERIALS (08 Periods)

Introduction - classification of smart materials, electro - rheostatic and magneto - rheostatic, shape memory alloys (SMA): shape memory effect, types of shape memory effect, Characteristics of shape memory alloys, Applications of SMA.

UNIT-III: COMPOSITE MATERIALS (08 Periods)

Composite materials - basic structure- classification of composites: structural composites - laminates and sandwich panels, nanocomposites and its applications - composite materials in alternate energy sources - introduction and requirements for wind turbine blade materials.

UNIT- IV: NANOMATERIALS (09 Periods)

Nanomaterials: Introduction to quantum wells, quantum wires and quantum dots - Lithography: Fabrication of nanomaterials by lithographic technique using photons - aerogels - types - properties and applications (qualitative treatment).

Nanostructured materials: Nanostructured materials, nano structured steel and its applications - nanostructured materials for renewable energy applications - nanomaterials in solar cells for photovoltaic applications, Nano Electro-Mechanical Systems (NEMS).

UNIT-V: EMERGING MATERIALS AND ITS SPECIALIZED APPLICATIONS (10 Periods)

Functionally graded materials (FGM) - types, properties and its processing - applications of FGM -functionally graded particulate composite for use as structural material - functionally graded nanoelectronic, optoelectronic and thermoelectric materials - materials in robots, materials for rockets and missiles.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. William D Callister, David G Rethwisch, *Materials Science and Engineering*, Wiley, 9th edition, 2014.
2. K M Gupta, *Engineering Materials – Research, Applications and Advances*, CRC press (Taylor & Francis group), 2015.

REFERENCE BOOKS:

1. Sulabha K Kulkarni*, Nanotechnology: Principles and practices*, Springer, 9th edition, 2014.
2. Charles P. Poole and Frank J. Owens, *Introduction to Nanotechnology*, Wiley-Interscience, May 2003.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Level of correlation of the course	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT4HS02)BUSINESS COMMUNICATION AND CAREER SKILLS

(Open Elective-1)

(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: –

COURSE DESCRIPTION: Nature and Scope of Communication, Corporate Communication, Writing Business Messages & Documents, Careers & Résumés, and Interviews.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge of professional communication by examining and applying the styles and strategies of business communication in Communication Networks and Writing Messages.

CO2. Analyze the limitations of business communication by applying and demonstrating corporate communication aspects for effective communication through Interpersonal Communication, Informal Communication, and Crisis Management and Communication.

CO3. Apply appropriate writing techniques for effective professional communication in preparing documents by demonstrating and examining Stages in Writing Business Messages, Strategies for Writing the Body of a Letter, and Structuring Résumés.

CO4. Apply appropriate speaking techniques by examining and demonstrating effective communication in distinguished situations through Corporate Communication and Cross Cultural Communication

DETAILED SYLLABUS:

UNIT I - NATURE AND SCOPE OF COMMUNICATION: (9 periods)

Introduction: Communication Basics - Functions of Communication – Communication Networks - Interpersonal Communication – Informal Communication - Communication Barriers - Roles of a Manager

UNIT II - CORPORATE COMMUNICATION: (9 periods)

Introduction: Corporate Communication - Cross-Cultural Communication; Concept & Styles - Corporate Communication Strategy - Corporate Citizenship - Crisis Communication: Case Study

UNIT III - **WRITING BUSINESS MESSAGES &DOCUMENTS: (9 periods)**

Introduction: Importance of Written Business Communication - Types of Business Messages - Five Main Stages of Writing Business Messages – Business Letter Writing; Kinds of Business Letters – Common Components of Business Letters – Strategies for Writing the Body of a Letter

UNIT IV – CAREERS AND RÉSUMÉS: (9 periods)

Introduction - Career Building - Résumé Formats; Traditional, Electronic and Video Resumés – Sending Résumés - Follow-up Letters - Business Presentations and Speeches; Planning –
Structuring - Organizing – Delivery

UNIT V – INTERVIEWS: (9 periods)

Introduction - General Preparation for an Interview - Success in an Interview - Important Non-verbal Aspects – Types of Interviews – Styles of Interviewing - Types of Interviewing Questions - Online Recruitment Process

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Meenakshi Raman and Prakash Singh, *Business Communication*, Oxford University Press, New Delhi, 2nd edition, 2012.
2. Neera Jain and Sharma Mukherji, *Effective Business Communication*, Tata Mc Graw-Hill Education, Pvt. Ltd., New Delhi, 2012.

REFERENCE BOOKS:

1. Courtland L.Bovee et al., *Business Communication Today*, Pearson, New Delhi, 2011.
2. Krizan, *Effective Business Communication*, Cengage Learning, New Delhi, 2010.

ADDITIONAL LEARNING RESOURCES

1. http://www.career.vt.edu/interviewing/TelephoneInterviews.html
2. http://job-search-search.com/interviewing/behavioral_interviews
3. https://goo.gl/laEHOY (dealing with complaints)
4. http://www.adm.uwaterloo.ca/infocecs/CRC/manual/resumes.html
5. https://goo.gl/FEMGXS
6. http://www.resumania.com/arcindex.htmlhttps://goo.gl/FEMGXS
7. http://www.resumania.com/arcindex.html

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	3	-	-	-	-	3	-	-	-	-	-	-
CO2	1	3	-	-	3	-	-	-	-	3	-	-	-	-	-	-
CO3	1	2	-	-	3	-	-	-	-	3	-	-	-	-	-	-
CO4	1	1	-	-	2	-	-	-	-	2	-	-	-	-	-	-
Average	1.5	1.75	-	-	2.25	-	-	-	-	2.25	-	-	-	-	-	-
Level of correlation of the course	2	2	-	-	3	-	-	-	-	3	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT4HS04) ENTREPRENEURSHIP FOR MICRO, SMALL AND MEDIUM ENTERPRISES

(Open Elective-1)
(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE REQUISITE: -

COURSE DESCRIPTION: Entrepreneurship Development; Idea generation and formulation of business plans; Micro small and medium enterprises; Institutional finance; Women & rural entrepreneurship

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate Knowledge in principles, concepts, significance, schemes and institutionsencouraging entrepreneurship.
CO2. Develop skills in providing solutions for dynamic entrepreneurial ventures, women entrepreneurship serving as contrivance in societal development
CO3. Develop Critical thinking and evaluation ability
CO4. Inculcates business acumen and attitude towards trouble shooting
CO5. Design solutions for new start-ups

DETAILED SYLLABUS:

Unit – I: ENTREPRENEURSHIP DEVELOPMENT (9 periods)

Introduction to Entrepreneurship Development - Concept ofEntrepreneurship – Growth of Entrepreneurship in India **-** Factors affecting entrepreneurship growth - Characteristics of an Entrepreneur – Functions of Entrepreneur – Entrepreneurial Decision Process – Types of Entrepreneurs – Distinction between an Entrepreneur and a manager.

UNIT–II: IDEA GENERATION AND FORMULATION OF BUSINESS PLANS (9 periods)

Sources of Ideas – Methods of idea generation – Steps in Setting up of a Small Business Enterprise – Formulation of Business Plan – Contents of Business Plan – Significance – Common Errors in Business Plan Formulation – The role of incubation centers for promoting entrepreneurship and start-ups.

Unit – III: MICRO AND SMALL ENTERPRISES (9 periods)

Meaning and Definition – Micro and Macro units – Essentials – Features – Characteristics – Scope of Micro and Small Enterprises – Objectives of Micro Enterprises – relationship between Micro and Macro Enterprises- Problems of Micro and Small Enterprises

UNIT – IV: INSTITUTIONAL FINANCE (9 periods)

Institutional Finance **–** Need-Scope-Services - Various Institutions offering Institutional support: – Small Industries Development of Bank of India (SIDBI), State Industrial Development Corporations – Small Industries Development Organisation (SIDO) – Small Industries Service Institutes (SISIs) – SFCs - National Institute of Entrepreneurship and Small Business Development (NIESBUD) – Micro Units Development and Refinance Agency Bank (MUDRA).

UNIT –V: WOMEN & RURAL ENTREPRENEURSHIP (9 periods)

Concept of Women entrepreneur - Functions of Women entrepreneurs - Growth of women entrepreneurship in India - Challenges of Women entrepreneurs- Programmes supporting women entrepreneurship – Rural Entrepreneurship – Meaning, Need for Rural entrepreneurship, Problems of rural entrepreneurship, Role of NGOs, Role of BharatiyaMahila Bank for encouraging Women Entrepreneurs – Micro Finance & Self Help Groups (Basic Concepts).

Total periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Dr.S.S.Khanka*, Entrepreneurial Development*, S. Chand and Company Ltd, Revised Edition, 2012.
2. MadhurimaLall& Shikha Sahai, *Entrepreneurship*, Excel Books India, 4th Edition, 2014.

REFERENCE BOOKS:

1. Nandan, H., *Fundamentals of Entrepreneurship*, PHI Learning Pvt. Ltd., New Delhi, 3rd Edition, 2013.
2. Bholanath Dutta, *Entrepreneurship Management* – Text and Cases, Excel Books, 3rd Edition, 2015.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	-	2	1	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	3	3	-	-	-	2	-	-	-	-	-
Average	2.5	2	-	-	-	2.5	2	-	-	-	2	-	-	-	-	-
Level of correlation of the course	3	2	-	-	-	3	2	-	-	-	2	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester
(19BT4HS06) GERMAN LANGUAGE (Deutsch alsFremdsprache)

(Open Elective-1)
(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Introduction; City and Food; Day to Day Conversations; Basic Grammar; Basic Writing.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate basic knowledge of German language and the verb conjugation.
CO2. Comprehend and apply the knowledge of vocabulary and phrases in day-to-day real-life conversation.
CO3. Apply the various sentence structures by examining the rules of grammar in speaking and writing.
CO4. Analyze and apply the various verb structure of English and German language effectively in professional writing

DETAILED SYLLABUS:

UNIT I: INTRODUCTION (9 Periods)

Introduction - German alphabets, numbers, days in a week, names of months, seasons. Grammar: Nouns –(i)Nominative case and (ii) Nominative personal pronouns, simple sentence, Verb Conjugation 1st and 2nd type, verb Conjugation 3rd type, 'Wh' questions (simple sentences) Nominative (definite and indefinite) Articles

UNIT II: CITY AND FOOD (9 Periods)

In the city: naming places and buildings, means of transport, basic directions. Food: drink, groceries and meals. Apartments: rooms, furniture, colours.
Grammar: Nouns-articles negation–(kein and nicht); imperative and the accusative case; Nominative Possessive Pronouns.

UNIT III: DAY TO DAY CONVERSATIONS (9 Periods)

Everyday life, telling time, making appointments, leisure activities, and celebrations. Different types of professions, Health and the body, Holiday and weather, Clothes and Dresses.

UNIT IV: BASIC GRAMMAR (9 Periods)

Grammar: Possessive articles, Prepositions (am, um, von. bis); Modal verbs, Separable verbs, the accusative, past tense of 'to have' and 'to be', the imperative sentences, dative case, perfect tense.

UNIT V: BASIC WRITING (9 Periods)

Translation from English to German and German to English, Contacts, Writing letters and Email Writing.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Stefanie Dengler, Paul Rusch, Helen Schmitz, Tana Sieber, *NetzwerkDeutsch als Fremdsprache, Kursbuch A1*, Goyal Publishers and Distributors Pvt. Ltd. 2015.

Web link:

- https://learngerman.dw.com/en/beginners/c-36519789

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
Average	3	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
Level of correlation of the course	3	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT4HS08) INDIAN HISTORY

(Open Elective-1)

(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-RQUISITES: -

CORSE DESCRIPTION: Introduction; Ancient India; Classical and Medieval era; Modern India; India after independence.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate contextual knowledge on evolution of ancient and medieval Indian History and acquire awareness on societal and cultural issues.

CO2**.** Analyze the situations before and after Independence and assess the societal reforms implemented in India after Independence

DETAILED SYLLABUS:

UNIT I: INTRODUCTION (8 Periods)

Elements of Indian History; History Sources: Archaeology, Numismatics, Epigraphy & Archival research; Methods used in History; History & historiography; sociological concepts-structure, system, organization, social institutions, Culture and social stratification (caste, class, gender, power), State & Civil Society.

UNIT II: ANCIENT INDIA (9 Periods)

Mohenjo-Daro civilization; Harappa civilization; Mauryan Empire.

UNIT III: CLASSICAL & MEDIEVAL ERA (12 Periods)

Classic Era (200 BC - 1200 AD); Hindu - Islamic Era (1200 - 1800 AD).

UNIT IV: MODERN INDIA (6 Periods)

Age of Colonialism (17th - 19th centuries); First war of Indian Independence; Freedom Struggle (1857-1947).

UNIT-V: INDIA AFTER INDEPENDENCE (1947 -) (10 Periods)

The Evolution of the Constitution and Main Provisions; Consolidation of India as a Nation; Politics in the States; Indian economy; Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and inclusion, ChangingNature of work and organization.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. K. Krishna Reddy, *Indian History,* Tata McGraw-Hill, 21st reprint, 2017.

REFERENCE BOOKS:

1. Guha, Ramachandra, *India after Gandhi*, Pan Macmillan, 2007.
2. Thapar, Romila, *Early India*, Penguin, 2002.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	2	-	-	-	-	-	-	-	-	-	-
Average	2	2	-	-	-	2	-	-	-	-	-	-	-	-	-	-
Level of correlation of the course	2	2	-	-	-	2	-	-	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester
(19BT4HS10) PERSONALITY DEVELOPMENT

(Open Elective-1)
(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Personalities and Leadership Qualities; Self Esteem and self Development; Attitude; Communication Relationship; Critical Work Skills and Ethics.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1**.** Demonstrate knowledge of leadership qualities by examining and applying personality traits through Positive self esteem, Open Communication and Self-Righteousness.
CO2**.** Analyze the limitations of Attitudes by applying and demonstrating communication traits through Decision Making, Ethics and Self Actualization.
CO3**.** Apply appropriate Analyzing techniques for comprehending different personalities by examining Positive and Negative Characteristic Traits and demonstrating through Leadership Styles, Mentoring and Behaviour Modification.
CO4. Apply appropriate techniques in Solving Problems by examining and demonstrating Time Management, Stress Management and Anger Management.

DETAILED SYLLABUS:

UNIT I – PERSONALITIES AND LEADERSHIP QUALITIES (9 periods)
Introduction: Different Personalities **-** Personality Analysis **-** Freudian Analysis **–** Vedantic Concept: Swamy Vivekananda**-** Personality Begets - Types- Leadership Qualities – Decision Making **-** Case Studies: Personalities

UNIT II - SELF ESTEEM AND SELF DEVELOPMENT (9 periods)
Know Yourself: Self Image - Positive Self Esteem -Turn Failure into Success - Be Sensitive to Feedback - Build Self Confidence – Self Actualization - Set Goals - Action Plans - Accountability – Behavior Modification – Mentoring - Learning- Counseling – Challenge yourself with Aptitude Tests and Internships.

UNIT III - ATTITUDE (9 p*eriods*)
Importance – Difference between Behavior and Attitude - Changing Negative Attitude- Impact of Attitudes on others - Unproductive Attitudes –Assess your Behaviour.

UNIT IV – COMMUNICATION RELATIONSHIP (9 periods)
Introduction – Positive and Negative Characteristic Traits - Grapevine Communication – Open Communication; Team Player - Leadership styles – Performance Expectations - Electronic Communication;TextMessaging – Voicemail – E-Mail.

UNIT V - CRITICAL WORK SKILLS AND ETHICS (9 p*eriods*)
Time Management - Balancing Life and Work - Stress Management - Anger Management - Making Decisions and Solving Problems - Developing Creativity - Ethics and Self-Righteousness – Being Judgemental in the Real World - Striving for Integrity.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Harold R. Wallace and L. Ann Masters, *Personal Development for Life and Work*, Cengage Learning, Delhi, 10th edition Indian Reprint, 2011. (6th Indian Reprint 2015)
2. Barun K. Mitra, *Personality Development and Soft Skills,* Oxford University Press, 2011.

REFERENCE BOOKS:

1. K. Alex, *Soft Skills*, S. Chand & Company Ltd, New Delhi, 2nd Revised Edition, 2011.
2. Stephen P. Robbins and Timothy A. Judge*, Organizational Behaviour*, Prentice Hall, Delhi, 16th edition, 2014.

ADDITIONAL LEARNING RESOURCES

- https://www.universalclass.com/.../the-process-of-perso...
- https://www.ncbi.nlm.nih.gov/pubmed/25545842

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	3	-	-	-	-	1	-	-	-	-	-	-
CO2	1	3	-	-	3	-	-	-	-	1	-	-	-	-	-	-
CO3	1	2	-	-	3	-	-	-	-	2	-	-	-	-	-	-
CO4	1	1	-	-	2	-	-	-	-	3	-	-	-	-	-	-
Average	1.5	1.75	-	-	2.75	-	-	-	-	1.75	-	-	-	-	-	-
Level of correlation of the course	2	2	-	-	3	-	-	-	-	2	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT4HS12) **WOMEN EMPOWERMENT**

(Open Elective-1)

(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	–	–	3

PRE–REQUISITES: -

COURSE DESCRIPTION: Concept & Framework, Status of Women, Women's Right to work, International Women's Decade, and Women Entrepreneurship.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate the characteristics of empowered women, their achievements, and frame work for women empowerment, legal laws, and political status of women.

CO2. Apply the knowledge of women rights to address various societal issues and obstacles in different fields including science and technology.

CO3. Understand the significance of participation in policy debates, National conferences and common forums for women's' equality and development.

CO4. Analyze the concept of women entrepreneurship, government schemes and entrepreneurial challenges and opportunities.

DETAILED SYLLABUS:

UNIT I: CONCEPT & FRAMEWORK (9 Periods)

Introduction- Empowered Women's Characteristics- Achievements of Women's Empowerment **Concept of Empowerment:** Meaning& Concept- Generalizations about Empowerment -Empowerment Propositions - Choices women can make for empowerment - Women's participation in decision making, development process & in Governance. **Framework for Women's Empowerment** - Five levels of equality- Tenets of Empowerment- Elements - Phases and aspects - Techniques - Categories and Models – Approaches.

UNIT II: STATUS OF WOMEN (9 Periods)

Legal Status: Present Scenario- Call for Social change- Significant trends - Legal & Schemes - Personal Law- Joint Family- Criminal Law- Shift towards Dowry - Deterrent Punishment - Criminal Law(II Amendment) - Discrimination in Employment

Political Status: Present Scenario - Political Participation & its Nature- Socio-economic Characteristics - Political Mobilization: Mass Media - Campaign Exposure - Group Orientation - Awareness of issues and participation - Progress & Future Thrust.

UNIT III: WOMEN'S RIGHT TO WORK (9 Periods)

Introduction- Present Scenario - Changes in Policy &Programme - National Plan of Action- Women's Cells and Bureau - Increase in work participation rate- Discrimination in labourmarket - Women in unorganized sector - Issues and Obstacles- Women in Education - Women in Science & Technology - **Case Study:** Linking Education to Women's Access to resources.

UNIT IV: WOMEN'S PARTICIPATORY DEVELOPMENT (9 Periods)

Dynamics of social change- conscious participation - Information Explosion - Organized Articulation - National Conference - Common Forums - Participatory Development - New Issues Identified - Role of other Institutions.

UNIT V: WOMEN ENTREPRENEURSHIP (9 Periods)

Introduction–Definition-Concept- Traits of women Entrepreneurs- Role of women Entrepreneurs in India -Reasons of Women Entrepreneurship- Government schemes &

Financial Institutions to develop Women Entrepreneurs - Key policy recommendations - Project Planning-Suggestions and measures to strengthen women entrepreneurship - Growth & Future challenges - Training and Opportunities - **Case Study:** Training Women as Hand-pump Mechanics- **Case Study** : Literacy for Empowering Craftswomen

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. NayakSarojini, Nair Jeevan, *Women's Empowerment in India*, Pointer Publishers, Jaipur, 2017.
2. SahaySushama, *Women and Empowerment*, Discovery Publishing House, New Delhi, 2013.

REFERENCE BOOKS:

1. Baluchamy. S, *Women's Empowerment of Women*. Pointer Publishers, Jaipur, 2013.
2. KhobragadeGrishma, *Women's Empowerment: Challenges and Strategies Empowering Indian Women*, BooksclinicPublishing, Chhattisgarh, 2020.

ADDITIONAL LEARNING RESOURCES

1. https://www.economicsdiscussion.net/entrepreneurship/women-entrepreneurs-in-india
2. https://www.businessmanagementideas.com/entrepreneurship-2/women-entrepreneurs

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	3	-	1	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	2	-	-	-	3	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Average	3	-	-	-	-	2.33	-	1	-	3	2	-	-	-	-	-
Level of correlation of the course	3	-	-	-	-	3	-	1	-	3	2	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester
(19BT4HS14) CONSTITUTION OF INDIA

(Open Elective-1)
(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Preamble and its Philosophy; Union Legislature; Federalism in India; Judiciary and Public Services; Nation Building.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge in the Parliamentary proceedings, Election Commission, Public Services and Foreign Policy of India.

CO2. Apply the reasoning informed by the various aspects of the Constitution and its provisions to assess societal issues and the consequent responsibilities relevant to the professional engineering practice.

DETAILED SYLLABUS:

UNIT-I: PREAMBLE AND ITS PHILOSOPHY (9 Periods)

Introduction to Indian Constitution; Evolution of Indian Constitution; preamble and its philosophy

UNIT-II: UNION LEGISLATURE (9 Periods)

The Parliament, Parliamentary Structure, Process of Legislation; President of India – Powers and Functions; Prime Minister and Council of Ministers; Constitution Amendment Procedure.

UNIT-III: FEDERALISM IN INDIA (9 Periods)

Centre-State Administrative Relationship;Governors - Powersand Functions; State Legislature - Composition and powers; Chief Ministers - Powers and Functions; The Election Commission – Powers and Functions.

UNIT-IV: JUDICIARY AND PUBLIC SERVICES (9 Periods)

The Union Judiciary - Supreme Court and High Court;Fundamental Rights and Duties All India Services - Central Civil Services -State Services - Local Services.

UNIT-V: INTERNATIONAL PARTICIPATION (9 Periods)

Foreign Policy of India; International Institutions Influence: UNO, WTO, WHO, SAARC, International Summits:BRICS, NSS, UNEP – India's Role in International Negotiations; Environmentalism in India.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Briji Kishore Sharma, *Introduction to the Constitution of India*, Prentice Hall of India, 2005.

REFERENCE BOOKS:

1. Mahendra Pal Singh, V. N. Shukla's, *Constitution of India*, Eastern Book Company, 2011.
2. Pandey J. N., *Constitutional Law of India* - Central Law Agency, 1998

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	-	-	-	3	2	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	3	-	3	-	-	-	-	-	-	-	-
Average	1	-	-	-	-	3	2	-	-	-	-	-	-	-	-	-
Level of correlation of the course	2	-	-	-	-	3	-	3	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT40205) RELIABILITY AND SAFETY ENGINEERING

(Open Elective-1)

(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Differential Equations and Multi-Variable Calculus, and Transformation Techniques and Linear Algebra.

COURSE DESCRIPTION: Fundamentals of reliability engineering; Network modeling and reliability evaluation; Markov chain and Markov processes; basics of safety concepts and safety techniques and applications.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Develop mathematical model of a network to evaluate the parameters for assessing the reliability of a system.

CO2. Analyze the time dependent/independent characteristics of a repairable system and frequency durations techniques to assess reliability.

CO3. Understand various safety management, policy, and planning strategies for personal and industrial safety.

CO4. Understand various safety and hazard identification techniques and follow appropriate safety measures in industry and society.

DETAILED SYLLABUS:

UNIT-I: FUNDAMENTALS OF RELIABILITY ENGINEERING (9 Periods)

Random variables, probability concepts, rules for probabilities of events. Probability density and distribution functions.Binomial distribution - Expected value and standard deviation for binomial distribution. Reliability functions, f(t), F(t), h(t) - Relationship between these functions, Exponential density and distribution functions, expected value and standard deviation of exponential distribution. Measures of reliability - MTTF, MTTR, MTBF.Bathtub curve.

UNIT-II: NETWORK MODELING AND RELIABILITY EVALUATION (9 Periods)

Basic concepts - Evaluation of network reliability/unreliability, series systems, parallel systems, series - Parallel configuration systems.Redundant systems and its types. Evaluation of network Reliability / Unreliability using conditional probability method, tie-set and cut-set based approach, complete event tree and reduced event tree methods.

UNIT-III: MARKOV CHAIN AND MARKOV PROCESSES (9 Periods)

Basic concepts, stochastic transitional Probability matrix, time dependent probability evaluation, Limiting State Probability evaluation, Absorbing states. Modelling concepts – State space diagrams, time dependent reliability evaluation of single component repairable model, two component repairable model.Frequency and duration techniques.

UNIT IV: BASICS OF SAFETY CONCEPTS (9 Periods)

Introduction, goals, need for safety, history of safety movement - evolution of modern safety concept, general concepts of safety management. Planning for safety-productivity, quality and safety, line and staff functions, budgeting for safety, safety policy.

UNIT V: SAFETY TECHNIQUES AND APPLICATIONS (9 Periods)

Introduction to safety techniques, Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, safety sampling, evaluation of performance of supervisors on safety. Hazard identification techniques, components of safety audit, types of audit, audit methodology, process of safety reporting. Applications of industrial Safety, environmental safety, health safety, electrical safety, fire safety.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Roy Billintonand Ronald N Allen, *Reliability Evaluation of Engineering Systems*, 2nd edition, Springer, New York, 2013.
2. Frank R. Spellman, Nancy E. Whiting, *Safety Engineering: Principles and Practices*, 3rd edition, Rowman & Littlefield, 2018.

REFERENCE BOOKS:

1. Charles E. Ebeling, *An introduction to reliability and maintainability engineering*,2nd edition Tata McGraw-Hill Education, 2010.
2. Dan Petersen, *Techniques of Safety Management: A Systems Approach*, 4th edition American society of safety engineers, 2003.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/105/108/105108128/
2. https://nptel.ac.in/courses/110/105/110105094/
3. https://www.youtube.com/watch?v=uutg8jKrL9w
4. https://www.youtube.com/watch?v=_c-iZ2BAXPw
5. https://www.youtube.com/watch?v=GeMCF3s5EDk
6. https://www.youtube.com/watch?v=xYWyype7cxE

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	-	2	1	1	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	2	1	1	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	2	1	1	1	-	-	-	-	-	-	-	-
CO4	3	-	-	-	2	1	1	1	-	-	-	-	-	-	-	-
Average	3	2.5	1	-	2	1	1	1	-	-	-	-	-	-	-	-
Level of correlation of the course	3	3	1	-	2	1	1	1	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT50107) ENVIRONMENTAL POLLUTION AND CONTROL

((Open Elective-1)

(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PREREQUISITES: -

COURSE DESCRIPTION: Fundamentals of air pollution; Dispersion of pollutants; Effects and control of air pollution; Water pollution; Soil pollution and control; Municipal solid waste management.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1: Analyze air and noise pollution using appropriate tools and techniques to solve complex environmental issues following relevant standards considering society, environment and sustainability besides communicating effectively in graphical form.

CO2: Analyze air and noise pollution control measures using appropriate tools and techniques to solve complex environmental issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO3: Analyze water pollution and its control measures using appropriate tools and techniques to solve complex environmental issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO4: Analyze soil pollution and its control measures using appropriate tools and techniques to solve complex environmental issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO5: Analyze solid waste and its management measures using appropriate tools and techniques to solve solid waste disposal issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT – I: AIR AND NOISE POLLUTION (08 Periods)

Air Pollution: Scope, Significance, Classification, Sources – Line, Area, Stationary, Mobile; Effects of air pollutants on man, material and vegetation; Global effects of air pollution; Air pollution meteorology - Lapse rate, Inversion, Plume pattern; Dispersion of air pollutants - Dispersion models and applications; Ambient air quality standards.

Noise Pollution: Sound pressure, Power and intensity, Impacts of noise, permissible limits of noise pollution, measurement of noise, Noise standards.

UNIT – II: AIR AND NOISE POLLUTION CONTROL (10 Periods)

Self cleansing properties of the environment,Dilution method, Control at source, Process changes and equipment modifications, Control of particulates – Types of equipment, Design and operation - Settling chambers, Centrifugal separators, Bag house filters, Wet scrubbers, Electrostatic precipitators; Control of gaseous pollutants – Adsorption, Absorption, Condensation, Combustion; Control of air pollution from automobiles, Control of noise pollution, Case studies, Latest developments in the air and noise pollution control.

UNIT – III: WATER POLLUTION AND CONTROL (10 Periods)

Water pollution – Sources, Causes, Effects; Surface and groundwater quality – Physical, Chemical, Biological; Drinking water quality standards, Water purification – Processes,

Engineered systems – Aeration, Solids separation, Settling operations, Coagulation, Softening, Filtration, Disinfection; Wastewater – Sources, Causes, Effects, Treatment process and disposal – Primary, Secondary, Tertiary; Case studies, Latest developments in the water pollution control.

UNIT – IV: SOIL POLLUTION AND CONTROL (08 Periods)

Soil pollutants, Sources of soil pollution, Causes, Effects and control of soil pollution, Diseases caused by soil pollution, Methods to minimize soil pollution, Effective measures to control soil pollution, Soil quality standards, Case studies, Latest developments in the soil pollution control.

UNIT – V: MUNICIPAL SOLID WASTE MANAGEMENT (09 Periods)

Municipal solid waste – Types, Composition and characteristics; Methods of collection and transportation; Methods of disposal – Open dumping, Sanitary landfill, Composting and Incineration; Utilization - 6R Concept, Recovery and recycling and Energy Recovery; Latest developments in solid waste management

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Peavy, H. S, Rowe, D. R., and Tchobanoglous, G., *Environmental Engineering*, McGraw Hill Inc., 1985.
2. C. S. Rao, *Environmental Pollution Control Engineering*, New Age International Pvt. Ltd., 2nd Edition, 2007.
3. Ibrahim A. Mirsa, *Soil Pollution: Origin, Monitoring & Remediation*, Springer, UK, 2nd Edition, 2008.

REFERENCE BOOKS:

1. M. N. Rao and H. V. N. Rao, *Air Pollution,* Tata McGraw–Hill Education Pvt. Ltd., 19th Edition, 2010.
2. Daniel Vallero, *Fundamentals of Air Pollution,* Academic Press (Elsevier), 5th Edition, 2014.
3. S. M. Khopkar, *Environmental Pollution Monitoring and Control,* New Age International Pvt. Ltd., 2nd Edition, 2007.
4. V. M. Domkundwar, *Environmental Engineering*, Dhanpat Rai & Co. Pvt. Ltd., New Delhi, 2014.

ADDITIONAL LEARNING RESOURCES:

1. *National Ambient Air Quality Standards*, Central Pollution Control Board, New Delhi
2. *Specifications for Drinking Water Standards*, IS10500:2012
3. *Solid Waste Management Rules*, 2016

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	2	2	2	3	2	-	1	-	-	-	-	-	-
CO2	3	3	-	2	2	2	2	1	-	1	-	1	-	-	-	-
CO3	3	3	-	2	2	2	2	1	-	1	-	1	-	-	-	-
CO4	3	3	-	2	2	2	2	2	-	1	-	1	-	-	-	-
CO5	3	3	-	2	2	2	2	1	-	1	2	1	-	-	-	-
Average	3	3	-	2	2	2	2.2	1.4	-	1	2	1	-	-	-	-
Level of correlation of the course	3	3	-	2	2	2	2	2	-	1	2	1	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT50108) PLANNING FOR SUSTAINABLE DEVELOPMENT

((Open Elective-1)

(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PREREQUISITES: -

COURSE DESCRIPTION: Sustainable development; Environmental impact; Sustainable Policies; Governance; Theories and strategies; Media and education for sustainability.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1: Compare sustainable development theories in national and global context to protect the society and environment.

CO2: Analyze the unforeseen environmental impacts on sustainable development to protect the society and environment.

CO3: Analyze policies and governance for sustainable development considering ethics, economics, society and environment.

CO4: Analyze systems and strategies for sustainable development using appropriate tools and techniques considering ethics, economics, society and environment.

CO5: Analyze the role of media and education in sustainable development using appropriate tools and techniques considering ethics, society and environment besides communicating effectively.

DETAILED SYLLABUS:

UNIT– I: SUSTAINABLE DEVELOPMENT (09 Periods)

Definition and concepts of sustainable development, Capitalization of sustainability-National and global context; Sustainable development goals, Emergence and evolution of sustainability and sustainable development, Theories of sustainability, Case studies.

UNIT –II: ENVIRONMENTAL IMPACT (09 Periods)

Climate change – Science, Knowledge and sustainability; Unforeseen environmental impacts on development, Challenges of sustainable development, Centrality of resources in sustainable development, Case studies.

UNIT– III: SUSTAINABLE POLICIES AND GOVERNANCE (09 Periods)

Governance - Democracy and Eco–welfare; Global civil society and wo rld civil politics, Civic environmentalism, Policy responses to sustainable development, Economics of sustainability, Social responsibility in sustainability, National action, ISO 14001: Environmental management system.

UNIT– IV: SUSTAINABLE SYSTEMS AND STRATAGIES (09 Periods)

Need for system innovation, Transition and co–evolution, Theories and methods for sustainable development, Strategies for eco–innovation, Ecological foot print analysis, Socio ecological indicators – Eco labels; Policy programmes for system innovation, Case studies.

UNIT –V: MEDIA AND EDUCATION FOR SUSTAINABILITY (09 Periods)

Role of emerging media, Remarkable design and communication art, Activism and the public interest, Education for sustainability, Participation in decision making, Critical thinking and reflection, Case studies.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. John Blewitt, *Understanding Sustainable Development*, Earth Scan Publications Ltd., 2nd Edition, 2008.
2. Jennifer A. Elliot, *An Introduction to Sustainable Development*, Earth Scan Publications Ltd., 4th Edition, 2006.

REFERENCE BOOKS:

1. Peter Rogers, Kazi F Jalal and John A Boyd, *An Introduction to Sustainable Development*, Earth Scan Publications Ltd., 2006.
2. Simon Dresner, *The Principles of Sustainability*, Earth Scan Publications Ltd., 2nd Edition, 2008.
3. Peter Bartelmus, *Environment Growth and Development: The Concepts and Strategies of Sustainability*, Routledge, 3rd Edition, 2003.
4. Gabriel Moser, Enric Pol, Yvonne Bernard, MiriliaBonnes, Jose Antonio Corraliza and Maria Vittoria Giuliani, *People Places and Sustainability*, Hogrefe& Huber Publishers, 2nd Edition, 2003.

ADDITIONAL LEARNING RESOURCES:

1. Anil Markandya, *Climate Change and Sustainable Development: Prospects for Developing Countries*, Routledge, 2002

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	1	2	3	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	3	3	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	2	1	1	-	-	1	-	-	-	-	-
CO4	3	3	-	-	1	2	1	1	-	-	1	-	-	-	-	-
CO5	2	2	-	-	2	2	1	1	-	2		-	-	-	-	-
Average	2.8	2.8	-	-	1.3	2.2	1.8	1	-	2	1	-	-	-	-	-
Level of correlation of the course	3	3	-	-	2	2	2	1	-	2	1	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT50109) **RURAL TECHNOLOGY**

(Open Elective-1)

(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES:-

COURSE DESCRIPTION: Technology for rural development; Nonconventional energy; Technologies for rural development; Community development; IT in rural development.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1: Compare various technologies for rural development by solving rural problems through different schemes by considering ethics, society, environment and sustainability.

CO2: Analyzenon conventional energy sources using appropriate tools and techniques to solve rural energy problems considering society, environment and sustainability besides communicating effectively in graphical form.

CO3: Select appropriate technologies in different areas of rural development to solve rural issues following latest developments considering society, environment and sustainability.

CO4: Relate water conservation, health, safety and rural employment issues for community development to solve rural problems through appropriate technologies considering ethics, society, environment and sustainability.

CO5: Analyze the impact of IT, public and private partnership on rural development to solve complex rural problems using appropriate tools and techniques considering ethics, society, environment and sustainability.

DETAILED SYLLABUS:

UNIT – I: TECHNOLOGY FOR RURAL DEVLOPMENT (09 Periods)

India - Technology and rural development, Pre and post independence period, Rural India Life, Indian farmer, Role of science and technology in rural development, Rural technology and poverty eradication, Rural business hubs, Technology in improving rural infrastructure, Various organizations related to innovation, Issues of technology transfer - CAPART, NABARD, CSIR, NIF.

UNIT – II: NON CONVENTIONAL ENERGY (09 Periods)

Definition of energy, Types of alternative sources of energy, Sources of non conventional energy – Solar energy: Solar pump in agriculture, Solar dryer, Solar cooker, Solar heater; Biogas, Recycling and management, Wastes conservation, Assessment and production of biomass products and their utilization.

UNIT – III: TECHNOLOGIES FOR RURAL DEVELOPMENT (09 Periods)

Food and agro based technologies, Tissue culture, Nursery, Building and construction technologies, Cultivation and processing of economic plants, Cottage and social industries, Latest developments in rural technologies.

UNIT – IV: COMMUNITY DEVELOPMENT (09 Periods)

Water conservation, Rain water Harvesting, Drinking water Standards and simple treatments used, Environment and Sanitation, Bio fertilizers, Medical and aromatic plants, Employment generating technologies–Apiculture, Pisciculture, Aquaculture.

UNIT – V: IT IN RURAL DEVELOPMENT (09 Periods)

Role of information technology (IT) in rural areas, Impact of IT in rural development, Need and necessity of technology, Corporate social responsibilities, Private sector

participation (Activities in different spheres: Employment, Education, Health, Agriculture and service sectors) and Saansad Adarsh Gram Yojana (SAGY), Village adoption schemes.

Total Periods: *45*

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. M. S. Virdi, *Sustainable Rural Technologies*, Daya Publishing House, 2nd Edition 2018.
2. S. V. Prabhath and P. Ch. Sita Devi, *Technology and Rural India*, Serials Publications, 1st Edition, 2012.

REFERENCE BOOKS:

1. R. Chakravarthy and P. R. S. Murthy, *Information Technology and Rural Development*, Pacific Book International, 1st Edition, 2012.
2. Shivakanth Singh, *Rural Development Policies and Programmes*, Northern Book Centre, 1st Edition, 2002.
3. Katar Singh and Anil Shishodia*, Rural Development: Principles, Policies, and Management,* SAGE Publications India Private Limited, 4th Edition, 2016.
4. A. Vinayak Reddy, M. YadagiraCharyulu, *Rural Development in India: Policies & Initiatives,* New Century Publications, 1st Edition, 2008.

ADDITIONAL LEARNING RESOURCES:

1. L. M. Prasad, *Principles and Practice of Management*, S. Chand & Sons, 9th Edition, 2019.
2. Venkata Reddy, K., *Agriculture and Rural Development - Gandhian Perspective*, Himalaya Publishing House, 1st Edition, 2017.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	-	3	2	1	1	1	-	-	-	-	-	-	-	-
CO2	2	3	-	2	2	1	1	-	-	1	-	-	-	-	-	-
CO3	2	3	-	2	2	1	1	-	-	-	-	1	-	-	-	-
CO4	2	3	-	2	2	1	2	1	-	-	-	-	-	-	-	-
CO5	2	3	-	3	2	1	1	1	-	-	-	-	-	-	-	-
Average	2	3	-	2.4	2	1	1.2	1	-	1	-	1	-	-	-	-
Level of correlation of the course	2	3	-	3	2	1	1	1	-	1	-	1	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT50505) ETHICAL HACKING

(Open Elective-1)

(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PREREQUISITES: --

COURSE DESCRIPTION: Ethical hacking, Network and computer attacks, Footprinting, Social engineering, Port scanning, System hacking, Sniffers, Denial of service, Hacking web servers, Wireless hacking, Cryptography, Network Protection System.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on the computer security, social engineering and the intent of ethical hacking.
CO2. Select and apply footprinting and port scanning tools to discover vulnerabilities of the computer system.
CO3. Investigate hacking techniques and tools to maintain computer security.
CO4. Analyze cryptosystems and network protection systems for information security and intrusion prevention.

DETAILED SYLLABUS:

UNIT I -ETHICAL HACKING, NETWORK AND COMPUTER ATTACKS (9 Periods)

Introduction to Ethical Hacking: The role of security and penetration testers, Penetration-Testing methodologies, What you can and cannot do legally.

Network and Computer Attacks: Malicious software, Trojans, Backdoors, Viruses, and Worms, Protection against malware attacks, Intruder attacks on networks and computers, Addressing physical security.

UNIT – II: TCP/IP CONCEPTS AND SOCIAL ENGINEERING (9 Periods)

TCP/IP Concepts: Overview of TCP/IP – Application layer, Transport layer, Internet layer; IP addressing – Planning IP address assignments, IPv6 addressing.

Social Engineering: What is social engineering, What are the common types of attacks, Understand insider attacks, Understand identity theft, Describe phishing attacks, Understand online scams, Understand URL obfuscation, Social engineering countermeasures.

UNIT-III: FOOTPRINTING ANDPORT SCANNING (9 Periods)

Footprinting: Using web tools for footprinting, Conducting competitive intelligence, Using domain name system zone transfers.

Port Scanning: Port scanning, Using port scanning tools, Conducting ping sweeps, Understanding scripting.

UNIT-IV: SYSTEM HACKING (9 Periods)

System hacking -Password cracking techniques, Types of passwords, Key loggers and other spyware technologies, Escalating privileges, Root kits, How to hide files, Steganography technologies, How to cover your tracks and evidences; Sniffers - Protocols susceptible to sniffing, Active and passive sniffing, ARP poisoning, Ethereal capture and display filters, MAC flooding, DNS spoofing techniques, Sniffing countermeasures; Denial of Service - Types of DoS attacks, How DDoS attacks work, How BOTs/BOTNETs work, Smurf attack, SYN flooding, DoS/DDoS counter measures; Session hijacking - Spoofing vs. hijacking, Types of session hijacking, Sequence prediction, Steps in performing session hijacking, Preventing session hijacking.

UNIT-V: CRYPTOGRAPHY, NETWORK PROTECTION SYSTEMS (9 Periods)

Cryptography: Understanding Cryptography basics, Symmetric and asymmetric algorithms, Public key infrastructure, Cryptography attacks.

Network Protection Systems: Understanding routers, Firewalls, Honeypots.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Michael T. Simpson, Kent Backman, James E. Corley, *Hands-On Ethical Hacking and Network Defense*, 3rdEdition, Cengage Learning, 2017.
2. Kimberly Graves, *CEH: Official Certified Ethical Hacker Review Guide*, Wiley, 2007.

REFERENCE BOOK:

1. Michael Gregg, *Certified Ethical Hacker (CEH) Cert guide*,3rdEdition, Pearson, 2019.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	3	-	3	-	-	-	-	-	3	-	-
CO2	3	-	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	-	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
Average	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
Level of correlation of the course	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT51207) **AI IN HEALTHCARE**

(Open Elective-1)

(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PREREQUISITES: --

COURSE DESCRIPTION: Concepts of Artificial Intelligence (AI) in Healthcare; The Present State and Future of AI in Healthcare Specialties; The Role of Major Corporations in AI in Healthcare; Applications of AI in Healthcare.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Understand the fundamental concepts of AI in Healthcare sector.
CO2. Understand the applications of AI in Healthcare specialties.
CO3. Demonstrate AI applications developed by corporate companies.
CO4. Demonstrate knowledge on future applications of Healthcare using AI.
CO5. Understand the principles of AI applications through case studies.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO ARTIFICIAL INTELLIGENCE IN HEALTHCARE (8 Periods)

Introduction to AI in Healthcare, Benefits and Risks, AI in the health sector, AI versus Human Intelligence, The future of AI in health sector, AI and Neural networks.

UNIT-II: THE PRESENT STATE AND FUTURE OF AI IN HEALTHCARE SPECIALTIES (10 Periods)

Artificial Intelligence in: preventive healthcare, Radiology, Pathology, Surgery, Anesthesiology, Psychiatry, Cardiology, Pharmacy, Dermatology, Dentistry, Orthopedics, Ophthalmology.

UNIT-III: ROLE OF MAJOR CORPORATIONS IN AI IN HEALTHCARE (8 Periods)

IBM Watson, The role of Google and Deep mind in AI in Healthcare, Baidu, Facebook and AI in Healthcare, Microsoft and AI in Healthcare.

UNIT-IV: FUTURE OF HEALTHCARE IN AI (10 Periods)

Evidence-based medicine, personalized medicine, Connected medicine, Disease and Condition Management , Virtual Assistants, Remote Monitoring, Medication Adherence, Accessible Diagnostic Tests, Smart Implantables, Digital Health and Therapeutics, Education, Incentivized Wellness. Artificial Intelligence, Block chain, Robots, Robot-Assisted Surgery, Exoskeletons, Inpatient Care, Companions, Drones, Smart Places, Smart Homes, Smart Hospitals, Reductionism, Innovation vs. Deliberation.

UNIT- V: APPLICATIONS OF AI IN HEALTHCARE (9 Periods)

Case Study 1: AI for Imaging of Diabetic Foot Concerns and Prioritization of Referral for Improvements in Morbidity and Mortality.

Case Study 2: Outcomes of a Digitally Delivered, Low-Carbohydrate, Type 2 Diabetes Self-Management.

Case Study 3: Delivering a Scalable and Engaging Digital Therapy.

Case Study 4: Improving Learning Outcomes for Junior Doctors through the Novel Use of Augmented and Virtual Reality for Epilepsy

Case Study 5: Big Data, Big Impact, Big Ethics-Diagnosing Disease Risk from Patient Data.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Dr. Parag Mahajan, *Artificial Intelligence in Healthcare,* MedManthra Publications, 1st Edition 2019.
2. *Arjun Panesar, Machine Learning and AI for Healthcare Big Data for Improved Health*, Apress Publications, 2019.

REFERENCE BOOKS:

1. Michael Matheny, SonooThadaneyIsrani, Mahnoor Ahmed, and Danielle Whicher, *Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril*, National Academy of Medicine Publication, 1st Edition, 2019.

ADDITIONAL LEARNING RESOURCES:

1. https://www.udacity.com/course/ai-for-healthcare-nanodegree--nd320 (AI for Healthcare).
2. https://builtin.com/artificial-intelligence/artificial-intelligence-healthcare (Surgical robots, new medicines and better care: 32 examples of AI in healthcare).
3. https://healthtechmagazine.net/article/2020/02/future-artificial-intelligence-healthcare (Future of Artificial Intelligence in Healthcare).

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	3	-	2	-	2	2	-	-	-	-	-	-	-	-	2
CO3	2	-	2	2	-	-	-	-	-	-	-	-	-	-	-	2
CO4	2	-	-	-	2	2	-	-	-	-	-	-	-	-	-	2
CO5	2	-	-	-	2	2	-	-	-	-	-	-	-	-	-	2
Average	2	2	2	2	2	2	2	-	-	-	-	-	-	-	-	2
Level of correlation of the course	2	2	2	2	2	2	2	-	-	-	-	-	-	-	-	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT51506) **BIOINFORMATICS**

(Open Elective-1)

(Common to CE, ME, CSE, CSSE, and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Biology for Engineers.

COURSE DESCRIPTION: Biological Data Acquisition, Databases, Data Processing, Methods of Analysis, Applications of Bio-informatics

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Understand basic biological data acquisition in bioinformatics.
CO2. Identify the proper databases for the information search by choosing the biological databases and also submission and retrieval of data from databases.
CO3. Analyze the results of bioinformatics data using text and sequence-based searching techniques.
CO4. Analyze the secondary and tertiary structures of proteins by applying different alignment programs
CO5**.** Design biological databases and novel drugs by using contextual knowledge on bioinformatics.

DETAILED SYLLABUS:

UNIT-I: BIOLOGICAL DATA ACQUISITION (9 Periods)

Biological information, Retrieval methods for DNA sequence, protein sequence and protein structure information

UNIT-II: DATABASES (9 Periods)

Format and Annotation: Conventions for database indexing and specification of search terms, Common sequence file formats. Annotated sequence databases - primary and secondary sequence databases, protein sequence and structure databases.

UNIT-III: DATA PROCESSING (9 Periods)

Data – Access, Retrieval and Submission: Standard search engines; Data retrieval tools – Entrez, DBGET and SRS; Submission of (new and revised) data; Sequence Similarity Searches: Local and global. Distance metrics. Similarity and homology. Scoring matrices, PAM and BLOSUM

UNIT-IV: METHODS OF ANALYSIS (9 Periods)

Dynamic programming algorithms, Needleman-Wunsch and Smith-waterman.Heuristic Methods of sequence alignment, FASTA and BLAST; Multiple Sequence Alignment and software tools for pair wise and multiple sequence alignment, CLUSTAL program, Prediction of Tertiary structure of proteins.

UNIT-V: APPLICATIONS (9 Periods)

Genome Annotation and Gene Prediction; ORF finding; Phylogenetic Analysis, Genomics, Proteomics, Genome analysis – Genome annotation, DNA Microarray, computer aided drug design (CADD).

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Lesk, A. K., *Introduction to Bioinformatics*, Oxford University Press, 4th Edition, 2013
2. Dan Gusfield, *Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology*, Cambridge University Press, 1997.

REFERENCE BOOKS:

1. Baldi, P. and Brunak, S., *Bioinformatics: The Machine Learning Approach*, 2nd Edition, MIT Press, 2001
2. Mount, D.W., *Bioinformatics Sequence and Genome Analysis*, 2nd Edition, Cold Spring Harbor Laboratory Press, 2004
3. Tindall, J., *Beginning Perl for Bioinformatics: An introduction to Perl for Biologists*, 1st Edition, O'Reilly Media, 2001

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	3	2	-	3	-	-	-	-	-	-	-	2	-	-	-
CO4	3	3	2	-	3	-	-	-	-	-	-	-	2	-	-	-
CO5	3	2	3	2	2	-	-	-	-	-	-	-	2	-	-	-
Average	3	2.5	2.3	2	2.6	-	-	-	-	-	-	-	2	-	-	-
Level of correlation of the course	3	3	3	2	3	-	-	-	-	-	-	-	2	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – II Semester

(19BT6HS02) Organizational Behavior

(Common to CE, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE REQUISITE:-

COURSE DESCRIPTION: Introduction to organizational Behavior; Individual behavior and Personality; Interpersonal and group behavior; Leadership; Organizational change and development

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Equip with basic idea on concepts and skills of organizational behavior.
CO2. Demonstrate the applicability of the concept of organizational behavior to understand thebehavior of people in the organization.
CO3. Analyze the complexities associated with management of the individual, group behavior in the organization.
CO4. Develop leadership qualities.
CO5. Improve individual behavior, skill and life-long learning in a group.

DETAILED SYLLABUS:

UNIT – I: INTRODUCTION TO ORGANIZATIONAL BEHAVIOR (9 periods)

Meaning and Definition, Nature, Scope, Features, Significance of Organizational Behavior, Levels and Contributing disciples to OB, Emerging Issues and Challenges of OB

UNIT – II: INDIVIDUAL BEHAVIOR AND PERSONALITY (9 periods)

Individual: Introduction – Role of Brain and Mind in Individual Behavior – Similarities and Dissimilarities in Individuals – Reasons for individual differences – Nature of Man – Models of man – Values, Attitudes, emotions, Moods and Job satisfaction.

Personality: Introduction– Personality Traits – Determinants of Personality – Personality Theories**.**

UNIT – III: INTERPERSONAL AND GROUP BEHAVIOR (9 periods)

Introduction To Interpersonal: Process of perception – Inter personal perception; **Group Behavior**: Meaning and Definition of a Group – Classification of Groups – Stages of Group development.

UNIT – IV: LEADERSHIP (9 periods)

Meaning and Definition of Leadership – Leadership Theories: Behavioral Theories and Modern theories – Leadership Styles – New directions for leadership

UNIT – V: ORGANIZATIONAL CHANGE AND DEVELOPMENT (9 periods)

Meaning – Nature of work change – Pressure for change – Change Process – Types of change – Factors influencing change – Organizational development process – Organizational Development interventions/Techniques.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Stephen P. Robbins, Timothy A. Judge and Neharika Vohra, *Organizational Behavior*, Pearson, Noida, 16th Edition, 2017.
2. P.Subba Rao, *Management and Organizational behavior*, Himalaya Publishing House, Mumbai, Re-print 2019.

REFERENCE BOOKS:

1. Fred Luthans, *Organizational behavior*, McGraw Hill Higher Education, 10th Edition, 2016.
2. Shashi K. Gupta and Rosy Joshi, *Organizational Behavior*, Kalyani Publications,8th Edition, 2017.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	2	-	-	1	-	-	-	-
CO3	-	-	-	1	-	-	-	-	3	-	-	2	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CO5	-	1	-	-	-	-	-	-	3	-	-	2	-	-	-	-
Average	2.6	1.6	-	1	-	-	-	-	2.5	-	-	1.75	-	-	-	-
Level of correlation of the course	3	2	-	1	-	-	-	-	3	-	-	2	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – II Semester

(19BT60501) COMPILER DESIGN

(Common to CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Theory of Computation.

COURSE DESCRIPTION: Phases of compilers, Lexical analysis, Syntax analysis, Parsers, Syntax directed translation, Type checking, Intermediate code generation, Runtime environments, Code optimization, Code generation.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on structure of compiler and programming language basics.
CO2. Develop lexical analyzers for specification of tokens.
CO3. Design parsers for performing syntax analysis.
CO4. Use syntax directed translations and type expressions to construct semantic trees.
CO5. Analyze program code and runtime environment for code optimization and generation.

DETAILED SYLLABUS:

UNIT–I: INTRODUCTION TO COMPILERS AND LEXICAL ANALYSIS **(8 periods)**

Introduction to Compilers: Language Processors, Structure of a compiler, Programming language basics - Static scope and block structure, Dynamic scope.
Lexical Analysis: The role of the lexical analyzer,Input buffering, Specification of tokens, Structure of LEX program.

UNIT–II: SYNTAX ANALYSIS **(11 periods)**

Role of the parser, Context free grammar - Derivations, Parse trees, Ambiguity; Eliminating ambiguity from dangling-else grammar, Elimination of left recursion, Left factoring, Top-down parsing – Recursive descent parsing, LL(1) grammars, Non recursive predictive parsing; Bottom-up parsing - Definition of bottom up parsing, Handles, Handle pruning, Shift reduce parsing; LR parsers – Simple LR parser, Canonical LR(1) parser, LALR parser; Using ambiguous grammars, YACC-automatic parser generator.

UNIT–III: SYNTAX DIRECTED TRANSLATION AND TYPE CHECKING (7 periods)

Syntax Directed Translation: Syntax directed definitions, Construction of syntax trees, S-attributed and L-attributed definitions, Translation schemes.
Type Checking: Type expressions, Type systems, Static and dynamic checking of types, Type equivalence, Rules for type checking, Type conversions, Overloading of functions and operators, control flow.

UNIT–IV: INTERMEDIATE CODE GENERATION AND RUN TIME ENVIRONMENT **(10 periods)**

Intermediate Code Generation: Intermediate forms of source programs - abstract syntax tree, polish notation; Three-address code, Intermediate code for procedures, Syntax directed translation into three-address code, Translation of simple statements, Boolean expressions and flow-of-control statements.
Run Time Environment: Source language issues, Storage organization, Stack allocation of space, Access to nonlocal data on the stack, Parameter passing, Symbol tables.

UNIT–V: CODE OPTIMIZATION AND GENERATION **(9 periods)**

Code Optimization: Organization of code optimizer, Basic blocks and flow graphs, Optimization of basic blocks, The principal sources of optimization.

Code Generation: Issues in the design of a code generator, Machine dependent code generation, Object code forms, The target language, Simple code generator, Register allocation and assignment, Peephole optimization.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D. Ullman, *Compilers: Principles, Techniques and Tools*, Pearson, 2nd Edition, 2012.

REFERENCE BOOKS:

1. Y.N. Srikant, Priti Shankar, T*he Compiler Design Handbook: Optimizations and Machine Code Generation*, CRC Press, 2nd Edition, 2007.
2. Grune D, Van Reeuwijk K, Bal H.E, Jacobs C.J.H, Langendoen K, *Modern Compiler Design,* Springer, 2nd Edition, 2012.
3. David Galles, *Modern Compiler Design,* Pearson, 2007.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	3	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO3	2	3	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Average	**2.6**	**3**	**3**	**3**	**1**	-	-	-	-	-	-	-	-	-	2	-
Level of correlation of the course	**3**	**3**	**3**	**3**	**1**	-	-	-	-	-	-	-	-	-	2	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – II Semester
(19BT61201) CLOUD COMPUTING
(IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses onObject Oriented Programming through Java, Computer Networks and Operating Systems.

COURSE DESCRIPTION: Fundamental Cloud Computing and Virtualization; Understanding Cloud Models and Architectures; Understanding Cloud Services, Applications and Capacity Planning; Exploring Platform as a Service (PaaS); Exploring Infrastructure as a Service (IaaS).

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to*:**

CO1. Demonstrate knowledge on basic concepts and terminologies of Cloud Computing and Virtualization.
CO2. Select appropriate Cloud deployment models, Service models and Architectures in Cloud Application development.
CO3. Analyze Cloud services, Applications and Capacity Planning.
CO4. Apply different PaaS application frameworks to construct Cloud applications.
CO5. Develop web applications through Google, Microsoft and Amazon web services as per societal needs.

DETAILED SYLLABUS:

UNIT I–FUNDAMENTAL CLOUD COMPUTING AND VIRTUALIZATION (10 periods)
Cloud Computing: Origin and influences, Basic concepts and terminology, Goals and benefits, Risks and challenges, Roles and boundaries and Cloud characteristics.
Introduction to Virtualization: Characteristics, Taxonomy of virtualization technologies, Pros and cons of virtualization, Virtualization Technologies:Xen**,** VMware and Hyper-V.

UNIT II– UNDERSTANDINGCLOUD MODELS AND ARCHITECTURES (8 periods)
Cloud Models: NIST model, Cloud Cube model, Deployment models: Public, Private, Hybrid and Community; Service models: IaaS, PaaS and SaaS.
Understanding Cloud Architecture: Exploring the Cloud Computing Stack: Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications; Connecting to the Cloud: The Jolicloud Netbook OS and Chromium OS - The Browser as an Operating System.

UNIT III – UNDERSTANDING CLOUD SERVICES, APPLICATIONS AND CAPACITY PLANNING (9 periods)
Understanding Cloud Services and Applications Infrastructure as a Service (IaaS): IaaS workloads, Pods, aggregation, and silos; Platform as a Service (PaaS), Software as a Service (SaaS): SaaS characteristics, Open SaaS and SOA, Salesforce.com and CRM SaaS; Identity as a Service (IDaaS): Identity, Networked identity service classes, Identity system codes of conduct, IDaaS interoperability; Compliance as a Service (CaaS).
CapacityPlanning: Defining Baseline and Metrics: Baseline measurements, System metrics, Load Testing, Resource ceilings, Server and instance types; Network Capacity and Scaling.

UNIT IV – EXPLORING PLATFORM AS A SERVICE (PaaS) (10 periods)
PaaS Application Frameworks: Drupal, EccentexAppBase 3.0, LongJump, Squarespace, WaveMaker and Wolf Frameworks.

Exploring Platform as a Service using Google Web Services: Surveying the Google Application Portfolio, Google Toolkit and Working with the Google App Engine.
Exploring Platform as a Service using Microsoft Cloud Services: Exploring Microsoft Cloud Services, Microsoft Azure- Live Essentials, Live Home and Live for Mobile.

UNIT V – EXPLORING INFRASTRUCTURE AS A SERVICE (IaaS) (8 periods)
Understanding Amazon Web Services, Amazon Web Service Components and Services, Working with the Elastic Compute Cloud (EC2): Amazon Machine Images, Pricing models, System images and software, Creating an account and instance on EC2; Working with Amazon Storage Systems: Amazon Simple Storage System (S3), Amazon Elastic Block Store (EBS) and CloudFront; Understanding Amazon Database Services: Amazon SimpleDB, Amazon Relational Database Service (RDS) and Choosing a database for AWS.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:
1. Barrie Sosinsky, *Cloud Computing Bible,* Wiley India Pvt Ltd, 2011 (Reprint 2017).
2. Thomas Erl and RicardoPuttini, *Cloud Computing- Concepts, Technology and Architecture,* Pearson, 2014 (Seventh Impression 2017).

REFERENCE BOOKS:
1. Rajkumar Buyya, Christian Vecchiloa and S ThamaraiSelvi, *Mastering Cloud Computing*, McGraw Hill Education, 2013 (Reprint 2017).
2. George Reese, *Cloud Application and Architectures*, O'Relly, 2009 (Reprint 2017).

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	1	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	1	3	-
CO3	2	3	3	2	-	-	-	-	-	-	-	-	-	1	3	-
CO4	1	2	3	-	3	-	-	1	-	-	-	-	-	1	3	-
CO5	1	2	3	-		1	1	-	-	-	-	-	-	1	3	-
Average	2	2.33	3	2	3	1	1	1	-	-	-	-	-	1	3	-
Level of correlation of the course	2	3	3	2	3	1	1	1	-	-	-	-	-	1	3	-

Correlation Level: 3- High 2-Medium 1- Low

III B. Tech. – II Semester

(19BT50501) ADVANCED COMPUTER ARCHITECTURE

(IT)

(Professional Elective - 2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Computer Organization.

COURSE DESCRIPTION: Parallel computer models and network properties, Principles of scalable performance, Linear and nonlinear pipelining, Multiprocessors and multicomputers, Multi-vector and SIMD computers, Instruction level parallelism, Parallel languages and compilers, Parallel programming tools and environments.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Apply the knowledge of parallelism and principles of performance to assess the potential and limitations of parallel computing.
CO2. Design linear and nonlinear pipelines with collision free schedules to improve processor performance.
CO3. Analyze various shared memory organizations, cache synchronization and message passing mechanisms for implementing multiprocessor and multi computer systems.
CO4. Investigate the architectures of multiprocessors and SIMD array processors for developing high performance multivectorcomputers.
CO5. Use appropriate parallel programming languages, compilers and environments for parallel program development.

DETAILED SYLLABUS:

UNIT–I: THEORY OF PARALLELISM (10 periods)

Parallel Computer Models: Elements of modern computers, Evolution of computer architecture, Multiprocessors and multi-computers, Multi vector and SIMD computers.

Program and Network Properties: Conditions of parallelism, Program partitioning and scheduling, Program flow mechanisms, Network properties and routing, Static connection networks, Dynamic connection networks – Omega network, Baseline network.

UNIT–II: PRINCIPLES OF SCALABLE PERFORMANCE AND PIPELINING (8 periods)

Principles of Scalable Performance: System attributes to performance**,** Performance metrics and measures – Parallelism profile in programs, Mean performance, Efficiency, utilization and quality; Speedup performance laws – Amdahl's law, Gustafson's law.

Pipelining: Linear pipeline processors - Asynchronous and synchronous models,Clocking and timing control, Speedup, efficiency and throughput; Nonlinear pipeline processors - Reservation and latency analysis, Collision-free scheduling, Pipeline schedule optimization.

UNIT–III: MULTIPROCESSORS AND MULTICOMPUTERS (9 periods)

Shared Memory Organizations: Interleaved memory organization, Bandwidth and fault tolerance, Memory allocation schemes.

Cache Coherence and Synchronization Mechanisms: The cache coherence problem, Snoopy bus protocols, Directory-based protocols, Hardware synchronization mechanisms.

Message Passing Mechanisms: Message passing schemes, Deadlock virtual channels, Flow control strategies.

UNIT–IV: MULTIVECTOR AND SIMD COMPUTERS (8 periods)

Vector Processing Principles: Vector instruction types, Vector-access memory schemes.

Multivector Multiprocessors: Performance-directed design rules, Cray Y-MP, C-90, Fujitsu VP2000, Mainframes and Mini supercomputers.
SIMD Computer Organizations: Implementation models, CM-2 architecture, MasPar MP-1 architecture.

UNIT–V: INSTRUCTION LEVEL PARALLELISM AND PARALLEL PROGRAM DEVELOPMENT (10 periods)
Instruction Level Parallelism: Problem definition, Compiler-detected instruction level parallelism, Operand forwarding, Register renaming, Tomasulo's algorithm, Branch prediction, Limitations, Thread level parallelism.
Parallel Program Development: Parallel languages and compilers, Code optimization–Scalar optimization with basic blocks, Local and global optimizations, vectorization and parallelization methods; Software tools and environments for parallel programming.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:
1. Kai Hwang, Naresh Jotwani, *Advanced Computer Architecture*, McGraw Hill, 3rd Edition, 2015.

REFERENCE BOOKS:
1. John Hennessy, David Patterson, *Computer Architecture: A Quantitative Approach,* Morgan Kaufmann,6th Edition, 2017.
2. William Stallings, *Computer Organization and Architecture: Designing for Performance*, 11th Edition, Pearson Education, 2018.
3. John Paul Shen, Mikko H. Lipasti, Modern Processor Design: Fundamentals of Superscalar Processors, Waveland Press Inc, 2013.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	-	-	-	2	-	-	-	-	-	-	-	-	-	2	-
Average	3	2.5	3	-	2	-	-	-	-	-	-	-	-	-	2	-
Level of correlation of the course	3	3	3	-	2	-	-	-	-	-	-	-	-	-	2	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – IISemester
(19BT60505)**SOFT COMPUTING**
(Common to CSE, CSSE and IT)
(Professional Elective - 2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Numerical Methods, Probability and Statistics, Design and Analysis of Algorithms.

COURSE DESCRIPTION: Soft computing technique concepts, Supervised learning networks, Unsupervised learning networks, Genetic algorithms,Fuzzy logic, Hybrid soft computing techniques and applications.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***
CO1. Investigate soft computing techniques for solving computational problems.
CO2. Design efficient neural architectures to model patterns for a given learning problem.
CO3. Investigate and solve optimization problems using genetic algorithms.
CO4. Apply fuzzy logic and reasoning to handle uncertainty in engineering problems.
CO5. Develop intelligent solutions using hybrid soft computing techniques to solve problems of multidisciplinary domains.

DETAILED SYLLABUS:

UNIT–I: INTRODUCTIONTO SOFT COMPUTING AND SUPERVISED LEARNING NETWORKS (10 periods)

Introduction to Soft Computing: Neural networks, Application scope of neural networks, Fuzzy logic, Genetic algorithm, Hybrid systems, Soft computing.

Artificial Neural Networks: Fundamentals, Basic Models, Terminologies, Linear Separability, Hebb network.

Supervised Learning Networks: Perceptron Networks- Theory, Perceptron learning rule, Architecture, Flowchart for training process, Perceptron training algorithm for single and multiple output classes, Perceptron network testing algorithm; Back-Propagation Network - Theory, Architecture, Flow chart for training process, Training algorithm, Learning factors of back-propagation network, Testing algorithm for back-propagation network.

UNIT–II: UNSUPERVISED LEARNING NETWORKS (8 periods)

Fixed weight competitive nets – Maxnet, Mexican Hat Net, Hamming network;Kohonen self-organizing feature maps – Theory, Architecture, Flowchart, Training algorithm; Learning vector quantization – Theory, Architecture, Flowchart, Training algorithm, Variants; Counterpropagation networks – Theory, Full counterpropagation Net, Forward-only counterpropagation Net; Adaptive resonance theory network – Fundamental architecture, Fundamental operating principle, Fundamental algorithm.

UNIT–III: GENETIC ALGORITHMS (9 periods)

Genetic algorithms - Biological background, Traditional optimization and search techniques, Genetic algorithm and search space, Genetic algorithms vs. traditional algorithms, Basic terminologies in genetic algorithm, Simple GA, General genetic algorithm, Operators in genetic algorithm, Stopping condition for genetic algorithm flow, Constraints in genetic algorithm, Problem solving using genetic algorithm, Adaptive genetic algorithms, Hybrid genetic algorithms, Advantages and limitations of genetic algorithm, Applications of genetic algorithm.

UNIT–IV: FUZZY LOGIC (11 periods)

Introduction to fuzzy logic, Classical sets, Fuzzy sets, Membership function – Features, Fuzzification, Methods of membership value assignments; Fuzzy arithmetic and measures –Fuzzyarithmetic, Extension principle, Fuzzy measures, Measures of fuzziness, Fuzzy

integrals; Fuzzy rule base and approximation reasoning -Truth values and tables in fuzzy logic, Fuzzy propositions, Formation of rules, Compound rules, Aggregation of fuzzy rules, Fuzzy reasoning, Fuzzy inference systems, Overview of fuzzy expert system; Fuzzy decision making, Fuzzy logic control systems.

UNIT–V: HYBRID SOFT COMPUTING TECHNIQUES AND APPLICATIONS

(7 periods)

Hybrid Soft Computing Techniques: Genetic neuro hybrid systems, Genetic fuzzy hybrid and fuzzy genetic hybrid systems.

Applications of Soft Computing: Optimization of traveling salesman problem using genetic algorithm approach, Genetic algorithm-based internet search technique, Soft computing-based hybrid fuzzy controllers, Soft computing-based rocket engine control.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. S. N. Sivanandam and S. N. Deepa, *Principles of Soft Computing*, Wiley, 3rd Edition, 2019.

REFERENCE BOOKS:

1. S. Rajasekaran and G. A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic and Genetic Algorithms:*Synthesis and Applications, PHI Learning Private Ltd, 2011.
2. Udit Chakraborty, Samir Roy, *Soft Computing: Neuro-Fuzzy and Genetic Algorithms,* Pearson, 2013.
3. Saroj Kaushik, Sunita Tewari, *Soft Computing: Fundamentals, Techniques and Applications*, McGraw Hill, 2018.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	1	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	-	-	2	-	-	-	-	-	-	-	3	-	-
Average	3	2.5	3	1	-	-	-	-	-	-	-	-	-	3	-	-
Level of correlation of the course	3	3	3	1	-	2	-	-	-	-	-	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – II Semester

(19BT60504) FULL STACK DEVELOPMENT

(Professional Elective-2)
(Common to CSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Web Technologies.

COURSEDESCRIPTION: jQuery, Node.js –Node packages, Applications, Events, listeners, timers and callbacks, Handling data I/O, Accessing file system, Implementing HTTP services; MongoDB – Basics, MongoDB and Node.js,Manipulating MongoDB documents from Node.js, Accessing MongoDB from Node.js; Implementing Express in Node.js; Angular – Basics, Components, Data binding, Built-in directives.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on jQuery to control the behavior of different elements in web page.
CO2. Analyze Node.js syntax, NPM package management, MongoDB and Express.js syntaxes to build scalable and responsive web applications.
CO3. Develop components using templates, directives of AngularJS for designing single-page applications.
CO4. Build applications by applying Node.js, CRUD applications using MongoDB and Express.js.

DETAILED SYLLABUS:

UNIT–I: jQuery **(9 periods)**

Introduction, jQuery selectors, jQuery event methods, jQuery effects, DOM manipulation using jQuery get/set content methods, Add/remove new HTML elements, Manipulating CSS.

UNIT–II: Node.js **(11 periods)**

Understanding the web development framework, Understanding the Node.js-to-Angular stack components,Installing Node.JS, Node Package Manager (NPM), Creating Node.js application, Event model, Event queue, Callbacks, Buffer module, Stream module, Opening and closing files, Writing Files, Reading Files, Request, response and server objects, Implementing HTTP and HTTPS client-server.

UNIT–III: MongoDB **(11 periods)**

Configuring MongoDB environment, Datatypes, Administering databases, Managing collections, Connecting to MongoDB from Node.js, Objects – Db, Admin, Collection, Cursor; Accessing and manipulating collections, Manipulating MongoDB documents from Node.js, Query objects, Query options objects, Limiting and sorting result sets, Grouping result, Applying MapReduce by aggregating results.

UNIT–IV: Express in Node.JS: **(7 periods)**

Configuring and starting Express server, Configuring routes, Requests objects, Response objects, Implementing a template engine, Handling POST Body Data, Sending and Receiving Cookies, Implementing Sessions.

UNIT–V: Angular **(7 periods)**

Introduction to Angular, Creating a basic Angular application, Component configuration, Building template, Using Constructors, Using external templates, Injecting directives, Data binding, Built-in directives.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Brad Dayley, Brendan Dayley, Caleb Dayley,*Node.js, MongoDB and Angular Web Development*, Pearson, 2nd Edition,2018.
2. *HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and jQuery*, Dreamtech Press, 2ndEdition, 2016.

REFERENCE BOOKS:

1. Simon Holmes, Clive Harber, *Getting MEAN with Mongo, Express, Angular, and Node,* 2nd Edition, Manning Publishers, 2016.
2. Amos Q Haviv, Adrian Mejia, Robert Onodi, *Web Application Development with MEAN*, Packt Publishers, 2017.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	3	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO3	2	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
Average	3	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
Level of correlation of the	3	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B.Tech. - II semester

(19BT61202) INFORMATION RETRIEVAL SYSTEMS

(IT)

(Professional Elective–2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Data Structures and Database Management Systems.

COURSE DESCRIPTION: Architecture of Information Retrieval Systems; Functional Capabilities; Data Structures; Mathematical Algorithms; Indexing; Similarity and Clustering; Human Perception and Presentation; Text Search Techniques and Evaluation Measures.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze functionalities of information retrieval systems.
CO2. Apply data structures to manage data items and mathematical algorithms for information retrieval.
CO3. Create searchable index using item processing and automatic indexing techniques for information retrieval.
CO4. Apply similarity measures and clustering techniques to group similar items.
CO5. Demonstrate knowledge on information presentation.
CO6. Apply text search algorithms to search string patterns and evaluation measures to evaluate information retrieval systems.

DETAILED SYLLABUS:

UNIT I: INTRODUCTION (9 periods)

Primary information retrieval problems, Objectives of information retrieval system, Functional overview, Understanding the search functions, Relationship to DBMS, Digital libraries and data warehouses, Data structures and mathematical algorithms.

UNIT II: INGEST AND INDEXING (9 periods)

Ingest: Introduction, Item receipt, Duplicate detection, Item normalization, Zoning and creation of processing tokens, Stemming, Entity processing, Categorization, Citational metadata. **Indexing**: Manual indexing process, Automatic indexing of text and multimedia.

UNIT III: SEARCH AND CLUSTERING (12 periods)

Search: Similarity measures and ranking, Hidden-markov models, Ranking algorithms, Relevance feedback, Selective dissemination of information search, Weighted searches for boolean systems, Multimedia searching. **Clustering**: Introduction to clustering, Thesaurus generation, Item clustering, Hierarchy of clusters.

UNIT IV: INFORMATION PRESENTATION (7 periods)

Introduction, Presentation of the hits, Display of the item, Collaborative filtering, Multimedia presentation, Human perception and presentation.

UNIT V: SEARCH ARCHITECTURE AND EVALUATION (8 periods)

Search Architecture: Index search optimization, Text search optimization, GOOGLE Scalable multiprocessor architecture. **Evaluation**: Information system evaluation, Measures used in system evaluation.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Gerald Kowalski, *Information Retrieval Architecture and Algorithms*, Springer Pvt. Ltd, 2013.

REFERENCE BOOKS:

1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, *An Introduction to Information Retrieval*, Cambridge University Press, 2012.
2. Ricardo Baeza-Yates and Berthier Ribiero-Neto, *Modern Information Retrieval the Concepts and Technology behind Search*, Addison Wesley, 2nd Edition, 2010.
3. Dr. Badal Soni and Dr.Suganya Devi K, *Information Retrieval Models and Concepts*, Wiley Publication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	2	3	3	3	-	-	-	-	-	-	-	-	3	-	-	-
CO3	2	3	3		1	-	-	-	-	-	-	-	3	-	-	-
CO4	2	3	3	3	1	-	-	-	-	-	-	-	3	-	-	-
CO5	3	-	-	-	3	-	-	-	-	-	-	-	3	-	-	-
CO6	2	3	3	3	-	-	-	-	-	-	-	-	3	-	-	-
Average	2.17	3	3	3	1.67	-	-	-	-	-	-	-	3	-	-	-
Level of correlation of the course	2	3	3	3	2	-	-	-	-	-	-	-	3	-	-	-

Correlation Level: 3- High 2-Medium 1- Low

III B. Tech. – II Semester

(19BT61203) SEMANTIC WEB AND SOCIAL NETWORKS

(IT)

(Professional Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PREREQUISITE: Courses on Computer Networks and Web Technologies.

COURSE DESCRIPTION: Semantic web and social network analysis; web data & semantics in social network applications and knowledge representation; modeling, aggregating and social network data; developing social semantic applications; evaluation of web-based social network extraction and semantic- based network analysis in the science.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate Knowledge on semantic web and social networks.
CO2. Analyze Ontology tools and their role in the Semantic Web.
CO3. Apply Ontological representation for Social network applications.
CO4. Develop semantic web applications with social network features.
CO5. Apply different social network applications and knowledge representations in sciences.

DETAILED SYLLABUS:

UNIT-I: SEMANTIC WEB AND SOCIAL NETWORK ANALYSIS (8 Periods)

Introduction of Semantic Web, Limitations of the current Web, Development of semantic Web-Research, development and standardization, Technology adoption, The emergence of semantic web, network analysis, development of Social Network Analysis .Key concepts and measures in network analysis-The global structure of networks, the macro structure of social networks.

UNIT-II: SOCIAL NETWORK APPLICATIONS AND KNOWLEDGE REPRESENTATION (10 Periods)

Electronic sources for network analysis- Electronic discussion networks, Blogs and online communities , Web-based networks, Ontology and their role in the Semantic Web - Ontology-based knowledge Representation, Ontology languages for the Semantic Web- Resource Description Frame work and schema, Web Ontology Language ,comparison to the Unified modeling language, comparison to the Entity/ Relationship(E/R) model and the relational model, comparison to the Extensible Markup Language(XML) and XML schema.

UNIT-III: MODELING AND AGGREGATING SOCIAL NETWORK DATA (9 Periods)

State-of-the-art in network data representation, Ontological representation of social individuals , Ontological representation of social relationships , Aggregating and reasoning with social network data- Representing identity, On the nation of equality, Determining equality, Reasoning with instance equality ,Evaluating smushing, Advanced representations.

UNIT-IV: DEVELOPING SOCIAL SEMANTIC APPLICATIONS (9 Periods)

Building semantic Web applications with social network features- The generic architecture of semantic Web applications, Sesame, Elmo, GraphUtil. Flink- The social networks of the Semantic Web Community, The feature of Flink, system design, openacademia-distributed, semantic-based publication management- The features of openacademia, system design.

UNIT-V: EVALUATION OF WEB-BASED SOCIAL NETWORK EXTRACTION AND ANALYSIS IN THE SCIENCES (9 Periods)

Differences between survey methods and electronic data extraction, context of the empirical study, Data collection, preparing the data ,Optimizing goodness of fit ,Comparison across methods and networks, Predicting the goodness fit, Evaluation through analysis ,Methodology- Data acquisition, Representation, storage and reasoning, Visualization and analysis. Results- Descriptive analysis, Structural and cognitive effects on scientific performance.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Peter Mika, *Social Networks and the Semantic Web*, Springer, 1st Edition, 2007.

REFERENCE BOOK:

1. Charu C. Aggarwal, *Social Network Data Analytics*, Springer, 2011.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	2	-	-	-	-	-	-	-	-	3	-	-
CO3	1	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	1	2	3		-	1	-	-	-	-	-	-	-	3	-	-
CO5	2	3	3		2	-	2	-	-	-	-	-	-	3	-	-
Average	1.8	2.5	3	-	2	1	2	-	-	-	-	-	-	3	-	-
Level of correlation of the course	2	3	3	-	2	1	2	-	-	-	-	-	-	3	-	-

Correlation Level: 3- High 2-Medium 1- Low

III B. Tech. – II Semester

(19BT50502) **ARTIFICIAL INTELLIGENCE**

(Professional Elective – 3)

(IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Introduction to artificial intelligence, Designing intelligent agents, Solving general purpose problems, Search in complex environments, Probabilistic reasoning, Represent knowledge and reason under uncertainty, Robotics, Ethics and safety in AI.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Architect intelligent agents using artificial intelligence techniques and principles.
CO2. Analyze and interpret the problem, identify suitable solutions using heuristic functions, optimization algorithms and search algorithms.
CO3. Select and apply appropriate knowledge representation to build Bayesian network models to reason under uncertainty.
CO4. Investigate robot hardware and frameworks for intelligent robotic perception.
CO5. Demonstrate knowledge on ethical implications of intelligent machines for providing privacy, trust, security and safety.

DETAILED SYLLABUS:

UNIT–I: INTRODUCTION TO ARTIFICIAL INTELLIGENCE (10 periods)

Foundations of artificial intelligence, History of artificial intelligence, State of the art, Risks and benefits of AI, Intelligent agents – Agents and environments, The concept of rationality, Structure of agents.

UNIT–II: PROBLEM SOLVING BY SEARCHING (9 periods)

Problem solving agents, Search algorithms, Uninformed search strategies, Informed search strategies – Greedy best-first search, A* search; Heuristic functions.

UNIT–III: SEARCH IN COMPLEX ENVIRONMENTS (9 periods)

Local search algorithms and optimization problems – Hill-climbing search, Simulated annealing, Local beam search, Evolutionary algorithms; Optimal decisions in games – The minimax search algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Move ordering; Monte Carlo tree search.

UNIT–IV: PROBABILISTIC REASONING (9 periods)

Representing Knowledge in an uncertain domain, Semantics of Bayesian networks, Probabilistic reasoning over time – Time and uncertainty, Inference in temporal models, Hidden Markov models, Kalman Filter.

UNIT–V: ROBOTICS, ETHICS AND SAFETY IN AI (8 periods)

Robotics: Robots, Robot hardware, Robotic perception, Alternative robotic frameworks, Application domains.

Ethics and Safety in AI: Limits of AI, Ethics of AI – Surveillance, security and privacy, Fairness and bias, Trust and transparency, AI safety.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Stuart Russell, Peter Norvig, *Artificial Intelligence: A Modern Approach*, Prentice Hall, 4th Edition, 2020.

REFERENCE BOOKS:

1. Stephen Lucci, Danny Kopec, *Artificial Intelligence in the 21st Century*, Mercury Learning and Information, 3rd Edition, 2018.
2. Rich, Knight, Nair, *Artificial intelligence*, Tata McGraw Hill, 3rd Edition, 2009.
3. Deepak Khemani, *A First Course in Artificial Intelligence*, McGraw Hill, 2017.
4. Saroj Kaushik, *Artificial Intelligence,* Cengage Learning, 2011.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	1	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	
Average	3	2.3	2	-	-	1	-	2	-	-	-	-	-	-	-	3
Level of correlation of the course	3	3	2	-	-	1	-	2	-	-	-	-	-	-	-	3

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – IISemester
(19BT50503) **CYBER SECURITY**
(IT)
(Professional Elective – 3)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Computer Networks.

COURSE DESCRIPTION: Cybercrime, Cyberoffenses, Phishing, Identity theft, Cybercrime in mobile and wireless devices, Organizational measures for handling mobile devices, Security implications on using mobile devices, Tools and methods used in cybercrime, Forensics of computer and handheld devices, Real-life examples of cybercrime.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***
CO1. Analyze methods of cybercrime, cyberoffensesto maintain cybersecurity.
CO2. Investigate tools used for cybercrime to protect computational assets.
CO3. Apply appropriate authentication mechanisms to reduce attacks on mobile and wireless devices.
CO4. Use appropriate cyberforensics tools and techniques to maintain cybersecurity.
CO5. Recognize the need for cybersecurity and practice ethics to protect privacy, property rights in cyberspace.

DETAILED SYLLABUS:

UNIT–I: CYBERCRIME (8 periods)
Cybercrime and information security, Cybercriminals, Classifications of cybercrimes, Need for Cyberlaws in Indian context, Legal perspectives of cybercrime, Indian perspective of cybercrimes, Cybercrime and the Indian ITA 2000, Positive aspects and weak areas of ITA 2000, Amendments made in Indian ITA 2000 for admissibility of e-records, Amendments to the Indian IT Act, Global perspective on cybercrimes, Intellectual property in cyberspace, Ethical dimension of cybercrimes.

UNIT–II: CYBEROFFENSES (11 periods)
Categories of cybercrime, How criminals plan the attacks, Social engineering, Cyberstalking, Cybercafe and cybercrimes, Botnets, Attack vector, Cloud computing, Phishing – Methods, Techniques, Spear phishing, Phishing scams, Phishing toolkits, Spy phishing, Countermeasures; Identity Theft – Personally identifiable information, Types, Techniques, Countermeasures, Effacing online identity.

UNIT–III: CYBERCRIME IN MOBILE AND WIRELESS DEVICES (7 periods)
Proliferation of mobile and wireless devices, Trends in mobility, Credit card frauds in mobile and wireless computing era, Security challenges posed by mobile devices, Registry settings for mobile devices, Authentication service security, Attacks on mobile/cell phones, Security implications of mobile devices for organizations, Organizational measures for handling mobile devices related security issues.

UNIT–IV: TOOLS AND METHODS USED IN CYBERCRIME (10 periods)
Proxy servers and anonymizers, Password cracking, Keyloggers and spywares, Virus and worms, Trojan horses and backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow, Attacks on wireless networks.

UNIT–V: CYBERFORENSICS, CYBERCRIME IN REAL-WORLD (9 periods)
Forensics of Computer and Handheld Devices: Cyberforensics, Cyberforensics and digital evidence, Forensics analysis of e-mail, Forensics and social networking sites,

Forensics of handheld devices – Smartphone forensics, EnCase, Device Seizure, MOBILedit.

Cybercrime examples, mini-cases, online scams: Real-life examples - Official website of Maharashtra Government hacked, Indian banks lose millions of rupees, Game source code stolen; Mini-cases - Indian Case of online gambling, Indian case of intellectual property crime; Online scams - Cheque cashing scam, Charity scams.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Nina Godbole, SunitBelapure, *Cyber Security*: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley, 2013.

REFERENCE BOOKS:

1. Nilakshi Jain, Ramesh Menon, *Cyber Security and Cyber Laws*, Wiley, 2020.
2. Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, *Cybersecurity Essentials*, 1st Edition, Sybex, 2018.
3. ErdalOzkaya, *Cybersecurity: The Beginner's Guide*, 1st Edition, Packt Publishing, 2019.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-		-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	1	-		-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-		2	-	2	-	-	-	-	-	3	-	-
Average	3	2	1	-	2	2	-	2	-	-	-	-	-	3	-	-
Level of correlation of the course	3	2	1	-	2	2	-	2	-	-	-	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – II Semester

(19BT61506) **User Interface Design**

(Common to CSSE and IT)

(Professional Elective-3)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Computer Organization and Software Engineering.

COURSE DESCRIPTION: Usability Goals and Measures; Physical Abilities and Physical Workplaces; The Design Process, Design Frameworks;2-D and 3-D Interfaces; Keyboards and Keypads, Pointing Devices;Five-Stage Search Framework, Dynamic Queries and Faceted Search

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze the user requirements, technological and physical characteristics of users for better interface design
CO2. Analyze desktop and mobile applications by applying various user interface design methods
CO3. Analyze the usability of user-interfaces using qualitative Nielsen's guidelines and testing methodologies
CO4. Identify interaction and navigation styles to model the user interfaces
CO5. Apply speech recognition, command languages ,collaboration models to find the design consistency in user interfaces
CO6. Analyze search interfaces by applying five stage framework for effective data visualization

DETAILED SYLLABUS:

UNIT I: USABILITY OF INTERACTIVE SYSTEMS (9 Periods)

Usability Goals and Measures, Usability Motivations Universal Usability:Variations in Physical Abilities and Physical Workplaces, Diverse Cognitive and Perceptual Abilities, Personality Differences, Cultural and International Diversity, Users with Disabilities, Older Adult Users, Children, Accommodating Hardware and Software Diversity

UNIT II: DESIGN PROCESSES AND USER EXPERIENCE (9 Periods)

Organizational Support for Design, The Design Process, Design Frameworks, Design Methods, Design Tools, Practices, and Patterns, Social Impact Analysis, Legal Issues
Evaluation and the User Experience: Expert Reviews and Heuristics, Usability Testing and Laboratories, Survey Instruments, Acceptance Tests, Evaluation during Active Use and Beyond, Controlled Psychologically Oriented Experiments

UNIT III: INTERACTION STYLES (9 Periods)

Direct Manipulation and lmmersiveEnvironments:What Is Direct Manipulation?,2-D and 3-D Interfaces,Teleoperation and Presence, Augmented and Virtual Reality
Fluid Navigation: Navigation by Selection, Small Displays, Content Organization, Audio Menus, Form Fill-in and Dialog Boxes.
Case Study: Iterative Design Evaluation of Automated Teller Machines (ATMs)

UNIT IV: EXPRESSIVE HUMAN AND COMMAND LANGUAGES (9 Periods)

Speech Recognition, Speech Production, Human Language Technology, Traditional Command Languages
Device:Keyboards and Keypads, Pointing Devices, Displays
Communication and Collaboration: Models of Collaboration, Specific Goals and Contexts, Design Considerations
Case Study: Design Consistency at Apple Computer

UNIT V: INFORMATION SEARCH AND DATA VISUALIZATION (9 Periods)

Five-Stage Search Framework, Dynamic Queries and Faceted Search, Command Languages and "Natural" Language Queries, Multimedia Document Search and Other Specialized Search, the Social Aspects of Search

Data Visualization: Tasks in Data Visualization, Visualization by Data Type, Visualization by Data Type, Challenges for Data Visualization

Total Periods: 45

Topics for self study are provided in lesson plan

TEXT BOOK:

1. Schneiderman, Plaisant,Cohen, Jacobs, Elmqvist, *Designing the User Interface*, Pearson Education, 6th Edition, 2018.

REFERENCE BOOKS:

1. A Dix, Janet Finlay, G. D. Abowd and R. Beale, *Human- Computer Interaction*, Pearson Publishers, Third Edition, 2008.
2. Jonathan Wolpaw and Elizabeth Winter Wolpaw, *Brain-Computer Interfaces: Principles and Practice*, OxfordPublishers, 2012.

CO-PO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	2	-	2	-	-	-	-	-	-	-	-	-	3	-
CO3	2	3	1	2	1	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	1	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	1	2	-	-	-	-	-	-	-	-	-	3	-
CO6	2	3	1	2	1	-	-	-	-	-	-	-	-	-	3	-
Average	2.3	3	1.6	1.5	1.6	-	-	-	-	-	-	-	-	-	3	-
Level of correlation of course	3	3	2	2	2	-	-	-	-	-	-	-	-	-	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – II Semester

(19BT61204) INFORMATION SECURITY AND MANAGEMENT

(IT)

(Professional Elective-3)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Computer Networks.

COURSE DESCRIPTION: Introduction to Management Security and Planning for Security, Planning for Contingencies and Information Security Policy, Security Management Models and Security Management Practices, Risk Management, Protection Mechanisms and Personnel and Security.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1: Demonstrate knowledge on key characteristics and planning of information security and management.
CO2: Apply set of contingency plans and information security policy using business impact analysis.
CO3: Identify security models and strategies for the implementation of security measures.
CO4: Evaluate risk controls and formulate cost-benefit analysis using risk management.
CO5: Identify access control mechanisms to develop secure systems.

DETAILED SYLLABUS:

UNIT I: INTRODUCTION TO MANAGEMENT SECURITY AND SECURITY PLANNING (9 periods)

Introduction to Management Security: CNSS Security Model, Key Concepts of Information Security, Behavioral Types of Leaders, Management Characteristics, Solving Problems, Principles of Information Security Management, Project Management, Applying Project Management to Security, Project Management Tools.
Planning for Security: Role of Planning, Precursors to Planning, Strategic Planning, Information Security Governance, Planning for Information Security Implementation.

UNIT II: PLANNING FOR CONTINGENCIES AND INFORMATION SECURITY POLICY (9 periods)

Planning for Contingencies: Fundamentals of Contingency Planning, Components of Contingency Planning, Business Resumption, Testing Contingency Plans.
Information Security Policy: Introduction, Enterprise Information Security Policy, Issue Specific Security Policy, System Specific Security Policy, Guidelines for Effective Policy.

UNIT III – SECURITY MANAGEMENT MODELS AND SECURITY MANAGEMENT PRACTICES (9 periods)

Security Management Models: Blueprints, Frameworks and Security Models, Access Control Models, Security Architecture Models, Security Management Models.
Security Management Practices: Benchmarking, Performance Measurement in InfoSec Management.

UNIT IV – RISK MANAGEMENT (9 periods)

Risk Management, Risk Identification, Risk Assessment, Risk Control Strategies, Managing Risk, Feasibility and Cost Benefit Analysis

UNIT V – PROTECTION MECHANISMS AND PERSONNEL AND SECURITY (9 periods)

Protection Mechanisms: Access Controls, Firewalls, Intrusion Detection and Prevention Systems, Remote Access Protection, Wireless Networking Protection, Scanning and Analysis Tools

Personnel and Security: Staffing the Security Function, Information Security Professional Credentials, Employment Policies and Practices.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOK:

1. Michael E.Whitman and Herbert J.Mattord, *Management of Information Security,* Cengage Learning, 4th Edition, 2016.

REFERENCE BOOKS:

1. Nina GodBole, *Information Systems Security: Security Management, Metrics, Frameworks and Best Practices,* Wiley Publications, 1st Edition, 2009.
2. Jack Freund, Jack Jones, *Measuring and Managing Information Risk: A FAIR Approach*, Elsevier Inc, 2015

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	3	-	2	3	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	2	3	-	-
CO3	2	3	3	-	2	-	-	-	-	-	-	-	2	3	-	-
CO4	2	3	-	-	-	-	-	-	-	-	2	-	2	3	-	-
CO5	2	3	-	-	-	3	-	3	-	-	-	-	2	3	-	-
Average	2.4	3	3	-	2	3	-	3	-	-	2.5	-	2	3	-	-
Level of correlation of the course	3	3	3	-	2	3	-	3	-	-	3	-	2	3	-	-

Correlation Level: 3- High 2-Medium 1- Low

III B. Tech. – II Semester
(19BT61205) .NET TECHNOLOGIES
(IT)
(Professional Elective-3)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Web Technologies.

COURSE DESCRIPTION: Introduction to .NET Framework and C# Programming; Object-oriented concepts with C#, Exception handling; Interfaces, Generics, Delegates and Events in C#; Database access with ADO.NET; Introducing ASP.NET MVC and Introducing ASP.NET Web API.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on C# and .NET platform concepts.
CO2. Apply object oriented programming concepts and exception handling mechanisms to create software applications.
CO3. Apply generic, event handling principles to develop graphical user interfaces for enterprise applications.
CO4. Apply ADO.NET concepts for data management.
CO5. Design and develop web applications with ASP.NET.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO C# AND .NET PLATFORM (9 Periods)

The Philosophy of .NET: Key Benefits of .NET platform, Building blocks of the .NET platform, Overview of .NET assemblies, Common type system, Common language specification, Common language runtime, Platform-independent nature of .NET.
Building C# Applications: Building C# applications on windows, Building .NET applications on a Non-windows OS, Anatomy of a Simple C# Program, System.Console class, System data types and corresponding C# keywords, Working with String data, C# iteration constructs; Decision constructs and Relational/equality operators, Understanding C# arrays.

UNIT-II: OBJECT ORIENTED PROGRAMMING WITH C# AND EXCEPTION HANDLING (8 Periods)

Object Oriented Programming with C#: C# class type, Constructors, The role of the this keyword, The static keyword, Pillars of OOP, C# access modifiers, C# encapsulation services, automatic properties, The basic mechanics of inheritance, The details of Inheritance, C#'s polymorphic support.
Understanding Structured Exception Handling: The role of .NET exception handling, The simplest possible example, System-level exceptions, Application level exceptions, Processing multiple exceptions.

UNIT-III: INTERFACES, GENERICS, DELEGATES AND EVENTS (10 Periods)

Interfaces: Understanding interface types, Defining custom interfaces, Implementing an interface.
Generics: Role of generic type parameters, Creating custom generic methods, Creating custom generic structures and classes.
Delegates: Understanding the .NET delegate type, Delegate example, Generic delegate.
Events: C# events, Understanding Lambda Expressions.

UNIT-IV: ADO.NET AND ORM ENTITY FRAMEWORK (9 Periods)

Definition of ADO.NET, ADO.NET data providers, ADO.NET namespaces, Connected layer of ADO.NET, Data readers,Working with Create, Update, and Delete Queries, Creating a Console-

Based Client Application, Role of the Entity Framework, Code First from an Existing Database, Using the Model Classes in Code

UNIT-V: INTRODUCING ASP.NET MVC AND INTRODUCING ASP.NET WEB API (9 Periods)

Introducing ASP.NET MVC: MVC Pattern, The ASP.NET MVC Application Template, Routing, Addingan application usingDAL, Controllers and Actions, The Razor View Engine, MVC Views, The Display Data Annotation, Razor Templates, Working with Forms, Updating the Delete View, Validation

Introducing ASP.NET Web API: ASP.NET Web API, Updatingan application using MVC to Use WebAPI

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOK:

1. Andrew Troelsen and Philip Japikse, *Pro C# 7 With .NET and .NET Core*, Apress, 8th Edition, 2017.

REFERENCE BOOKS:

1. Christian Nagel, Jay Glynn and Morgan Skinner***,*** *Professional C# 5.0 and .NET 4.5.1*, WROX Publications, 1st Edition, 2014.
2. Mathew Mac Donald,The Complete Reference *ASP.NET, TATA McGraw Hill*, 1st Edition, 2010.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	1	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	1	2	3	-	-	-	-	1	-	-	-	-	-	-	3	-
CO4	1	2	3	1	-	-	-	-	-	-	-	-	2	-	1	-
CO5	1	2	3	-	1	1	1	-	-	-	-	-	-	-	3	-
Average	1.4	2	3	-	-	-	-	-	-	-	-	-	2	-	2.6	-
Level of correlation of the course	1	2	3	1	1	1	1	1	-	-	-	-	2	-	3	-

Correlation Level: 3- High 2-Medium 1- Low

III B.Tech. – II Semester
(19BT70412)**PATTERN RECOGNITION**
(Common to CSSE & IT)
(Interdisciplinary Elective-II)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Image processing.

COURSE DESCRIPTION:
Importance of pattern recognition; Baye's Decision Theory; Linear and non linear classifiers; Feature selection based on statistical hypothesis testing; Feature Generation; KL Transform; SVD; ICA; Clustering of features and clustering algorithms.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***
CO1. Analyze probability density function between the patterns using bayes classifier for supervised learning.
CO2. Estimate cost function and minimum mean square error between the pattern classes using linear and Non-Linear classifier algorithms such as LMS, Support Vector Machine and back propagation algorithms.
CO3. Apply feature selection and generation techniques to identify features and separate objects in an image.
CO4. Apply clustering techniques to identify various patterns in societal Applications.

DETAILED SYLLABUS

UNIT – I: INTRODUCTION TO PATTERN RECOGNITION (10 periods)
Importance of pattern recognition, Features, Feature Vectors and Classifiers, Supervised, Unsupervised and Semi Supervised Learning.Classifiers based on Baye's Decision Theory **-** Baye's decision theory, Discriminant Functions and decision surfaces, Bayesian classification for Normal Distributions, Estimation of Unknown probability density functions, The Nearest Neighbor Rule.

UNIT – II: LINEAR CLASSIFIERS (9 periods)
Linear Discriminant functions and Decision Hyperplanes, The perceptron Algorithm, Least Squares Method- Mean Square Error Estimation, Stochastic Approximation and the LMS Algorithm, Sum of Error Squares Estimation Least Squares Method; Mean Square Estimation Revisited-Mean Square Error Regression; Support Vector Machine**-** Separable classes, Nonseparable classes

UNIT – III: NON LINEAR CLASSIFIERS (9 periods)
The XOR problem, The two layer perceptron, Three layer perceptrons, The Back propagation Algorithm, The cost function choice, choice of the network size, A simulation example, Networks with weight sharing, generalized linear classifiers, polynomial classifiers, Radial basis Function Networks.

UNIT – IV: FEATURE SELECTION & GENERATION (9 periods)
Feature Selection-Pre processing, The peaking phenomenon, Feature selection based on statistical hypothesis testing, ROC curve, class separability measures, feature subset selection; Feature Generation -Basis Vectors and Images, The KL Transform, The Singular Value Decomposition, Independent Component Analysis, Non negative Matrix Factorization, Regional features, Features for shape and size characterization.

UNIT-V: CLUSTERING (8 periods)
Introduction, Types of Features, Definitions of Clustering, Proximity Measures-Proximity Measures between Two Points, Proximity Functions between a Point and a Set, Proximity Functions between Two Sets; Categories of Clustering Algorithms, Sequential Clustering

Algorithms, A Modification of BSAS, A Two-Threshold Sequential Scheme, Refinement Stages

Total Periods: 45

Topics for Self Study are provided in the Lesson Plan

Text Book:

1. Sergios Theodoridis, Konstantinos Koutroumbas, *Pattern Recognition*, Academic Press, 2nd Edition, 2009.

Reference Books:

1. Richard Duda, Peter E Hart, David G Stork, Pattern Classification, John Wiley & Sons, 2nd Edition, 2001.
2. Christopher M.Bishop, *Pattern Recognition and Machine Learning,* Springer Publications, 2006.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	3	-	2	3	-	-	-	-	-	-	-	-	-	-	2
CO4	3	3	-	-	3	2	1	-	-	-	-	-	-	-	-	2
Average	3	3	1	2.6	3	2	1	-	-	-	-	-	-	-	-	2
Level of correlation of the course	3	3	1	3	3	2	1	-	-	-	-	-	-	-	-	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech.–II Semester

(19BT70401)**EMBEDDED SYSTEMS**

(Common to CSE, CSSE and IT)
(Interdisciplinary Elective-II)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Digital Logic Design.

COURSE DESCRIPTION: MSP430 Architecture; Instruction Set; Programming; On-Chip Resources; Communication with peripherals; Embedded system design approaches.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze MSP430 Architecture, Instruction Set, Addressing modes to develop Programsfor various control applications using Assembly and Embedded C.
CO2. Solve Problems by analyzing MSP430 On Chip Resources such as Timer, Clock System, Low Power Modes/techniques and Interrupt Structure.
CO3. Realize Mixed Signal Processing and Networking Applications,by analyzing on-Chip Resources such as Comparator, ADC, Temperature Sensor, PWM andCommunication Peripherals.
CO4. Analyze Language, IDE Support, Processor IC & Design Technologies, and System Modeling Techniques to capture behavior of Embedded Prototype using suitable model.

DETAILED SYLLABUS:

UNIT- I: ARCHITECTURE OF MSP430 (09 periods)

Embedded Systems – Introduction, MSP430 - Anatomy of microcontroller, Memory, Software, Pin out (MSP430G2553), Functional Block diagram, Memory, CPU, and Memory mapped input and output, Clock generator; Exceptions- Interrupts and Resets.

UNIT- II: PROGRAMMING MSP430 (09 periods)

Development Environment, Aspects of C for Embedded Systems, Assembly Language, Register Organization, Addressing Modes, Constant Generator and Emulated Instructions, Instruction Set, Example programs- Light LEDs, Read input from a switch; Automatic Control-Flashing light by delay, use of subroutines and Functions; Basic Clock System, Interrupts and Low Power Modes.

UNIT- III: TIMERS AND MIXED SIGNAL SYSTEMS (09 periods)

Timers - Watchdog Timer, RTC, Timer_A, Measurement in capture mode, PWM generation;
Mixed Signal Systems- Comparator_A, ADC10 SAADC –Architecture, operation- Single Conversion, Temperature Sensor on ADC10, DTC in ADC10; ADC12 – Comparison with ADC10.

UNIT- IV: COMMUNICATION PERIPHERALS & PROTOCOLS (09 periods)

MSP430 Communication Interfaces- USART, USCI, USI;
Communication Protocols- SPI, Inter-integrated Circuit Bus, USB, CAN

UNIT - V: EMBEDDED SYSTEM DESIGN (09 periods)

Processor Technology, IC Technology, Design Technology, Tradeoffs.
Model VS.Language, System Modelling – Data Flow Model, FSM, FSMD, HCFSM, PSM, Concurrent Process Model & implementation.

Total Periods: *45*

Topics for Self Study are provided in the Lesson Plan

TEXT BOOKS:

1. John H. Davies, *MSP430 Microcontroller Basics*, Newnes Publications, 1st Edition, 2008.
2. SantanuChattopadyay, Embedded System Design,PHI, 2010.
3. Frank Vahid, Tony D. Givargis, *Embedded System Design – A Unified Hardware/Software Introduction,*John Wiley, 2006

REFERENCE BOOKS:

1. Chris Nagy, *Embedded Systems Design using the TI MSP30 Series*, Newnes Publications, 2003.
2. JorgeonStaunstrup, Wayne Wolf, *Hardware/Software Co-design Principles and Practice*, Springer 2009.
3. Patrick R Schamont, *A Practical Introduction to Hardware/Software Co-design,Springer publications*, January 2010.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	1	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	3	2	3	2	2	-	-	-	-	-	-	-	-	-	2
CO3	3	3	3	2	2	2	-	2	-	-	-	-	-	-	-	2
CO4	3	3	2	2	2	2	-	2	-	-	-	-	-	-	-	2
Average	3	3	2.3	2	2	2	-	2	-	-	-	-	-	-	-	2
Course Correlation Level	3	3	3	2	2	2	-	2	-	-	-	-	-	-	-	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. –IISemester

(19BT60541)AD HOC AND WIRELESS SENSOR NETWORKS

(Common to CSSE and IT)
(Interdisciplinary Elective-II)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Computer Networks

COURSE DESCRIPTION: Ad hoc Wireless Networks, Medium Access Control Protocolsfor Ad hoc Wireless Networks, Routing Protocols for Ad hoc Wireless Networks, Wireless Sensor Networks, Medium Access Control Protocols for WSN.

COURSE OUTCOMES: *After successful completion of this course, the students will be able to:*

CO1. Investigate ad hoc and wireless sensor networks to improve the network performance.
CO2. Analyze the issues in MAC, routing protocols in Ad hoc wireless networks.
CO3. Apply routing protocols of MAC Layer in sensor networks to provide networking solutions.
CO4. Follow norms and standards in engineering practice to solve ad hoc and wireless sensor network problems.

DETAILED SYLLABUS:

UNIT–I: AD HOC WIRELESS NETWORKS (8 periods)

Fundamentals of wireless communication technology, The electromagnetic spectrum, Radio propagation mechanisms, Characteristics of the wireless channel, Applications, Issues, Ad hoc wireless Internet.

UNIT–II: MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS (8 periods)

Issues in designing a MAC protocol, Classification of MAC protocols, Contention based protocols, Contention based protocols with reservation mechanisms, Contention based protocols with scheduling mechanisms.

UNIT–III: ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS (9 periods)

Issues in designing routing and transport layer protocol for Ad hoc networks, Classification of routing protocols, Table driven routing protocols, On demand routing protocols, Hybrid routing protocols.

UNIT–IV: WIRELESS SENSOR NETWORKS (9 periods)

Vision of ambient intelligence, Application examples, Types of applications, Challenges of WSN's, Why are sensor networks different, Enabling technologies, Hardware components, Energy consumption of sensor nodes.

UNIT–V: MEDIUM ACCESS CONTROL PROTOCOLS FOR WIRELESS SENSOR NETWORKS (11 periods)

Fundamentals of MAC protocols, Low duty cycle protocols and wake up concepts, Contention based protocols, Schedule based protocols, IEEE 802.15.4 MAC protocol, 802.11 and Bluetooth, Case study on tele healthcare – Introduction, MASN hardware design, Reliable MASN communication protocols, MASN software design, Integration of RFID and wearable sensors.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. C. Siva Ram Murthy, B.S. Manoj, *Ad Hoc Wireless Networks: Architectures and Protocols*, Pearson, 2012.
2. Holger Karl and Andreas Willig, *Protocols and Architectures for Wireless Sensor Networks*, Wiley, 2017.

REFERENCE BOOKS:

1. Fei Hu and Xiaojun Cao, *Wireless Sensor Networks: Principles and Practice*, CRCPress, 2010.
2. Yi Qian, Peter Muller andHsiao–Hwa Chen, *Security in Wireless Networks and Systems*, Wiley, 2011.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	2	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	2	-	2	-	-	-	-	-	3	-	-
Average	2.6	2.3	1.5	-	-	2	-	2	-	-	-	-	-	3	-	-
Level of correlation of the course	3	3	2	-	-	2	-	2	-	-	-	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – II Semester
(19BT61206)INTRUSION DETECTION SYSTEMS
(IT)
(Inter Disciplinary Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Computer Networks.

COURSE DESCRIPTION: Intrusion Detection and Prevention Principles, Other Detection Approaches and IDPS Technologies; Network Based IDPS, Host-Based IDPS, Wireless IDPS and Network Behavior Analysis System; Introduction to TCP Dump and TCP, Fragmentation, Automated and Manual Response and Examining IP Header Field; Session Fixation, Honeypots and Honeynets; Architectural Issues, Organizational Issues and Unified Threat Management.

COURSE OUTCOMES: *After successful completion of this course, the students will be able to:*

CO1. Demonstrate knowledge on different types of Intrusion Detection and prevention mechanisms.
CO2. Apply knowledge of the Intrusion Detection principles and approaches in order to improve the security posture of an enterprise.
CO3. Analyze the Automated and Manual Response systems and Understand TCP dump and examine IP header.
CO4. Analyze network traffic to identify threats that generate unusual traffic flows.
CO5. Apply models to monitor the security of the system.

DETAILED SYLLABUS:

UNIT I– INTRUSION DETECTION AND PREVENTION PRINCIPLES, OTHER DETECTION APPROACHES AND IDPS TECHNOLOGIES (9 periods)

Intrusion Detection and Prevention Principles: Uses of IDPS Technologies, Key Functions of IDPS Technologies, Common Detection Methodologies, Types of IDPS Technologies.

Other Detection Approaches: Misuse detection(Pattern Matching, Rule based Techniques, State based Techniques, Techniques based on Data Mining), Anomaly Detection (Advanced Statistical Models, Rule based techniques, Biological Models, Learning Models) Specification based Detection , Hybrid Detection.

IDPS Technologies: Components and Architecture, Security Capabilities, Management.

UNIT II – NETWORK BASED IDPS, HOST-BASED IDPS, WIRELESS IDPS AND NETWORK BEHAVIOR ANALYSIS SYSTEM (9 periods)

Network based IDPS: Networking Overview, Components and architecture.

Host-Based IDPS: Components and architecture.

Wireless IDPS: Wireless networking overview, components and architecture, capabilities, management.

Network Behavior Analysis System: Components and architecture, security capabilities, management.

UNIT III – INTRODUCTION TO TCP DUMP AND TCP, FRAGMENTATION, AUTOMATED AND MANUAL RESPONSE AND EXAMINING IP HEADER FIELD (9 periods)

Introduction to TCP Dump and TCP: TCP Dump, Introduction to TCP, TCP Gone awry.

Fragmentation: Theory of Fragmentation, Malicious Fragmentation.

Automated and Manual Response: Automated Response, Honey Pot, Manual Response.

Examining IP Header Field: Insertion and Evasion Attacks, IP Header Fields, MF Flag.

UNIT IV – SESSION FIXATION, HONEYPOTS AND HONEYNETS (9 periods)

Session Fixation: Session Fixation Attack Process, Session Fixation Process Tree, Session Fixation Countermeasures, Session Fixation vs. Session Hijacking.

Honeypots and Honeynets: Introduction, Architecture of Honeypot, Physical vs Virtual Honeypots, Honeypot vs Honeynet.

Business Case for Intrusion Detection: Management Issues, Threats and Vulnerabilities

UNIT V – ARCHITECTURAL ISSUES, ORGANIZATIONAL ISSUES AND UNIFIED THREAT MANAGEMENT (9 periods)

Architectural Issues: Events of Interest, Limits to Observation, Human Factors Limit Detects, Severity, Countermeasures, Calculating Severity, Sensor Placement and outside firewall.

Organizational issues: Defining Risk, Threat and Risk management.

Unified Threat Management: Introduction, Different Inspection Methods and their Benefits, High Level Diagram of UTM.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Karen Scarfone, Peter Mell, *Guide to Intrusion Detection and Prevention System (IDPS) National Institute of Standards and Technology*, Technology Administration, U.S. Department of Commerce 1stEdition, 2007.
2. Stephen Northcutt and Judy Novak, *Network Intrusion Detection*, New Riders, 3rdEdition, 2003.

REFERENCE BOOKS:

1. Peter Szor, *The Art of Computer Virus Research and Defense*, Symantec Press, 2005.
2. Markus Jakobsson and Zulfikar Ramzan, *Crime ware, Understanding New Attacks and Defenses*, Symantec Press, 2008.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	3	-	-	-	-	-	-	-	3	-	-
CO2	1	2	3	-	1	3	3	2	-	-	-	-	-	3	-	-
CO3	2	3	-	-	-	2	2	2	-	-	-	-	-	3	-	-
CO4	2	3	-	-	2	3	3	2	-	-	-	-	-	3	-	-
CO5	1	2	3	-	-	-	-	2	-	-	-	-	-	3	-	-
Average	1.8	2.5	3	-	1.5	2.75	2.7	2	-	-	-	-	-	3	-	-
Level of correlation of the course	2	3	3	-	2	3	3	2	-	-	-	-	-	3	-	-

Correlation Level: 3- High 2-Medium 1- Low

III B. Tech. – II Semester

(19BT61531)**INTERNET OF THINGS LAB**

(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	1	2	2

PRE-REQUISITES:-

COURSE DESCRIPTION:
Setting up IoT work-flow, Programming with Python, Micro-controller programming using Arduino, Building IoT Applications using Raspberry Pi, IoT Cloud Infrastructure

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***
CO1. Design an interface to embedded systems using real time sensors with Arduino and Raspberry Pi.
CO2. Develop applications to capture the data generated by sensors and send to cloud.
CO3. Develop real time applications using NodeMCU and BLYNK.
CO4. Design applications to push sensor data to cloud using MQTT protocol.
CO5. Work independentlyand in team to solve problems with effective communication.

Theory Component: (10 Periods)
Arduino IDE, 7-segment display, Servo motor, ultrasonic sensor, LCD, Flame sensor, gas sensor, Humidity & temperature sensors, MQTT protocols, ECG System, Raspberry Pi, Home security system with camera, PIR sensor, light sensor, motion detector, NodeMCU, BLYNK, cloud

LIST OF EXPERIMENTS:
1. (a) Design and Simulate LED 7-Segment Display interfacing with Arduino.
   (b) Design and Simulate Servo motor interfacing with Arduino.
2. (a) Design and Simulate ultrasonic sensor and LCD interfacing with Arduino.
   (b) Design and Simulate Flame Sensor interfacing with Arduino.
3. Design and Implement to capture Gas Sensor and send sensor data to cloud from your NodeMCU device using Arduino IDE.
4. Design and Implementation of Humidity and Temperature Monitoring Using Arduino and upload data to cloud using MQTT.
5. Design and Implementation of an IoT ECG (Electrocardiogram) System to record hearts electrical activity.
6. Design and Simulate controlling an LED 7-Segment Display with Raspberry Pi.
7. Design and implementation of Raspberry Pi Home Security System with Camera and PIR Sensor with Email Notifications.
8. Design and Implement to upload Light sensor (TSL) data to cloud through Raspberry Pi.
9. Design and Implementation of Motion Detector with NodeMCU and BLYNK.
10. Design and Implementation of Fire notification IoT system with BLYNK.

REFERENCE BOOKS:

1. Adrian McEwen and HakinCassimally, *Designing the Internet of Things,* Wiley India.
2. Simon Monk, *Programming Aurdino,* Second Edition,McGraw-Hill Education**,**2016.
3. Matt Richardson and Shawn Wallace, *Getting Started with Raspberry Pi*, O'Reilly, 2014.
4. Rahul Dubey, *An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications* , Cengage Learning India Pvt. Ltd,2019

CO to PO mapping for IoT Laboratory:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	3	-	-	2	2	-	-	-	-	-	-	3	-	-
CO2	2	-	2	-	-	2	3	-	-	-	-	-	-	3	-	-
CO3	1	3	2	-	1	1	1	-	-	-	-	-	-	3	-	-
CO4	1	2	2	-	3	1	1	1	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-	-	3	-	-
Average	1.5	2.5	2.25	-	2	1.5	1.75	1	3	-	-	-	-	3	-	-
Level of correlation of the course	2	3	3	-	2	2	2	1	3	-	-	-	-	3	-	-

Level of correlation: 3- High 2-Medium 1- Low

III B. Tech. – II Semester
(19BT61231) CLOUD COMPUTING LAB
(IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A course on Cloud Computing.

COURSE DESCRIPTION: The course is designed to provide hands on practice on Virtual PC, Virtual Box, Google, Microsoft, Amazon Web Services, Qwiklabs Cloud, IBM Cloud environment, Cloud Analyst simulation tool and Thingspeak Cloud.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate hands-on experience on Virtualization models and Cloud Environment.
CO2. Use Amazon Elastic Compute Cloud (EC2) and Simple Storage Services (S3) to create virtual machine instance and storage of objects.
CO3. Apply AWS Lambda, Amazon DynamoDB, Google Cloud Pub/Sub and Dialogflow services to perform different operations in Qwiklabs Cloud Environment.
CO4. Develop and deploy different web applications using Watson studio in IBM Cloud Environment.
CO5. Create virtual datacenters and instances for monitoring and visualizing of Cloud data through Cloud Analyst simulation tool and Thingspeak Cloud.
CO6. Work independently or in teams to solve problems with effective communication.

List of Exercises/List of Experiments:

1. Create a Virtual Machine on Virtual Box with Ubuntu 14LTs files, 2GB RAM and 200GB Hard Disk configuration through Infrastructure as a Service (IaaS).
2. Create a Virtual Machine on Virtual PC with Windows, 2GB RAM and 200GB Hard Disk configuration through Infrastructure as a Service (IaaS).
3. Create Virtual Private Cloud (VPC) with subnets, route table and Internet gateway using AWS Management Console.
4. Create a virtual machine instance with 2GB RAM and 200 GB hard disk configuration on Amazon Web Services (AWS) cloud through Elastic Compute Cloud (EC2) service and develop a home web page for online bookstore information.
5. Develop a catalogue web page for online bookstore and create a Simple Storage Service (S3) bucket on Amazon Web Services (AWS) cloud and upload catalogue web page into S3 bucket.
6. Compute the following tasks through AWS Lambda function in an event-driven environment using Qwiklabs Cloud:
    i. Create an AWS Lambda function
    ii. Configure an Amazon S3 bucket as a Lambda Event Source
    iii. Trigger a Lambda function by uploading an object to Amazon S3
    iv. Monitor AWS Lambda S3 functions through Amazon CloudWatch Log.
7. Compute the following tasks through Amazon DynamoDB using Qwiklabs Cloud:
    i. Create an Amazon DynamoDB table
    ii. Enter data into an Amazon DynamoDB table
    iii. Query an Amazon DynamoDB table
    iv. Delete an Amazon DynamoDB table.
8. (a) Perform the following operations through Google Cloud Pub/Sub using Qwiklabs Cloud:
    i. Setup a topic to hold data
    ii. Subscribe to a topic to access the data
    iii. Publish and then consume messages with a pull subscriber.

(b) Create an Google Assistant environment through Actions and Dialogflow for building an Assistant application that generates quotes when prompted by a user using Qwiklabs Cloud.

9. (a) Implement a Python Program using Watson studio in IBM Cloud Environment
   (b) Deploy and Run any application in IBM Cloud Environment
   (c) Develop a chat bot using Watson Assistant in IBM Cloud Environment.
10. (a) Create two data centers in different regions with 10-20 physical host, 6-10 userbases, 100-250 executable instructions length per request using Cloud Analyst simulation tool.
    (b) Evaluate and generate reports for 10(a) with different Service Broker and Load Balancing Policies. Sketch out the comparison report on different policies.
11. Create an instance for connecting, monitoring and visualizing Internet of Things (IoT) device data through Thingspeak cloud.
12. Mini Project: Form a group of maximum 3 members as a team and assign unique projects for each team.

REFERENCE BOOKS/LABORATORY MANUALS:

1. Barrie Sosinsky, *Cloud Computing Bible,* Wiley India Pvt Ltd, 2011 (Reprint 2017).
2. Rajkumar Buyya, Christian Vecchiloa and S ThamaraiSelvi, *Mastering Cloud Computing*, McGraw Hill Education, 2013 (Reprint 2017).
3. Lab Manual on Cloud Computing.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	3	3	-
CO2	2	2	1	-	3	-	-	-	-	-	-	-	-	1	3	-
CO3	2	2	3	-	2	-	-	-	-	-	-	-	-	1	3	-
CO4	1	2	2	-	3	2	2	2	-	-	-	-	-	1	3	-
CO5	1	2	3	2	3	-	-	-	-	-	-	2	1	1	3	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Average	1.4	2	2.25	2	2.75	2	2	2	3	3	-	2	1	1.4	3	-
Level of correlation of the course	2	2	2	2	3	2	2	2	3	3	-	2	2	2	3	-

Correlation Level: 3- High 2-Medium 1- Low

III B.Tech. - II Semester
(19BT61232) **SOCIALLY RELEVANT PROJECT-II**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	-	1

PREREQUISITES: -

COURSE DESCRIPTION: Identification of topic for the socially relevant project; Literature survey; Collection of preliminary data; Identification of implementation tools and methodologies; Performing critical study and analysis of the topic identified; Time and cost analysis; Implementation of the socially relevant project; Preparation of thesis and presentation.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Create/Design engineering systems or processes to solve complex societal problems using appropriate tools and techniques following relevant standards, codes, policies, regulations and latest developments.

CO2. Consider environment, sustainability, economics and project management in addressing societal problems.

CO3. Perform individually or in a team besides communicating effectively in written, oral and graphical forms on socially relevant project.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	-	3	-	-	-	3	3	3	3
CO2	-	-	-	-	-	-	3	-	-	-	3	3	3	3	3
CO3	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Level of correlation of the course	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – II Semester

(19BT503AC) FOUNDATIONS OF ENTREPRENEURSHIP

(Common to CSE, CSSE and IT)

(AUDIT COURSE)

L	T	P	C
2	-	-	2

COURSE PREREQUISITES: -

COURSE DESCRIPTION:

The nature and growth of entrepreneurship; Characteristics of an entrepreneur; Types of Entrepreneurs;Ethics and social responsibility of entrepreneurs;Generating ideas; Opportunity identification; Implementing and managing the venture; Principles of creativity and innovation; Methods of protecting innovation and creativity; Market research; Feasibility analysis;Sources of funding;Preparation of business plan;Start-Ups;Social Entrepreneurship; Rural entrepreneurship.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO 1: Demonstrate knowledge on personal attributes that enable best use of entrepreneurial opportunities.
CO 2: Apply suitable method to protect creativity and innovation.
CO 3: Design and prepare high impact strategic and business plan.
CO 4: Analyze the major steps and requirements in order to convert innovative idea into a successful start-up.
CO 5: Develop an idea to create a business for social change by identifying social entrepreneurship opportunities.

DETAILED SYLLABUS:

UNIT – I: ENTREPRENEURIAL MINDSET (06 Periods)

The nature and growth of entrepreneurship,Entrepreneurship and Intrapreneurship, Characteristics of an entrepreneur, Types of Entrepreneurs, Women as an Entrepreneur, Factorsthatcontribute to the success of entrepreneurs, Ethics and social responsibility of entrepreneurs.

UNIT – II: **ENTREPRENEURIAL PROCESS (06Periods)**

Generating ideas, Opportunity identification, Business concepts, Resources (Financial, Physical and Human), Implementing and managing the venture,Harvesting the venture, Harvesting strategies: Absorption of new concept into mainstream operations, Licensing of rights, Family succession, Liquidate (Shut down) venture, Selling the venture, Management Buy-Out (MBO).

UNIT – III: CREATIVITY AND INNOVATION (06Periods)

Principles of creativity and innovation, Disruptive, incremental and open innovations, Nurturing and managing innovation, Methods of protecting innovation and creativity: Intellectual property rights, Branding, Trademarks, Patents, Copyrights, Registered design protection, Trade secrets.

UNIT – IV: NEW VENTURE PLANNING AND CREATION (06 Periods)

Market research (venture opportunity screening), Feasibility analysis, Start-up capital; Sources of funding: equity financing, debt financing (loans, venture funding, angel funding), grants, gifts, bequests and financial statements, Introduction to the business plan, Preparation of business plan.

UNIT – V: START-UPS AND SOCIAL ENTREPRENEURSHIP (06 Periods)

Start-Ups: Definition to start-up, Start-up activities, Promising start-ups, Venture-backed start-ups, Corporate-supported start-ups.

Social Entrepreneurship: Social enterprise-Need - Types - Characteristics and benefits of social enterprises, Rural entrepreneurship.

Total Periods: 30

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Robert D. Hisrich, Mathew J. Manimala, Michael P. Peters, Dean A. Shepherd,*Entrepreneurship*, McGraw Hill Education (India) Private Limited, 8th Edition, 2013.
2. Marc J Dollinger, *Entrepreneurship: Strategies and Resources*, Pearson, 3rd Edition, 2003.

REFERENCE BOOKS:

1. Vasant Desai, *Dynamics of Entrepreneurial Development and Management,* Himalaya PublicationsHouse, 2004.
2. *Harvard Business Review on Entrepreneurship,* HBR Paper Back.
3. Thomas W. Zimmerer and Norman M. Scarborough, *Essential of Entrepreneurship and small business management,* PHI.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	1	-	1	-	-	1	-	-	-	-	-
CO2	3	2	1	-	-	1	-	1	-	-	1	-	-	-	-	-
CO3	3	2	2	-	-	2	-	1	-	-	-	-	-	-	-	-
CO4	3	3	1	-	-	2	-	1	-	-	3	-	-	-	-	-
CO5	3	2	1	-	-	2	-	1	-	-	1	-	-	-	-	-
Average	3	2.2	1.2	-	-	1.6		1	-	-	1.5	-	-	-	-	-
Level of correlation of the course	3	2	1	-	-	2		1	-	-	2	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

IV B. Tech. – I Semester

(19BT6HS01)PRINCIPLES OF BUSINESS ECONOMICS AND ACCOUNTANCY

(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE REQUISITE: -

COURSE DESCRIPTION: Business economics and demand analysis; theory of production and cost analysis; markets and pricing; principles of accounting and capital; final accounts and Tally ERP 9.0.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate Knowledge in concepts, principles and significance of Business Economics, Financial accounting and Tally ERP 9.0
CO2. Demonstrate analytical skills in managerial decision making of an organization by applying theories of Economics
CO3. Develop effective communication in Business and Accounting transactions.
CO4. Ascertain the profitability and soundness of an organization.
CO5. Preparing Financial Statements

DETAILED SYLLABUS:

UNIT – I: BUSINESS ECONOMICS AND DEMAND ANALYSIS (9 periods)

Definition - Nature and Scope of Business Economics, **Demand:** Determinants of demand, Demand function, Law of demand, assumptions and exceptions, Elasticity of demand, Types of elasticity of demand, Demand forecasting and methods of demand forecasting.

UNIT – II: THEORY OF PRODUCTION AND COST ANALYSIS (9 periods)

Production Function: Input-output relationship, Law of Variable proportion, Isoquants and Isocosts

Cost Concepts: Total, Average and Marginal Cost, Fixed vs. Variable costs, Opportunity Costs Vs Outlay Costs– Separable Costs Vs Joint Costs, Urgent Costs Vs Postponable Costs- Avoidable Costs Vs Unavoidable Costs.

Break Even Analysis (BEA) – Assumptions, Merits and demerits, Determination of Break Even Point (Simple problems).

UNIT – III: MARKETS AND PRICING (9 periods)

Market Structure: Types of Markets, Features of perfect competition, Monopoly and monopolistic competition, Price and Output determination in perfect competition, monopoly and monopolistic Markets.

Pricing: Objectives and policies of pricing, Sealed bid pricing, Marginal cost pricing, Cost plus pricing, Going rate pricing, penetration Pricing, skimming Pricing, Block pricing, Peak load pricing, Cross subsidization.

UNIT – IV: PRINCIPLES OF ACCOUNTING AND CAPITAL (9 periods)

Accountancy: Introduction, Concepts, Conventions, Double Entry Book Keeping, Journal, Ledger, Trial Balance (Simple problems).

Capital: Significance - Types of capital – Sources of Capital.

UNIT – V: FINAL ACCOUNTS AND TALLY ERP 9.0 (9 periods)

Introduction to Final Accounts: Trading account, Profit and Loss account and Balance Sheet with simple adjustments (Simple problems).

Tally ERP 9.0: Introduction, Create a company, Create ledger, Posting vouchers, Advantages of Tally.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. H L Ahuja, *Business Economics (Thirteenth edition)*, S Chand Publishing, Jan 2016.
2. S.P. Jain and K.L. Narang, *Financial Accounting*, Kalyani Publishers, Ludhiana, 12th Edition, 2018.

REFERENCE BOOKS:

1. Joseph G.Nellis and David Parker, *Principles of Business Economics*, Pearson Education Canada, 2nd Edition, 2016.
3. Larry M. Walther, *Financial Accounting,* Create Space Independent Publishing Platform, July 2017.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	-	2	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	2	-	-	-	-	-	-
CO3	-	1	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO4	1	2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	3	-	2	-	-	-	-
Average	2	1.6	-	-	-	-	-	-	-	2.3	3	2.5	-	-	-	-
Level of correlation of the course	2	2	-	-	-	-	-	-	-	3	3	3	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

IV B. Tech. – I Semester
(19BT71201)DATA ANALYTICS
(Common to CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Database Management Systems.

COURSE DESCRIPTION: The course provides Introduction to Data Analytics and its Life Cycle,Review of Basic Data Analytic Methods Using R, Advanced Analytical Theory and Methods,Advanced Analytics-Technology and Tools: In-Database Analytics and Communicating and Operationalizing an Analytics Project

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1.Use Analytical Architecture and its life cycle in Data Analytics
CO2. Analyze and Visualize the Data Analytics Methods using R.
CO3. Apply Advanced Analytical Methods for Text Analysis and Time –Series Analysis.
CO4. Develop Analytical Report for given Analytical problems.
CO5. Analyze and Design Data Analytics Application on Societal Issues.

DETAILED SYLLABUS:

UNIT I – INTRODUCTION TO DATA ANALYTICS and R (9 periods)
Practice in Analytics: BI versus Data Science, Current Analytical Architecture, Emerging Big Data Ecosystem and a New Approach to Analytics. **Data Analytics Life Cycle**: Key Roles for a Successful Analytics Project Background and Overview of Data Analytics Lifecycle Phases - Discovery Phase, Data Preparation Phase, Model Planning, Model Building, Communicate Results, Operationalize.**Introduction to R:**R Graphical User Interfaces, Data Import and Export, Attribute and Data Types, Descriptive Statistics.

UNIT II – BASIC DATA ANALYTICAL METHODS (9 periods)
Exploratory Data Analysis: Visualization Before Analysis, Dirty Data, Visualizing a Single Variable, Examining Multiple Variables, Data Exploration VersusPresentation.**Statistical Methods for Evaluation**: Hypothesis Testing, Difference of Means, Wilcoxon Rank-Sum Test, Type I and Type II Errors, Power and Sample Size, ANOVA, Decision Trees in R, Naïve Bayes in R.

UNIT III – ADVANCED ANALYTICAL TECHNOLOGY AND METHODS (9 periods)
Time Series Analysis: Overview of Time Series Analysis, Box-Jenkins Methodology, ARIMA Model, Autocorrelation Function (ACF),Autoregressive Models, Moving Average Models , ARMA and ARIMA Models ,Building and Evaluating an ARIMA Model, Reasons to Choose and Cautions.
Text Analysis: Text Analysis Steps, A Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency—Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments, Gaining Insights.

UNIT IV –ANALYTICAL DATA REPORT AND VISULAIZATION (9 periods)
Communicating and Operationalizing an Analytics Project, Creating the Final Deliverables: Developing Core Material for Multiple Audiences, Project Goals, Main Findings, Approach, Model Description, Key Points Supported with Data, Model Details Recommendations, Additional Tips on Final Presentation, Providing Technical Specifications and Code, Data Visualization.

UNIT V –DATA ANALYTICS APPLICATIONS (9 periods)
Text and Web: Data Acquisition, Feature Extraction, Tokenization, Stemming, Conversion to Structured Data, Sentiment Analysis, Web Mining.

Recommender Systems: Feedback, Recommendation Tasks, Recommendation Techniques, Final Remarks.
Social Network Analysis: Representing Social Networks, Basic Properties of Nodes, Basic and Structural Properties of Networks.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. EMC Education Services, Data Science and Big Data Analytics – Discovering, Analyzing, Visualizing and Presenting Data, John Wiley and Sons, 2015.
2. Joao Moreira, Andre Carvalho, Andre Carlos Ponce de Leon Ferreira Carvalho, Tomas Horvath, *A General Introduction to Data Analytics*, John Wiley and Sons, 1st Edition,2019.

REFERENCE BOOKS:

1. Anil Maheshwari, *Data Analytics Made Accessible*, Lake Union Publishing, 1st Edition, 2017.
2. Richard Dorsey, Data Analytics: Become a Master in Data Analytics, Create Space Independent Publishing Platform, 2017.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	-	2	-	-	-	-	-	-	-	3	-	-	2
CO2	2	3	-	-	2	2	-	-	-	-	-	-	3	-	-	1
CO3	1	2	3	-	2	-	-	-	-	-	-	-	3	-	-	2
CO4	2	3	3	2	2	-	-	-	-	-	-	-	3	-	-	2
CO5	2	2	3	2	2	3	-	-	-	-	-	-	3	-	-	2
Average	1.8	2.6	3	2	2	2	-	-	-	-	-	-	3	-	-	1.8
Level of correlation of the course	2	3	3	2	3	2	-	-	-	-	-	-	3	-	-	2

Correlation Level: 3- High 2-Medium 1- Low

IV B. Tech. – I Semester
(19BT71202) MOBILE APPLICATION DEVELOPMENT
(IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses onObject Oriented Programming through Java and Web Technologies.

COURSE DESCRIPTION: Mobile platforms; Mobile User Interface and tools; Introduction to Android; Activities; Views; Menus; Database Storage; SMS; e-mail; Displaying Maps; Building a Location Tracker Web Services Using HTTP; Sockets Programming; Communication between a Service and an Activity; Introduction to iOS.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on mobile platforms, mobile user interface and user interface design requirements.
CO2. Design user interfaces by analyzing user requirements.
CO3. Develop mobile applications for Messaging, Location-Based Services, and Networking
CO4. Develop mobile applications and publish in different mobile platforms

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION AND MOBILE USER INTERFACE DESIGN (8 periods)
Mobile web presence, Mobile applications, Marketing, App as a mobile web app; User interface design - Effective use of screen real estate, Mobile application users, Mobile information design, Mobile platforms, Tools of mobile interface design.
Android versions, Features and architecture, Required tools, Android application launching.

UNIT - II: ACTIVITIES, INTENTS AND ANDROID USER INTERFACE (9 periods)
Activities, Linking activities using intents, Calling Built – In Applications Using Intents, Displaying notifications, Components of a screen, Adapting to display orientation, Managing changes to screen orientation, Utilizing the action bar, Listening for UI notifications.

UNIT - III: ADVANCED USER INTERFACE AND DATA PERSISTENCE (10 periods)
Basic views, Picker views, List view, Image view, Menus with views, Web view, saving and loading user preferences, Persisting data to files, Creating and using databases.

UNIT - IV: MESSAGING, LOCATION-BASED SERVICES, AND NETWORKING (9 Periods)
SMS messaging, sending e-mail, displaying maps, getting location data, monitoring a location, Consuming web services using HTTP.

UNIT - V: ANDROID SERVICES, PUBLISHING ANDROID APPLICATIONS AND IOS (9 Periods)
Services, Communication between a service and an activity, Binding activities to services, Threading, Preparing for publishing, Deploying APK files.
iOS tools, iOS project, Debugging iOS apps, Objective-C basics, Hello world app, Building the derby app in iOS.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. J. F. DiMarzio, *Beginning Android Programming with Android Studio*, Wiley India, 4th Edition, 2017.
2. Wei – Meng Lee, *Beginning Android 4 Application Development*, Wrox, 2017.
3. Jeff McWherter and Scott Gowell, *Professional Mobile Application Development,* Wiley India, 1st Edition, 2012.

REFERENCE BOOKS:

1. Neils Smyth, *Android Stduio Development Essentials*, Creative Space Independent publishing platform, 7th Edition 2016.
2. Paul Deital and Harvey Deital, *Android How to Program*,Detial associates publishers, 1st Edition, 2013.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
CO1	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO2	1	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	1	2	2	2	3	2	2	1	-	-	-	-	1	-	3	-
CO4	1	2	3	2	3	2	2	1	-	-	-	-	1	-	3	-
Average	1.6	2	2.5	2	3	2	2	1	-	-	-	-	1	-	3	-
Level of correlation of the course	2	2	3	2	3	2	2	1	-	-	-	-	1	-	3	-

Correlation Level: 3- High 2-Medium 1- Low

IV B.Tech – I Semester

(19BT71503) **Deep Learning**

(Common to CSE, CSSE and IT)

(Professional Elective-4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Machine Learning.

COURSE DESCRIPTION: Overview of machine learning; Fundamentals of deep learning;Modern approaches in deep learning;Feedforward neural network architectures; Deep learning Models and Applications.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze a neural network by applying the basics of mathematics and machine learning.
CO2. Analyze the data using multilayer perceptron and backpropagation algorithms.
CO3. Apply regularization and optimization techniques to improve the performance of Deep neural networks.
CO4. Identify appropriate deep learning model for text, multimedia, and biological data analysis.
CO5. Compare deep neural networks and deep learning models to infer the suitable learning algorithm on large scale data.
CO6. Develop a model for domain specific applications by applying various network models in deep learning.

DETAILED SYLLABUS:

UNIT –I: INTRODUCTION (9 Periods)

Historical Trends in Deep Learning, Machine Learning basics, Learning algorithms: Supervised and Unsupervised Training, Linear Algebra for Machine Learning, Testing, Cross Validation, Dimensionality Reduction, Over fitting /Under Fitting, Hyper parameters and validation sets, Estimators, Bias, Variance, Loss Function, Regularization

UNIT- II: NEURAL NETWORKS (9 Periods)

Biological Neuron, Idea of Computational units, Linear Perceptron, Perceptron Learning Algorithm, Convergence theorem for Perceptron Learning Algorithm, Linear Separability, Multilayer perceptron, Backpropagation.

UNIT –III: MODERN PRACTICES IN DEEP NETWORKS (10 Periods)

Introductions to Simple DNN, Platform for Deep Learning, Deep Learning Software Libraries, Deep Feed forward networks, Gradient-Based Learning, Architecture Design, Various Activation Functions, ReLU, Sigmoid, Error Functions, Regularization methods for Deep Learning, Early Stopping, Drop Out, Optimization methods for Neural Networks, Adagrad, Adam

UNIT-IV: DEEP LEARNING MODELS (9 Periods)

Convolutional Neural Networks (CNNs): CNN Fundamentals, Architectures, Pooling,Visualization, **Sequence Modeling**: Recurrent Neural Networks (RNN), Long-Short Term Memory (LSTM),Bidirectional LSTMs, Bidirectional RNNs, **Deep Unsupervised Learning**: Autoencoders,Auto Encoder Applications, Deep Boltzmann Machine (DBM).

UNIT- V: CASE STUDY AND APPLICATIONS (8 Periods)

Application Case Study, Handwritten digits recognition using deep learning, LSTM with Keras, Sentiment Analysis, Image Dimensionality Reduction using Encoders LSTM with Keras,Alexnet,VGGnet.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, *Deep Learning*, 4th Edition,MIT Press,2016.

REFERENCE BOOKS:

1. KevinP.Murphy, *Machine Learning: AProbabilistic Perspective*, MITPress,2012.
2. Chael Nielsen, *Neural Networks and Deep Learning,* Determination Press, 2015.
3. Deng & Yu, *Deep Learning: Methods and Applications*, Now Publishers, 2013

CO to PO and PSO mapping for the course Deep Learning

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	1	-	-	-	-	-	-	-	-	-	3	2
CO2	2	3	2	2	2	-	-	-	-	-	-	-	-	-	3	2
CO3	2	2	2	2	1	-	-	-	-	-	-	-	-	-	3	2
CO4	2	3	2	2	1	-	-	-	-	-	-	-	-	-	3	2
CO5	1	2	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO6	2	2	3	2	3	1	1	-	-	-	-	-	-	-	3	2
Average	2	2.5	2.2	2	1.3	-	-	-	-	-	-	-	-	-	2.8	2
Level of correlation of the course	2	3	3	2	2	-	-	-	-	-	-	-	-	-	3	2

Correlation Levels: 3- High 2-Medium 1- Low

IV B.Tech. – I Semester
(19BT71203)BIG DATA TECHNOLOGIES
(Common to CSE, and IT)
(Professional Elective-4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Database Management Systems and Data Warehousing and Data Mining.

COURSE DESCRIPTION: Introduction to Big Data, Hadoop; Hadoop Distributed File Systems; Hadoop I/O; MapReduce; Hive; Pig; HBase; Zookeeper; Sqoop and Case studies.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on Structure of Big Data, Big Data characteristics, storage, processing, querying and reporting.
CO2. Analyze large dataset with Hadoop Distributed File System and MapReduce techniques to optimize storage space.
CO3. Apply MapReduce, Hive, Pig, and HBase tools for data analytics.
CO4. Apply Sqoop, and Zookeeper tools for solving data analysis problems.

DETAILED SYLLABUS:

UNIT I - INTRODUCTION TO BIG DATA AND HADOOP (9 periods)

Introduction to Big Data: Evolution and Definition of Big Data, Structure of Big Data, Characteristics, Advantages, Applications and Tools.
Hadoop: Data storage and analysis, Comparison with other systems, History of Hadoop, Apache Hadoop and the Hadoop Ecosystem, Hadoop Releases.

UNIT II – HADOOP DISTRIBUTED FILE SYSTEM AND HADOOP I/O (9 periods)

Hadoop Distributed File system: HDFS concepts, Command-Line Interface, Hadoop file systems, Java Interface, Data Flow, Hadoop Archives.
Hadoop I/O: Data Integrity, Compression, Serialization, File-Based Data Structures.

UNIT III – MAPREDUCE, TYPES & FORMATS AND FEATURES (9 periods)

MapReduce: Analyzing the data with Hadoop, Scaling Out, Hadoop Streaming, Hadoop Pipes.
Types and Formats: MapReduce Types, Input Formats, Output Formats.
Features: Counters, Sorting, Joins, Side Data Distribution and MapReduce Library Classes.

UNIT IV – HIVE, PIG AND HBASE (9 periods)

Hive: Comparison with Traditional Databases, HiveQL, Tables, Querying Data, and User-Defined Functions.
Pig: Comparison with Databases, Pig Latin, User-Defined Functions, Data Processing Operators.
HBase: Basics, Concepts, Clients, HBase vs. RDBMS, Praxis.

UNIT V – ZOOKEEPER, SQOOP AND CASE STUDIES (9 periods)

Zookeeper: Zookeeper Service, Building applications with Zookeeper, Zookeeper in production.
Sqoop: Database Imports, working with Imported Data, Importing Large Objects, Performing an Export.
Case Studies: WhatsApp, Facebook and Twitter.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Tom White, *Hadoop: The Definitive Guide***,** O'REILLY Publications, 3rd Edition, 2012.
2. Anil Maheswari, *Big Data***,** Tata McGraw Hill, 1stEdition, 2017.

REFERENCE BOOKS:

1. Bart Baesens, *Analytics in a Big Data World: The Essential Guide to Data Science and its Applications*, Wiley Publications, 2014.
2. Paul Zikopoulos, IBM, Chris Eaton and Paul Zikopoulos, *Understanding Big Data: Analytics for Enterprise Class Hadoop and streaming Data,*The McGraw-Hill Companies, 2012.
3. Chuck Lam, Hadoop in action, Manning Publications, 2011.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3
CO2	2	3	-	-	2	-	-	1	-	-	-	-	3	-	-	2
CO3	1	2	3	3	1	1	1	1	-	-	-	-	3	-	-	2
CO4	1	2	3	3	1	1	1	1	-	-	-	-	3	-	-	2
Average	1.75	2.33	3	3	1.33	1	1	1	-	-	-	-	3	-	-	2.3
Level of correlation of the course	2	3	3	3	2	1	1	1	-	-	-	-	3	-	-	3

Correlation Level: 3- High 2-Medium 1- Low

IV B. Tech. – I Semester

(19BT71204) COMPUTER FORENSICS

(IT)

(Professional Elective-4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Computer Networks.

COURSE DESCRIPTION: Computer Forensics Fundamentals, Types of Computer Forensics Technology; Types of Computer Forensics Systems, Vendor and Computer Forensics Services; Computer Forensics Evidence and Capture; Computer Forensics Analysis, Reconstructing Past Events, Networks; Countermeasures.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on Computer Forensics and Techniques.
CO2. Demonstrate knowledge on Types of Computer Forensics Systems and Services.
CO3. Apply Data Recovery, Evidence Collection and Data Seizure, Computer Image Verification and Authentication for Computer Forensics Evidence and Capture.
CO4. Analyze Computer Forensics for Reconstructing Past Events and Networking Forensics Scenarios.
CO5. Apply Countermeasures and tools for Computer Forensics.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO COMPUTER FORENSICS (9 Periods)

Computer Forensics Fundamentals: Introduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps Taken by Computer Forensics Specialists, Who Can Use Computer Forensic Evidence, case studies.

Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement: Computer Forensic Technology, Types of Business Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data and How to Find It, Spyware and Adware, Encryption Methods and Vulnerabilities, Protecting Data from Being Compromised, Internet Tracing Methods, Security and Wireless Technologies, Avoiding Pitfalls with Firewalls, Biometric Security Systems.

UNIT-II: FORENSIC SYSTEMS (9 Periods)

Types of Computer Forensics Systems-Internet Security Systems, Intrusion Detection Systems, Firewall Security Systems, Storage Area Network Security Systems, Network Disaster Recovery Systems, Public Key Infrastructure Systems, Wireless Network Security Systems, Satellite Encryption Security Systems, Instant Messaging (IM) Security Systems, Net Privacy Systems, Identity Management Security systems, Identity Theft, Biometric Security Systems, Homeland Security Systems.

Vendor and Computer Forensics Services-Occurrence of Cyber Crime, Cyber Detectives, Fighting cyber crime with Risk-management techniques, Computer Forensics Investigative Services, Forensic process Improvement, Case studies.

UNIT-III: **COMPUTER FORENSICS EVIDENCE AND CAPTURE (9 Periods)**

Data Recovery: Data Recovery Defined, Data Backup and Recovery, The Role of Backup in Data Recovery, The Data-Recovery Solution, Hiding and Recovering Hidden Data, Case Studies.

Evidence Collection and Data Seizure: Why Collect Evidence?, Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collection, Artifacts, Collection Steps, Controlling Contamination: The Chain of Custody, Reconstructing the Attack.

Duplication and Preservation of Digital Evidence-Preserving the Digital Crime Scene, Computer Evidence Processing Steps, Legal Aspects of Collecting and Preserving Computer Forensic Evidence.
Computer Image Verification and Authentication: Special Needs of Evidential Authentication, Practical Considerations.

UNIT-IV: FORENSIC ANALYSIS (9 Periods)
Computer Forensics Analysis: Discovery of Electronic Evidence -Electronic Document Discovery: A Powerful New Litigation ToolIdentification of Data-Timekeeping,Forensic Identification and Analysis of Technical Surveillance Devices.
Reconstructing Past Events: How to Become a Digital Detective, Useable File Formats, Unusable File Formats, Converting Files.
Networks: Network Forensics Scenario, A Technical Approach, Destruction of Email, Damaging Computer Evidence, Tools Needed for Intrusion Response to the Destruction of Data, System Testing.

UNIT-V: COUNTER MEASURES (9 Periods)
The Information Warfare Arsenal of the Future: Weapons of the Future, The Global Positioning System, Snoop, Sniff, and Snuff Tools, Email Wiretaps Like Carnivore Can Steal Sensitive Correspondence, IW Weapons of the Future, Nanotechnology.
Surveillance Tools for Information Warfare of the Future: Monitoring Everything, Cyber Surveillance, The Cyber Footprint and Criminal Tracking, The Implications of Cookies and Integrated Platforms, Wintel Inside, or How Your Computer Is Watching You, Data Mining for What?, The Internet Is Big Brother. The Wireless Internet: Friend or Foe.
Advanced Computer Forensics: Advanced Encryption: The Need to Conceal, Advanced Hacking, Advanced Tracker Hackers, The Problems of the Present.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:
1. John R. Vacca, *Computer Forensics – Computer Crime scene Investigation*, Cengage Learning, 2nd Edition, 2010.

REFERENCE BOOKS:
1. Darren R. Hayes, *A Practical Guide to Computer Forensics Investigations*, Pearson Education, 1st Edition, 2015.
2. Cory Altheide and Harlan Carvey, *Digital Forensics with Open Source Tools*, Elsevier, 2011.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											Program Specific Outcom es				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	
CO3	1	1	3	-	-	-	-	2	-	-	-	-	-	3	-	
CO4	2	3	-	-	-	2	2	-	-	-	-	-	-	3	-	-
CO5	1	2	3	-	3	-	-	-	-	-	-	-	-	2	-	-
Average	2	2	3	-	3	2	2	2	-	-	-	-	-	2.8	-	-
Level of correlation of the course	2	2	3	-	3	2	2	2	-	-	-	-	-	3	-	-

Correlation Level: 3- High 2-Medium 1- Low

IV B. Tech. – I Semester

(19BT71205)DECISION SUPPORT AND INTELLIGENT SYSTEMS

(IT)

(Professional Elective-4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Database management Systems, Data Warehousing and Data Mining.

COURSE DESCRIPTION: Decision Support Systems Development, Collaborative Computing Technologies, Enterprise Information Systems, Knowledge Acquisition, Representation & Reasoning, Advanced intelligence system, Implementing MSS in the E-Business ERA and Integration, Impacts and the future of management support systems.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on phases of management support and decision making systems.

CO2. Develop efficient decision support systems by choosing appropriate decision models.

CO3. Demonstrate knowledge on collaborative computing technologies, enterprise information systems and knowledge management for making Decision Support Systems.

CO4. Apply Artificial Intelligence, Machine Learning and Genetics Algorithms for decision making.

CO5. Demonstrate knowledge on Management Support Systems in E-Business, E-Commerce, L-Commerce, Intra-business, Legal and Ethical Issues in E-commerce.

DETAILED SYLLABUS:

UNIT I– DECISION MAKING AND COMPUTERIZED SUPPORT (9 periods)

Management support systems: Managers and Decision-Making ,Managerial Decision-Making and Information Systems ,Managers and Computer Support, Computerized Decision Support and the Supporting Technologies, A Framework for Decision Support , The Concept of Decision Support Systems, Group Support Systems, Enterprise Information System, Knowledge Management Systems, Expert Systems, Artificial Neural Networks, Advanced Intelligent Decision Support Systems, Hybrid Support Systems . **Decision making systems modeling- support**: Phases of decision Making Process.

UNIT II – DECISION SUPPORT SYSTEMS (9 periods)

Decision Support Systems: DSS Configurations, What Is a DSS, Characteristics and Capabilities of DSS, Components of DSS, The User, DSS Hardware, DSS Classifications.**Modeling and Analysis**: MSS Modeling, Static and Dynamic Models, Certainty, Uncertainty, and Risk. Decision Analysis of a Few Alternatives (Decision Tables and Decision Trees), The Structure of MSS Mathematical Models.

Decision Support System Development: The Traditional System Development Life Cycle, Alternative Development Methodologies.

UNIT III– COLLABORATIVE COMPUTING TECHNOLOGIES (9 periods)

Collaborative Computing Technologies: Group Support Systems, Group Decision-Making, Communication and Collaboration, Communication Support, Group Support Systems, Group Support Systems Technologies, Group systems Meetingroom and Online, The GSS Meeting Process.

Enterprise Information Systems: Concepts and Definitions, The Evolution of Executive and Enterprise Information Systems, Excecutive Roles and Information Needs**. Knowledge Management**: Introduction to Knowledge Management, Organizational

Learning and Transformation, Knowledge Management Initiatives, Approaches to Knowledge.

UNIT IV – INTELLIGENT DECISION SUPPORT SYSTEMS (9 periods)

Artificial Intelligence and Expert Systems: Concepts and Definitions of Artificial Intelligence, Evolution of Artificial Intelligence, The Artificial Intelligence Field, Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems.

Knowledge Acquisition, Representation & Reasoning: Methods of Knowledge Acquisition from Experts, Knowledge Verification and Validation, Representation of Knowledge, Reasoning in Rule-Based Systems.

Advanced intelligence system: Machine-Learning Techniques, Case-Based Reasoning, and Genetic Algorithms Fundamentals.

UNIT V – IMPLEMENTING MSS IN THE E-BUSINESS ERA (9 periods)

Implementing MSS in the E-Business ERA: E-Commerce Mechanisms: Auctions and Portals, Business-to-Consumer Applications, Market Research, e-CRM, and Online Advertising, Intrabusiness, Business-to-Employees, and People-to-People, E-Government, E-Learning, and Customer-to-Customer EC, M-Commerce, L-Commerce, and Pervasive Computing, Legal and Ethical Issues in E-Commerce.

Integration, Impacts and the future of management support systems: Models of MSS Integration Intelligent Modeling and Model Management, MSS Impacts on Organizations, Intelligent Systems and Employment Levels, Internet Communities, The Future of Management-Support Systems

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Efraim Turban, Jay E Aronson and Ting-Peng Liang, *Decision Support Systems and Intelligent Systems*, Prentice Hall India, 7th Edition, 2007.

REFERENCE BOOKS:

1. V. S. Janakiraman and K. Sarukesi, *Decision Support Systems*, PHI Learning, 1st Edition, 2009.
2. Efrem G Mallach, *Decision Support Systems and Data Warehouse Systems*, McGraw Hill, 2008.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3
CO2	2	2	3	-	2	-	-	-	-	-	-	-	1	-	-	3
CO3	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3
CO4	2	2	3	-	-	1	-	-	-	-	-	-	1	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3
Average	2.6	2	3	-	2	1	-	-	-	-	-	-	2.2	-	-	3
Level of correlation of the course	3	2	3	-	2	1	-	-	-	-	-	-	2	-	-	3

Correlation Level: 3- High 2-Medium 1- Low

IV B. Tech. – I Semester

(19BT71206) SYSTEM AND NETWORK ADMINISTRATION

(IT)

(Professional Elective–4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Operating Systems and Computer Networks.

COURSE DESCRIPTION: System Components; Infrastructure as Code and Workstation; Workstation Software Life Cycle, OS Installation Strategies and Workstation Service Definition Architecture; Server Hardware Strategies, Features and Specifications; Network Architecture; Operations and Running A Datacenter

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on DevOps, system components and Automation.
CO2. Demonstrate knowledge on programmable infrastructure, configuration management tools and workstation architecture.
CO3. Analyze workstation lifecycle, OS installation strategies and workstation services.
CO4. Apply strategies for Data warehousing, server administration and maintenance of hardware.
CO5: Demonstrate skills on network architecture, operating networks and naming data centers.

DETAILED SYLLABUS:

UNIT I – INTRODUCTION (9 periods)

Climbing Out of the Hole: Organizing WIP, Eliminating Time Sinkholes; DevOps-DevOps Without Devs, Bottlenecks.

System components: The Carpenter Analogy; Fixing Hell Month-Improving Emergency Failovers; Launching Early and Often.

Pets and Cattle : The Pets and Cattle Analogy, Scaling; Desktops as Cattle, Server Hardware as Cattle; Pets Store State, Isolating State, Generic Processes; Moving Variations to the End, Automation.

UNIT II – INFRASTRUCTURE AS CODE AND WORKSTATION ARCHITECTURE (9 periods)

Infrastructure as Code : Programmable Infrastructure; Tracking Changes, Benefits of Infrastructure as Code, Principles of Infrastructure as Code; Configuration Management Tools; Example Infrastructure as Code Systems, Bringing Infrastructure as Code to Your Organization; Infrastructure as Code for Enhanced Collaboration; Downsides to Infrastructure as Code, Automation Myths.

Workstation Architecture: Fungibility, Hardware, Operating System, Network Configuration; Accounts and Authorization, Data Storage, OS Updates, Security, Logging.

UNIT III – WORKSTATION SOFTWARE LIFE CYCLE, OS INSTALLATION STRATEGIES AND WORKSTATION SERVICE DEFINITION (9 periods)

User Workstation Software Life Cycle: Life of a Machine; OS Installation, OS Configuration; Updating the System Software and Applications, Rolling Out Changes, Disposal.

OS Installation Strategies: Consistency Is More Important Than Perfection, Installation Strategies; Test-Driven Configuration Development, Automating in Steps, When Not to Automate; Vendor Support of OS Installation.

Workstation Service Definition: Basic Service Definition, Refresh Cycles; Tiered Support Levels, Workstations as a Managed Service.

UNIT IV – SERVER HARDWARE STRATEGIES, FEATURES AND SPECIFICATIONS (9 periods)

Strategies: All Eggs in One Basket, Beautiful Snowflakes; Buy in Bulk, Allocate Fractions, Grid Computing, Blade Servers; Cloud-Based Compute Services, Server Appliances, Hybrid Strategies.

Features: Workstations Versus Servers, Server Reliability, Remotely Managing Servers; Separate Administrative Networks, Maintenance Contracts and Spare Parts Selecting Vendors with Server Experience.

Specifications: Models and Product Lines; Server Hardware Details, Things to Leave Out.

UNIT V – NETWORK ARCHITECTURE, OPERATIONS AND RUNNING A DATACENTER (9 periods)

Network Architecture: Physical Versus Logical, The OSI Model; Wired Office Networks, Wireless Office Networks, Datacenter Networks; WAN Strategies, Routing, Internet Access; Corporate Standards, Software-Defined Networks, IPv6.

Network Operations: Monitoring, Management, Documentation, Support.

Running a Datacenter: Capacity Management-Life-Cycle Management; Patch Cables, Labeling, Console Access; Workbench, Tools and Supplies.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Thomas A. Limoncelli, Christina J. Hogan and Strata R. Chalup, *The Practice of System and Network Administration: Volume 1: DevOps and other Best Practices for Enterprise IT*, Addison-Wesley Professional; 3rdEdition, 2016.

REFERENCE BOOKS:

1. Thomas A. Limoncelli, Christine Hogan and Strata R. Chalup, *The Practice of System and Network Administration*, 2ndEdition, 2007.

O-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	-	-	2	-	-	-	-	-	-	-	-	3	-	-
CO3	2	3	-	-	2	-	-	-	-	-	-	-	-	3	-	-
CO4	2	2	3	-	2	-	-	-	-	-	2	-	1	3	-	-
CO5	2	2	3	-	2	-	-	-	-	-	-	-	1	3	-	-
Average	2.4	2.3	3	-	2	-	-	-	-	-	2	-	1	3	-	-
Level of correlation of the course	3	3	3	-	2	-	-	-	-	-	2	-	1	3	-	-

Correlation Level: 3- High 2-Medium 1- Low

IV B. Tech. – ISemester

(19BT70501)**AUGMENTED REALITY AND VIRTUAL REALITY**

(Professional Elective -5)

(Common to CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Transformation Techniques and Linear Algebra, Machine Learning, and Web Technologies.

COURSE DESCRIPTION: Augmented reality - Displays, Visual perception, Tracking methods, Computer vision algorithms, Interaction, Authoring, Navigation and Collaboration methods; Virtual reality - Stereoscopic displays, Computing platforms, Virtual reality hardware, Basics of 3D graphics, Basics of Unity 3D, Gear VR and WebVR.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze the augmented reality display environment, applications and tracking methods for spatial measurement and alignment of objects.
CO2. Analyze optical tracking and scene reconstruction algorithms for electronically perceiving imagery from camera sensors.
CO3. Investigate interaction, authoring, navigation and collaboration methods for providing human computer interaction in augmented reality systems.
CO4. Demonstrate knowledge on the fundamental concepts and hardware of virtual reality medium.
CO5. Develop virtual reality modules using Oculus SDK and WebVR API to provide simulated experience.

DETAILED SYLLABUS:

UNIT–I: INTRODUCTION TO AUGMENTED REALITY (9 periods)

History of augmented reality, Examples, Related fields – Mixed reality, Virtual reality, Ubiquitous computing; Displays – Multimodal displays, Visual perception, Requirements and characteristics, Spatial display model, Visual displays.

UNIT–II: COMPUTER VISION FOR AUGMENTED REALITY (10 periods)

Tracking – Tracking, calibration and registration, Coordinate systems, Characteristics of tracking technology, Stationary tracking systems, Mobile sensors, Optical tracking, Sensor fusion; Marker Tracking, Multiple-camera Infrared tracking, Natural feature tracking by detection, Incremental tracking, Outdoor tracking.

UNIT–III: HUMAN COMPUTER INTERACTION FOR AUGMENTED REALITY (9 periods)

Interaction – Input modalities, Output modalities, Haptic interaction, Multimodal interaction; Authoring – Requirements of AR authoring, Elements of authoring, Stand-alone authoring solutions, Plug-In approaches; Navigation – Foundations of human navigation, Route visualization, Viewpoint guidance, Multiple perspectives; Collaboration – Co-located collaboration, Remote collaboration.

UNIT–IV: INTRODUCTION TO VIRTUAL REALITY (8 periods)

Stereoscopic displays, Motion tracking hardware, Input devices, Computing platforms, Virtual reality applications, Virtual reality hardware – Oculus Rift, Crescent Bay, Samsung Gear VR, Google Cardboard; 3D graphics basics – Coordinate systems, Meshes, Polygons, Vertices, Materials, Textures, Lights, Transforms, Matrices, Cameras, Perspective, Viewports and Projections, Stereoscopic Rendering; Unity 3D, Setting up the Oculus SDK, Example VR Application.

UNIT–V: Gear VR AND WebVR IN VIRTUAL REALITY (9 periods)

Gear VR – Gear VR user interface and Oculus Home, Oculus Mobile SDK, Developing for Gear VR using Unity3D, Deploying applications for Gear VR; WebVR – WebVR API, Creating WebVR application, Tools and techniques for creating WebVR.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Dieter Schmalstieg, Tobias Hollerer, *Augmented Reality: Principles and Practice*, Addison Wesley, 2016.
2. Tony Parisi, *Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web and Mobile*, O'Reilly, 2015.

REFERENCE BOOKS:

1. Grigore C. Burdea, Philippe Coiffet, *Virtual Reality Technology*, 2nd Edition, Wiley, 2006.
2. Helen Papagiannis, *Augmented Human: How Technology Is Shaping the New Reality*, O'Reilly, 2017.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3	2
CO4	3	-	-	-	2	-	-	-	-	-	-	-	-	-	3	2
CO5	3	2	2	-	2	-	-	-	-	-	-	-	-	-	3	2
Average	3	2.2	2	-	2	-	-	-	-	-	-	-	-	-	3	2
Level of correlation of the course	3	3	2	-	2	-	-	-	-	-	-	-	-	-	3	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

IV B.Tech. – ISemester

(19BT70503) **BLOCKCHAIN TECHNOLOGIES**

(Program Elective – 5)

(Common to CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Cryptography and Network Security.

COURSE DESCRIPTION: Introduction to Blockchain Technologies and its decentralization concepts, Digital Currencies, Smart Contracts, Ethereum, Hyperledger, Alternative Blockchains, Current Challenges and Scope of Research.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze the concepts of distributed systems, decentralization and blockchains in the Blockchain ecosystem.
CO2. Devise suitable Blockchain platforms for scalable applications.
CO3. Assess the challenges, trending technologies for understanding the research scope in Blockchain technologies.
CO4. Pertain to ethical and legal usage of Blockchain applications.
CO5. Formulate secured and sustainable Blockchains for healthy and safe society.

DETAILED SYLLABUS:

UNIT–I: INTRODUCTIONTO BLOCKCHAIN AND DECENTRALIZATION **(9 Periods)**

Introduction to Blockchain: Distributed systems, History of Blockchain, Introduction to Blockchain - Definitions, Generic elements, Features, Applications, Tiers; Types of Blockchain, CAP theorem and Blockchain, Benefits and limitations of Blockchain technology.

Decentralization: Decentralization using Blockchain, Decentralization methods and routes, Full ecosystem decentralization, Smart contract, Decentralized organizations, Decentralized autonomous organizations, corporations and societies, Applications and platforms for decentralization.

UNIT–II: DIGITAL CURRENCY –BITCOIN **(9 Periods)**

Definitions, Transactions – Life cycle, Structure, Types; Blockchain – Structure of block and block header, Genesis block, Bitcoin network, Wallets; Bitcoin Payments – Investment and buying and selling bitcoins, Installation; Bitcoin Limitations, Namecoin.

UNIT–III: SMART CONTRACTS AND ETHEREUM **(11 Periods)**

Smart Contracts: History & definition, Ricardian contracts - Smart contract templates, Oracles, Smart Oracles, Deployment of smart contracts on Blockchain.

Ethereum: Introduction, Ethereum Blockchain, Elements of Ethereum Blockchain, Precompiled contracts, Accounts, Block, Ether, Messages, Mining – Ethash, CPU and GPU mining; Clients and wallets, Ethereum Network, Applications developed on Ethereum, Scalability and security issues.

UNIT–IV: HYPERLEDGERS AND ALTERNATIVE BLOCKCHAINS **(8 Periods)**

Hyperledgers: Projects, Hyperledger as protocol, Fabric, Hyperledger Fabric, Sawtooth Lake, Corda.

Alternative Blockchains: Blockchains - Kadena, Stellar, Rootstock, Quorum, Tezos, Storj, Maidsafe, BigChainDB, Multichain, Tendermint; Platforms - BlockApps, Eris.

UNIT–V: CHALLENGES AND EMERGING TRENDS **(8 Periods)**

Current Challenges: Scalability - Block size increase, block internal reduction, Invertible Blooms lookup tables, Sharding, State channels, Private Blockchain, Proof of stake;

Privacy - Indistinguishability obfuscation, Homomorphic encryption, Zero knowledge proofs, State channels, Secure multiparty computation, Usage of hardware to provide confidentiality, Coinjoin, Confidential transactions, MimbleWimble; Security - Smart Contract Security.

Emerging Trends: Emerging trends, Improvement proposals, Blockchain Research - Smart contracts, Centralization issues, Limitations in cryptographic functions, Consensus algorithms, Scalability, Code obfuscation.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Imran Bashir, *Mastering Blockchain: Deeper Insights into Decentralization, Cryptography, Bitcoin, and Popular Blockchain Frameworks*, Packt Publishing,1st Edition, 2017.

REFERENCE BOOKS:

1. ArshdeepBahga, Vijay Madisetti, *Blockchain Applications: A Hands-On Approach*, VPT Books, 2017.
2. Josh Thompson, *Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming*, Create Space Independent Publishing Platform, 2017.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2				-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	3		3	-	-	-	-	-	-	-	-	3	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO4	-	-	-	-	-			3	-	-	-	-	-	2	-	-
CO5	-	-	-	-	-	3	3		-	-	-	-	-	3	-	-
Average	2.3	2.5	3		3	3	3	3	-	-	-	-	-	2.6	-	-
Level of correlation of the course	3	3	3		3	3	3	3	-	-	-	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

IV B.Tech. – I Semester
(19BT71504) High Performance Computing
(Common to CSE, CSSE and IT)
(Program Elective – 5)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Computer Organization.

COURSE DESCRIPTION:
Heterogeneous Parallel Computing, Architecture of Modern CPU; Data Parallelism, CUDA Program Structure;Device Global Memory and DataTransfer;Thread Scheduling and Latency Tolerance,Querying Device Properties;Computational Thinking, Basic OpenACC Programs, Future Directions of OpenACC

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Explore parallel programming models to understand behavior of algorithms and application on parallel systems.
CO2. Analyze the functionality of GPU architecture using parallel computing platform CUDA
CO3. Design CUDA kernel functions to launch data parallel execution on multiple GPU's processor cores
CO4. Explore the concepts of CUDA thread organization and scheduling for data access in heterogeneous systems
CO5. Apply strategies of CUDA memories to boost the execution efficiency of kernel functions on parallel computers
CO6. Identify OpenCL API and OpenACC directivesto accelerate the applications on high performance architectures

DETAILED SYLLABUS:

UNIT I: PARALLEL COMPUTING (08 Periods)
Heterogeneous Parallel Computing, Architecture of Modern CPU, Why more parallelism, Speeding up real applications, Parallel programming languages and models

UNIT II: GPU COMPUTING (10 Periods)
Evolution of Graphics Pipelines, GPGPU: An intermediate Step, GPU Computing.
Introduction to Data Parallelism and CUDA C:Data Parallelism, CUDA Program Structure, A Vector Addition Kernel, Device Global Memory and Data Transfer, Kernel Functions and Threading

UNIT III: DATA-PARALLEL EXECUTION MODEL (10 Periods)
CUDA Thread Organization, Mapping Threads to Multidimensional Data, Matrix-Matrix Multiplication-A More Complex Kernel, Synchronization and Transparent Scalability, Assigning Resources to Blocks, Querying Device Properties, Thread Scheduling and Latency Tolerance

UNIT IV: CUDA MEMEORIES AND PARALLEL PROGRAMMING (08 Periods)
Importance of Memory Access Efficiency, CUDA Device Memory Types, A Strategy for Reducing Global Memory Traffic, A Tiled Matrix_ Matrix Multiplication Kernel, Memory as a Limiting Factor to Parallelism
Parallel Programming: Goals of Parallel Computing, Problem Decomposition, Algorithm Selection, Computational Thinking

UNIT V: AN INTRODUCTION TO OPENCL&PARALLEL PROGRAMMING WITH OPENACC (09 Periods)

Data Parallelism Model, Device Architecture, Kernel Functions, Device Management and Kernel Launch, Electrostatic Potential Map in OpenCL.
OpenACC: OpenACC Versus CUDA C, Execution Model, Memory Model, Basic OpenACC Programs,Future Directions of OpenACC

Total Periods: 45

Topics for self study are provided in lesson plan

TEXT BOOK:

1.David B. Kirk, Wen-mei W. Hwu, *Programming Massively Parallel Processors: A Hands-on Approach*, Elsevier Science,2nd Edition,2013.

REFERNCE BOOKS:

1. Charles Severance and Kevin Dowd, *High Performance Computing*, O'Reilly Media, 2nd Edition, 1998.
2. Kai Hwang and Faye Alaye Briggs, *Computer Architecture and Parallel Processing*, McGraw Hill, 1984.

CO-PO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	1	2	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	1	1	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	1	1	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	2	1	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	3	2	2	-	-	-	-	-	-	--	-	-	3	-
CO6	3	3	2	2	2	-	-	-	-	-	-	-	-	-	3	-
Average	2.6	2.8	2	1.5	1.5	-	-	-	-	-	-	-	-	-	3	-
Level of correlation of course	3	3	2	2	2	-	-	-	-	-	-	-	-	-	3	-

3- High mapping **2-Medium Mapping** **1- Low Mapping**

IV B. Tech. – I Semester

(19BT71207) GAME DEVELOPMENT

(IT)

(Professional Elective–5)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PREREQUISITE: A course on Object Oriented Programming through Java.

COURSE DESCRIPTION: Third Dimension, Prototyping and Scripting Basics; Creating the Environment, Player Characters and Further Scripting; Interactions, Collection, Inventory, and HUD(heads up display); Instantiation and Rigidbodies, Particle Systems; Designing Menus, Animation Basics, and Building.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on Third Dimension, Prototyping and Scripting.
CO2. Build game environment, player characters and script for game development.
CO3. Analyze the interactions between players, understand the Collections and Inventory for game development.
CO4. Develop games using rigidbodies and particle systems.
CO5. Design menus, animations and publish the games.

DETAILED SYLLABUS:

UNIT-I: Third Dimension, Prototyping and Scripting Basics (9 Periods)

Third Dimension : Getting to grips with 3D, Rigidbody physics, Essential Unity concepts, The interface

Prototyping and Scripting Basics : First Unity project, A basic prototyping environment, Introducing scripting, Understanding Translate, Testing the game so far, Storing with prefabs, Using Instantiate() to spawn objects

UNIT-II: Creating the Environment, Player Characters and Further Scripting (9 Periods)

Creating the Environment: Designing the game, Using the terrain editor, The terrain toolset, Creating the island—sun, sea, and sand.

Player Characters and Further Scripting: Working with the Inspector, Anatomy of a character, Deconstructing the First Person Controller object, Further scripting, Full example, Inter-script communication and Dot Syntax, Scripting for character movement.

UNIT-III: Interactions, Collection, Inventory, and HUD(Heads up Display) (9 Periods)

Interactions: External modeling applications, Setting up the outpost model, Adding the outpost, Collisions and triggers, Ray casting, Opening the outpost.

Collection, Inventory, and HUD: Creating the power cell prefab, Scattering power cells, Restricting outpost access, Displaying the power cell HUD.

UNIT-IV: Instantiation and Rigidbodies, Particle Systems (9 Periods)

Instantiation and Rigidbodies: Utilizing instantiation, Rigidbodies, Making the mini-game.

Particle Systems: particle system, Creating the task, Testing and confirming**.**

UNIT-V: Designing Menus, Animation Basics, and Building (9 Periods)

Designing Menus: Interfaces and menus, Creating the menu with GUITextures and mouse events, Creating the menu with the Unity GUI class and GUI skins

Animation Basics: Game win sequence.

Building: Build options, Build Settings, Player Settings, Quality Settings, Building the game

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Will Goldstone**,** *Unity 3.x Game Development Essentials Game development with C# and Javascript*, PACKT Publishing, 2nd Edition, 2011.

REFERENCE BOOKS:

1. Sue Blackman, *Beginning 3D Game Development with Unity 4*, Apress Publisher, 2nd Edition, 2013.
2. Mike Geig, *Unity Game Development in 24 Hours*, Pearson Education, 1st Edition, 2013.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO2	1	2	3	-	1	-	-	-	-	-	-	-	-	-	3	
CO3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	3	
CO4	1	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	1	2	3	-	-	1	1	1	-	-	-	-	-	-	3	-
Average	1.6	2.3	3	-	2	1	1	1	-	-	-	-	-	-	3	-
Level of correlation of the course	2	2	3	-	2	1	1	1	-	-	-	-	-	-	3	-

Correlation Level: 3- High 2-Medium 1- Low

IV B. Tech. – I Semester

(19BT71208) MOBILE DATABASES

(IT)

(Professional Elective-5)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Mobile Computing and Wireless Networks.

COURSE DESCRIPTION: Mobile Database, Wireless Network Communication, Location and Handoff Management, Fundamentals of Database Technology, Concurrency Control Mechanism Data Processing and Mobility, Transaction management in Mobile Database systems, Mobile database Recovery.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on:
- Mobile databases
- Wireless Network communications
- Location and Handoff management.

CO2. Analyze the conventional approaches of data processing and build a transaction model.

CO3. Identify the concurrency control schemes for mobile database systems.

CO4. Demonstrate knowledge on the transaction management in mobile database systems.

CO5. Demonstrate knowledge on the various mobile database recovery schemes.

DETAILED SYLLABUS:

UNIT I: **INTRODUCTION** **(10 periods)**

Mobile Database: Introduction, Fully Connected Information Space, Types of Mobility.

Wireless Network Communication: Introduction, Continuous Connectivity.

Location and Handoff Management: Location Management, Handoff Management, Roaming.

UNIT II: FUNDAMENTALS OF DATABASE TECHNOLOGY **(9 periods)**

Conventional Database Architecture, Database Processing, Serialization of Transaction, Advanced Transaction Model

UNIT III: CONCURRENCY CONTROL MECHANISM & DATA PROCESSING AND MOBILITY **(10 periods)**

Concurrency Control Mechanism: Introduction, ways of locking data items. The Phantom Problem, Multi-granularity locking, Heuristics approach in locking scheme, Non-locking based schemes.

Data Processing and Mobility: Introduction, Effect of mobility on the management of data, Data Categorization, Location dependent data distribution.

UNIT IV: TRANSACTION MANAGEMENT IN MOBILE DATABASE SYSTEMS **(10 periods)**

Mobile Database systems, Transaction execution in MDS, Mobile Transaction Model, Execution model on ACID transaction framework, pre-write transaction execution model, data consistency in intermittent connectivity.

UNIT V: MOBILE DATABASE RECOVERY **(6 periods)**

Introduction, Log Management in Mobile Database systems, Mobile database recovery scheme

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Vijay Kumar, *Mobile Database Systems*, John Willy and Sons, 1st Edition, 2006.

REFERENCE BOOKS:

1. Elmasri, Navathe, *Fundamentals of Database Systems*, 3rd Edition, Pearson Education, 2000.
2. Henry F Korth, Abraham Silberschatz, S. Sudharshan, *Database System Concepts*, 5th Edition, McGraw Hill, 2006.
3. V. S. Subramanian, *Principles of Multimedia Database Systems*, Harcourt India Pvt Ltd., 2001.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	2	-	-	-	-	-	-	-	3	-	-	-
CO2	2	3	-	-	2	-	-	-	-	-	-	-	3	-	-	-
CO3	2	3	-	-	2	2	-	-	-	-	-	-	3	-	-	-
CO4	3	-	-	-	3	3	-	-	-	-	-	-	3	-	-	-
CO5	3	-	-	-	3	3	-	-	-	-	-	-	3	-	-	-
Average	2.6	3	-	-	2.4	2.6	-	-	-	-	-	-	3	-	-	-
Level of correlation of the course	3	3	-	-	3	3	-	-	-	-	-	-	3	-	-	-

Correlation Level: 3- High 2-Medium 1- Low

IV B. Tech. – I Semester
(19BT71231) DATA ANALYTICS LAB
(IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A course on Data Analytics

COURSE DESCRIPTION: Introduction to R Tool; Data import and export; Prediction Modeling; Regression Techniques and visualization, Build a Decision Tress classification using different packages and prediction, Clustering Techniques, Association rules Mining, Time series Analysis and Text Mining using R tool.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on Prediction Modeling, Regression Techniques and visualization, Build a Decision Tress classification using different packages and prediction, Clustering Techniques, Association rules Mining, Time series Analysis and Text Mining using R tool.
CO2. Apply Classification, clustering and Regression algorithms for Data Analysis
CO3. Develop solution for Text Analysis and Time Series Analysis problems.
CO4. Analyze and Visualize data using R programming.
CO5. Work independently or in teams to solve problems with effective communication..

LIST OF EXPERIMENTS:

1. Introduction to R Studio, Basic operations and import and export of data using R Tool.
2. Implement Data Exploration and Visualization on different Datasets to explore multiple and Individual Variables.
3. Build a Decision Tree using party and rpart packages.
4. Build a predictive model using Random Forest Package.
6. Implement Linear and logistic Regression on Datasets to predict the probability.
7. Implement K-Means, K-Medoids, Hierarchical and Density-based Clustering techniques.
8. Implement Time Series Analysis using Classification and clustering Techniques.
9. Implement Apriori Algorithm in Association Rule Mining.
10. Implement Text Mining on Twitter data using twitteR package.
11. Mini Project

REFERENCE BOOKS/LABORATORY MANUALS:

1. Yanchang Zhao, *R and Data Mining: Examples and Case Studies*, Eleiver, 1st Edition, 2015, (PDF URL: http://www.RDataMining.com).
2. EMC Education Services, *Data Science and Big Data Analytics – Discovering, Analyzing, Visualizing and Presenting Data*, John Wiley and Sons, 2015.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3
CO2	1	2	3	-	-	1	-	-	-	-	-	-	3	-	-	3
CO3	1	2	3	3	-	-	2	2	-	-	-	-	3	-	-	3
CO4	2	3	-	-	2	-	-	2	-	-	-	2	3	-	-	2
CO5	-	-	-	-	-	-	-	-	3	3	-	-	3	-	-	3
Average	1.7	2.3	3	3	2	1	2	2	3	3	-	2	3	-	-	2.8
Level of correlation of the course	2	3	3	3	2	1	2	2	3	3	-	2	3	-	-	3

Correlation Level: 3- High 2-Medium 1- Low

IV B. Tech. – I Semester

(19BT71232)**MOBILE APPLICATION DEVELOPMENT LAB**

(IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Mobile Application Development.

COURSE DESCRIPTION: Hands-on experience on development of Android Mobile applications with Submenus; Context menus; Layouts; Buttons; Date Picker and database access with Android SQLite.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on:
- Mobile platforms and Mobile User Interface
- Android Activities and Intents
- Messaging, Networking, Location based Services, Android Services
- iOS.

CO2. Analyze the context of complex problems and identify user interface design requirements.
CO3. Design and develop mobile applications as per societal needs.
CO4. Use Android studio and iOS tools to develop mobile applications.
CO5. Work independently or in teams with effective communication.

LIST OF EXPERIMENTS:

1. Test the android development environment by performing the following operations.
    a. Add the sample application to a project in Android studio.
    b. Create an Android Virtual Device (AVD) for sample project.
    c. Create a launch configuration for sample project.
    d. Run a sample application in Android Emulator.
2. Develop a program which will implement Sub menu in android application.
3. Develop a program to implement Context menu (Floating List of Menu Items) in android application.
4. Develop a program to implement Email service by using Relative Layout Views with different attributes.
5. Develop GMaps application by using Linear Layout Views with different attributes.
6. Develop a program to implement a Custom Button and handle the displayed message on button press.
7. Develop a program to implement the Table layout in View Group that displays child View elements in rows and columns.
8. Develop a program to implement the List View in android application.
9. Develop a program to show how to use Date picker control of ADK in android applications.
10. Develop a program to insert, delete, display, and update the employee details using Android SQLite.
11. Design and develop a program to create sign-up and sign-in pages and maintain the user details with SQLite

Mini project: Develop the following applications using Android.
a. Alarm b. Calculator c. Weather application d. Video Player

REFERENCE BOOKS/LABORATORY MANUALS:

1. J. F. DiMarzio, *Beginning Android Programming with Android Studio*, Wiley India, 4th Edition, 2017.
2. Wei – Meng Lee, *Beginning Android 4 Application Development*, Wrox, 2017.
3. Paul Deital and Harvey Deital, *Android How to Program,*Detial Associates Publishers, 1st Edition, 2013.

4. Neils Smyth, *Android Stduio Development Essentials*, Creative Space Independent publishing platform, 7th edition 2016.
5. Jeff McWherter and Scott Gowell, *Professional Mobile Application Development*,Wiley India, 1st Edition, 2012.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	3	3	2	-	-	-	-	-	-	3	-
CO4	2	-	-	2	3	-	-	-	-	-	-	-	2	-	3	-
CO5	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-	-
Average	2	3	3	2	3	3	3	2	3	3	-	3	2	-	3	-
Level of correlation of the course	2	3	3	2	3	3	3	2	3	3	-	3	2	-	3	-

Correlation Level: 3- High 2-Medium 1- Low

IV B. Tech. – I Semester
(19BT71233)**INTERNSHIP**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	100	100	-	-	-	2

PREREQUISITES: -

COURSE DESCRIPTION: Expose students to the industrial environment; Create competent professionals for the industry; sharpen the real time technical / managerial skills required at the job; Gain professional experience and understand engineer's responsibilities and ethics; Familiarize with latest equipment, materials and technologies; Gain exposure to technical report writing; Gain exposure to corporate working culture.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1: Analyze latest equipment, tools and technologies that are used in industry to solve complex engineering problems following relevant standards, codes, policies and regulations.
CO2: Analyze safety, health, societal, environmental, sustainability, economical and managerial factors considered in industry in solving complex engineering problems.
CO3: Perform individually or in a team besides communicating effectively in written, oral and graphical forms on practicing engineering.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	-	-	3	-	-	-	3	3	3	3	3
CO2	-	3	-	-	-	3	3	-	-	-	3	-	3	3	3	3
CO3	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Average	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Level of correlation of the course	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Correlation Level: 3-High 2-Medium 1-Low

IV B. Tech. – I Semester
(19BT712AC)**DATA SCIENCE AND APPLICATIONS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	-	-	2	-	-	-

PRE-REQUISITES: Courses on Data Warehouse and Data Mining and Probability and Statistics.

COURSE DESCRIPTION: Fundamentals of Data Science; The data science process; Mathematical Foundations in Data Science; Text mining and Text analytics; Data visualization.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on Data Science and its process.
CO2. Demonstrate knowledge on mathematical concepts needed in data science.
CO3. Applytext mining techniques to build text classification models.
CO4. Analyze data science process to perform text analytics.
CO5. Develop an interactive dashboard to the end users on different data science applications.

DETAILED SYLLABUS:

UNIT- I: INTRODUCTION TO DATA SCIENCE (5 periods)
About Data Science, Benefits and uses of data science and big data, Facets of data, The Current Landscape of Data Science, Data Science Profile and Thought Experiment Meta-Definition, The big data ecosystem and data science, Overview of Python concepts.

UNIT –II: THE DATA SCIENCE PROCESS (7 periods)
Overview of the data science process, Defining research goals and creating a project charter, Retrieving data, Cleansing, integrating, and transforming data, Exploratory data analysis, Build the models, Presenting findings and building applications.

UNIT- III: MATHEMATICAL FOUNDATIONS IN DATA SCIENCE (7 periods)
Linear algebra, Calculus, Probability and Optimization Techniques for Machine Learning.

UNIT –IV: TEXT MINING AND TEXT ANALYTICS (6 periods)
Text mining in the real world, Text mining techniques, Case Studies: Finding latent variables in a wine quality data set, Predicting malicious URLs, Assessing risk when loaning money and Classifying Reddit posts.

UNIT- V: DATA VISUALIZATION (5 periods)
Data visualization options, Crossfilter, the JavaScript MapReduce library, Creating an interactive dashboard and Dashboard development tools.

Total Periods: 30

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Davy Cielen, Arno D. B. Meysman and Mohamed Ali, *Introduction to Data Science,* Manning Publications Co., 2016.
2. SantanuPattanayak, *Pro Deep Learning with TensorFlow,* Apress, 2017.

REFERENCE BOOKS:

1. Rachel Schutt and Cathy O'Neil, *Doing Data Science*, O'Reilly Media, 2014.
2. Joel Grus, *Data Science from Scratch*, O'Reilly Media, 2015.

ADDITIONAL LEARNING RESOURCES:

1. "Data Science Specialization", https://www.coursera.org/specializations/jhu-data-science.
2. "Programming for Data Science with Python", https://www.udacity.com/course/programming-for-data-science-nanodegree--nd104.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3
CO3	2	2	3	3	3	-	-	-	-	-	-	-	1	-	-	3
CO4	2	3	3	-	-	-	-	-	-	-	-	-	2	-	-	3
CO5	1	3	3	-	-	1	1	-	-	-	-	-	1	-	-	3
Average	2.2	2.66	3	3	3	1	1	-	-	-	-	-	2	-	-	3
Level of correlation of the course	2	3	3	3	3	1	1	-	-	-	-	-	2	-	-	3

Correlation Level: 3- High 2-Medium 1- Low

IV B.Tech. - II Semester
(19BT81231) **PROJECT WORK**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
100	100	200	-	-	-	10

PREREQUISITES: -

COURSE DESCRIPTION:
Identification of topic for the project work; Literature survey; Collection of preliminary data; Identification of implementation tools and methodologies; Performing critical study and analysis of the topic identified; Time and cost analysis; Implementation of the project work; Preparation of thesis and presentation.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Create/Design algorithms and software to solve complex Computer Science, Information Technology and allied problems using appropriate tools and techniques following relevant standards, codes, policies, regulations and latest developments.

CO2. Consider society, health, safety, environment, sustainability, economics and project management in solving complex Computer Science, Information Technology and allied problems.

CO3. Perform individually or in a team besides communicating effectively in written, oral and graphical forms on Computer Science, and Information Technology based systems or processes.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	-	-	3	-	-	-	3	3	3	3	3
CO2	-	-	-	-	-	3	3	-	-	-	3	-	3	3	3	3
CO3	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Average	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Level of correlation of the course	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Correlation Level: 3-Hig 2-Medium 1-Low

HONORS DEGREE

in

Information Technology

(SVEC-19 Regulations)

HONORS DEGREE

INFORMATION TECHNOLOGY

Semester	Course Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
III B.Tech. I-Sem. (2 Theory+ 1 Lab)	19BT51211	Cloud Architectures	3	-	-	3	3	40	60	100
	19BT51212	IoT and Cloud	3	-	-	3	3	40	60	100
	19BT51213	Virtualization Techniques	3	-	-	3	3	40	60	100
	19BT51235	IoT Application Development using Cloud Lab	-	-	2	2	1	50	50	100
III B.Tech. II-Sem. (2 Theory+ 1 Lab)	19BT61210	Cloud Application Development	3	-	-	3	3	40	60	100
	19BT61507	Cloud Security	3	-	-	3	3	40	60	100
	19BT61207	Cloud Storage and Computing	3	-	-	3	3	40	60	100
	19BT61234	Cloud Application Development Lab	-	-	2	2	1	50	50	100
IV B.Tech. I-Sem. (1 Theory+ 1 Lab)	19BT71212	Back up and Disaster Recovery	3	-	-	3	3	40	60	100
	19BT71213	Cloud and DevOps	3	-	-	3	3	40	60	100
	19BT71235	Cloud and DevOps Lab	-	-	2	2	1	50	50	100

III B. Tech. – I Semester

(19BT51211) **CLOUD ARCHITECTURES**

(Honors Degree)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Computer Networks.

COURSE DESCRIPTION: Fundamental Cloud Computing, Concepts and Models; Fundamental and Advanced Architectures; Specialized Architectures and Cloud EA;Cloud Application Architecture; Cloud Data Architecture.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to*:**

CO1. Demonstrate knowledge on Cloud computing, Delivery and Deployment models.
CO2. Analyzetheusage of fundamental and advanced cloud architectures in Cloud.
CO3. Analyze the usage of special and enterprise frameworks & platforms in Cloud.
CO4. Analyze the usage of Enterprise Cloud Application architecture in Cloud.
CO5. Analyze the usage of Enterprise Cloud Data architecture in Cloud.

DETAILED SYLLABUS:

UNIT-I: FUNDAMENTAL CLOUD COMPUTING, CONCEPTS AND MODEL (9 Periods)

Fundamental Cloud Computing: Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges,
Fundamental Concepts and Models: Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.

UNIT-II: FUNDAMENTAL AND ADVANCED ARCHITECTURES (9 Periods)

Fundamental Cloud Architectures: Workload distribution, Resource pooling, Dynamic scalability, Elastic resource capacity, Service load balancing, Cloud bursting, Elastic disk provisioning, Redundant storage.
Advanced Cloud Architectures: Hypervisor Clustering, Load Balanced Virtual Server Instances, Non-Disruptive Service Relocation, Zero Downtime, Cloud Balancing, Resource Reservation, Dynamic Failure Detection and Recovery, Bare-Metal Provisioning, Rapid Provisioning, Storage Workload Management Architecture

UNIT-III: SPECIALIZED ARCHITECTURES AND CLOUD EA (9 Periods)

Specialized Cloud Architectures: Direct I/O Access, Direct LUN Access, Dynamic Data Normalization, Elastic Network Capacity, Cross-Storage Device Vertical Tiering, Intra-Storage Device Vertical Data Tiering, Load Balanced Virtual Switches, Multipath Resource Access, Persistent Virtual Network Configuration, Redundant Physical Connection for Virtual Servers, Storage Maintenance Window.
Frameworks and Platforms: Simplifying EA Development, The Zachman Framework, The Open Group Architecture Framework (TOGAF), The Federal Enterprise Architecture, The Oracle EA Framework, IBM's Actionable EA, Enterprise Architecture Tools

UNIT-IV: CLOUD APPLICATION ARCHITECTURE (9 Periods)

Cloud Application Architecture: Cloud Application Architecture, Services as Enterprise Building Blocks, Amazing Differentiators of SOA, Key Drivers for NG-SOA, Exemplary Enhancements in the Service Paradigm, Exciting Service Capabilities, Dynamic and Converged Service Infrastructures, Direct and Distinct Impacts of NG-SOA.

UNIT-V: CLOUD DATA ARCHITECTURE (9 Periods)

Cloud Data Architecture: A Perspective on Big-Data Computing, A Look at Big-Data Infrastructure, The Hadoop Software Family, Information-Oriented Architecture for Cloud, Environments, A Detailed Look at Data Integration, Data Services, Enterprise Data Mashups, Oracle's Big-Data Solution, Cloud Analytics.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, Thomas Erl and RicardoPuttini, *Cloud Computing- Concepts, Technology and Architecture*, Pearson, 2013.
2. Pethuru Raj, *Cloud Enterprise Architecture*, CRC Press, 2013

REFERENCE BOOKS:

1. Gautam Shroff*, Enterprise Cloud Computing Technology, Architecture, Applications,* Cambridge University Press, 2010.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	2	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-
CO3	2	2	3	3	3	-	-	-	-	-	-	-	-	2	2	-
CO4	2	2	2	3	3	-	-	-	-	-	-	-	-	2	3	-
CO5	2	2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
Average	2.4	2	2.6	3	3	-	-	-	-	-	-	-	-	2	2.6	-
Level of correlation of the course	3	2	3	-	-	-	-	-	-	-	-	-	-	2	3	-

Correlation Level: 3-High 2-Medium 1-Low

III B. Tech. – I Semester

(19BT51212)**IoT and CLOUD**

(Honors Degree)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

Pre-Requisite: A course on Computer Networks.

Course Description: The working of Internet of Things, application of IoT, cloud support for IoT and access data using mobile computing devices.

CourseOutcomes: ***After successful completion the course, the student will be able to*:**

CO1. Demonstrate knowledge on IoT fundamentals and Applications.
CO2. Demonstrate knowledge on hardware requirements of IoT and Communication protocols of IoT.
CO3. Develop IoT applications and deploy through Cloud Platforms.
CO4**.** Develop applications using AWS Cloud andPubNub API.
CO5. Demonstrate knowledge on IoT Operating Systems.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION (9 Periods)

Introduction to IoT: Things in IoT, IoT protocols, IoT communication model, IoT communication APIs, IoT enabling Technologies.

Application of IoT: Home, Cities, Environment, Energy, Retail, Logistics,Agriculture, Industry, Health, Life style, M2M – Machine toMachine, Difference between IoT and M2M. Industry 4.0concepts: cyber physical system, Security aspects in IoT.

UNIT-II: HARDWARE AND COMMUNICATION (9 Periods)

IOT Supported Hardware: Introduction to wireless sensor network, RFID, Sensors, Overview of IoT supported Hardware platforms: Raspberry pi, Arduino and Intel Galileo boards, Beaglebone, ARM Cortex Processors.

Communication in IOT:

Interface protocol, Serial, SPI, I2C, 6LoWPAN, 802.11wifi, 802.15 Bluetooth, 802.15.4 ZigBee, RTLS, GPS, CoAP: Constrained application protocol, RPL: routing protocol for lossy networks, MQTT.

UNIT-III: SERVERS AND CLOUD (9 Periods)

IoT Physical Servers and Cloud: Data retrieval from cloud, Data storage to cloud: datadissemination from sensors of IoT; Cloud Access to Sensors with IBM Bluemix, Juju Framework, Google Cloud Engine; Data visualization.

UNIT-IV: AWS CLOUD AND API (9 Periods)

AWS Cloud: Introduction to AWS IoT, AWS IoT core Services, AWS IoT Console; AWS IoT Quick Connect, Connecting to AWS IoT Core, Managing devices with AWS IoT; Monitoring AWS IoT.

API: PubNub API for IoT to cloud – mobile device as IoT –Mobile cloud access.

UNIT-V: IoT OPERATING SYSTEMS (9 Periods)

IoT Operating Systems: Introduction to Contiki OS and RIOT OS; Proto threads, Tasking; Simple IoT application with border router,implementation of CoAP in Contiki OS.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Arvind Ravulavaru, *Enterprise Internet of Things Handbook: Build end-to-end IoT Solutions using Popular IoT Platforms,*Packt Publishing Ltd, 1st Edition, 2018.
2. ArshdeepBahga, Vijay Madisetti, *Internet of Things: A hands-on Approach*, University Press, 1st Edition, 2015.

REFERENCE BOOKS:

1. Claire Rowland, Elizabeth Goodman, Martin Charlier, Ann Light, AlgredLui,*Designing Connected Products: UX for the consumer internet of things*, O'Reilly,1st Edition, 2016.
2. Peter Waher, *Rethinking the Internet of things: A Scalable Approach to Connecting Learning Internet of Things,* Packt Publishing, 2015.
3. Adrian Mcewen, HakinCassimally, *Designing the Internet of Things*, Wiley India Private Limited, 2014.
4. William Stallings, *Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud*, Addison-Wesley Professional; 1st Edition,2015.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	2	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-
CO3	2	2	3	3	3	-	-	-	-	-	-	-	-	2	2	-
CO4	2	2	2	3	3	-	-	-	-	-	-	-	-	2	3	-
CO5	2	2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
Average	2.4	2	2.6	3	3	-	-	-	-	-	-	-	-	2	2.6	-
Level of correlation of the course	3	2	3	3	3	-	-	-	-	-	-	-	-	2	3	-

Correlation Level: 3-High 2-Medium 1-Low

III B. Tech. – I Semester

(19BT51213) VIRTUALIZATION TECHNIQUES

(Honors Degree)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Computer organization and Computer Networks

COURSE DESCRIPTION: Virtualization and Server Virtualization; Desktop Virtualization, Portable Virtualization, Emulators, and Appliances; Layers of Virtualization; Creating and Installing Virtual Machine; Virtualization Challenges, Cloud Computing and the Forensic Challenges.

CourseOutcomes: ***After successful completion the course, the student will be able to:***

CO1. Demonstrate knowledge on categories of Virtualization and Server Virtualization.
CO2. Demonstrate knowledge on Desktop Virtualization, Emulators and Appliances.
CO3. Demonstrate knowledge on Layers of Virtualization.
CO4. Design and develop virtual machines using windows and Linux.
CO5. Demonstrate the knowledge on virtualization challenges, cloud computing and Forensic Challenges.

DETAILED SYLLABUS:

UNIT-I: VIRTUALIZATION AND SERVER VIRTUALIZATION (9 Periods)

How Virtualization Happens: Physical Machines, How Virtualization Works, Hypervisors, Main Categories of Virtualization-Full Virtualization; Paravirtualization; HardwareAssisted Virtualization; Operating System Virtualization; Application Server Virtualization; Application Virtualization; Network Virtualization; Storage Virtualization; Service Virtualization; Benefits of Virtualization; Cost of Virtualization.

Server Virtualization: What Is Server Virtualization, Differences between Desktop and Server Virtualization, Common Virtual Servers.

UNIT-II: DESKTOP VIRTUALIZATION, PORTABLE VIRTUALIZATION, EMULATORS, AND APPLIANCES (9 Periods)

Desktop Virtualization: What Is Desktop Virtualization, Common Virtual Desktops, Virtual Appliances and Forensics, Virtual Desktops as a Forensic Platform

Portable Virtualization, Emulators, and Appliances: MojoPac, MokaFive, Preconfigured Virtual Environments, Virtual Appliance Providers, JumpBox Virtual Appliances, VirtualBox, Virtualization Hardware Devices, Virtual Privacy Machine, Virtual Emulators

UNIT-III: LAYERS OF VIRTUALIZATION (9 Periods)

Layers of Virtualization: Layers of Virtualization**,** Access Virtualization**,**Application Virtualization, Processing Virtualization, Network Virtualization, Storage Virtualization, Security for Virtual Environments, Management for Virtual Environments

UNIT-IV: CREATING AND INSTALLING VIRTUAL MACHINE (9 Periods)

Creating a Virtual Machine: Performing P2V Conversions, Loading Your Environment, Building a New Virtual Machine.

Installing Windows on a Virtual Machine: Loading Windows into a Virtual Machine-Installing Windows 10; Installing VMware Tools, Understanding Configuration Options, Optimizing a New Virtual Machine.

Installing Linux on a Virtual Machine: Loading Linux into a Virtual Machine- Exploring Oracle VM VirtualBox; Installing Linux into a Virtual Machine; Installing VirtualBox Guest Additions, Understanding Configuration Options, Optimizing a New Linux Virtual Machine.

UNIT-V: VIRTUALIZATION CHALLENGES, CLOUD COMPUTING AND THE FORENSIC CHALLENGES (9 Periods)

Virtualization Challenges: Data Centers, Security Considerations**,** Malware and Virtualization, Red Pill, Blue Pill, No Pill, Additional Challenges, Virtualization Drawbacks.

Cloud Computing and the Forensic Challenges: What Is Cloud Computing?, Cloud Computing Services, Streaming Operating Systems, Application Streaming, VirtualApplications, Cloud Computing, Virtualization, and Security, Cloud Computing and Forensics.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Diane Barrett, and Gregory Kipper*, Virtualization and Forensics A Digital Forensic Investigator's Guide to Virtual Environments,* Syngress, 2010.

REFERENCE BOOKS:

1. Dan Kusnetzky, *Virtualization: A Manager's Guide*, O'Reilly Media, 2011.
2. Matthew Portnoy,*Virtualization Essentials*, Second Edition, Sybex, 2016.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	2	1	3	-	3	-	-	-	-	-	-	-	-	3	-	-
CO5	3	1	-	-		-	-	-	-	-	-	-	-	3	-	-
Average	2.8	1	3	-	3	-	-	-	-	-	-	-	-	3	-	-
Level of correlation of the course	3	1	3	-	3	-	-	-	-	-	-	-	-	3	-	-

Correlation Level: 3-High 2-Medium 1-Low

III B. Tech. –I Semester

(19BT61233)**IoT APPLICATION DEVELOPMENT USING CLOUD LAB**

(Honors Degree)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES:-A course on Computer Networks

COURSE DESCRIPTION: Hands-on practiceon Internet of Things (IoT); Usage of Sensors, *Arduino* microcontroller and *Raspberry Pi* microprocessor; Development of IoT Applications for societal needs; IoT with Cloud environments.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate hands-on experience on IoT.

CO2. Use Sensors, Arduino microcontroller and Raspberry Pi microprocessor for the development of IoT applications.

CO3. Analyze the user requirements for the development of IoT applications.

CO4. Develop IoT applications to solve societal problems using cloud environment.

CO5. Work independently or in teams to solve problems with effective communication

LIST OF EXPERIMENTS:

1. Implement the following using Thingspeak Cloud:
   I. Energy data analysis
   II. Traffic Monitoring System
   III. Weather Prediction System
   IV. Smart Farming
   V. Smart home monitoring
   VI. Pollution MonitoringSystem
   VII. Health Monitoring System
   VIII. Face Detection System
2. Interface to create and interact with your devices using AWS IoT.
3. AWS Based DHT Sensor

   Note: Experiment 1 is mandatory.

REFERENCE BOOKS:

1. ArshdeepBahga and Vijay Madisetti, *Internet of Things-A hands on approach,* 1st Edition, VPI Publications, 2014.
2. Adrian McEwen and HakinCassimally, *Designing the Internet of Things,* Wiley India.
3. Massimo Banzi and Michael Shiloh*, Getting Started with Arduino*, 3rd Edition, Maker Media, 2014.
4. Matt Richardson and Shawn Wallace, *Getting Started with Raspberry Pi*, O'Reilly, 2014.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	2	-	-	-	-	-	-	-	-	3	-	-
CO2	2	2	3	-	2	-	-	-	-	-	-	-	-	3	-	-
CO3	2	2	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO4	2	2	3	2	2	-	-	-	-	-	-	-	-	3	-	-
CO5	2				2	-	-	-	-	-	-	-	-	3	-	-
Average	2.2	2	3	2.5	2	-	-	-	-	-	-	-	-	3	-	-
Level of correlation of the course	2	2	3	3	2	-	-	-	-	-	-	-	-	3	-	-

Correlation Level: 3-High 2-Medium 1-Low

III B.Tech. II Semester

(19BT61210) **CLOUD APPLICATION DEVELOPMENT**

(Honors Degree)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Cloud Computing.

COURSE DESCRIPTION: Introduction to Cloud Computing and Virtualization, Cloud Computing Architecture, Cloud Platforms in Industry, Cloud Applications and Cloud Application Development in Python.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to*:**

CO1. Demonstrate basic concepts and terminologies of Cloud Computing and Virtualization.
CO2. Demonstrate Cloud Architecture and types of Clouds.
CO3. Analyze Cloud Platforms used in industry.
CO4. Apply different Cloud Services and Platforms to construct Cloud applications.
CO5. Design Cloud applications as per societal needs through different design approaches.

DETAILED SYLLABUS

UNIT-I: INTRODUCTION TO CLOUD COMPUTINGAND VIRTUALIZATION (8 Periods)

Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments, Computing Platforms and Technologies, Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization.

UNIT-II: CLOUD COMPUTING ARCHITECTURE (8 Periods)

Introduction, Cloud Reference Model: Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service; Types of Clouds: Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds; Economics of the Cloud, Open Challenges: Cloud Interoperability and Standards, Scalability and Fault Tolerance, Security, Trust, and Privacy, Organizational Aspects.

UNIT-III: CLOUD PLATFORMS IN INDUSTRY (10 Periods)

Amazon Web Services: Compute Services, Storage Services, Communication Services, Additional Services; Google AppEngine: Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations; Microsoft Azure: Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance.

UNIT-IV: CLOUD APPLICATIONS (9 Periods)

Scientific Applications: Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Biology: Gene Expression Data Analysis for Cancer Diagnosis, Geoscience: Satellite Image Processing; Business and Consumer Applications: CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming.

UNIT-V: CLOUD APPLICATION Development in Python (10 Periods)

Design Approaches: Design Methodology for IaaS Service Model, Design Methodology for PaaS Service Model; Image Processing App, Document Storage App, MapReduce App and Social Media Analytics App.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Rajkumar Buyya, Christian Vecchiloa and S ThamaraiSelvi, *Mastering Cloud Computing*, McGraw Hill Education, 2013 (Reprint 2017).
2. ArshdeepBahga and Vijay Madisetti, *CloudComputing – A Hands-on Approach,* Universities Press (India) Private Limited, 2014.

REFERENCE BOOKS:

1. Chris Hay, Brian H. Prince, *Azure in Action***,** Manning Publications, 2011.

ADDITIONAL LEARNING RESOURCES:

1. "Exploring the Google Toolkit", https://code.google.com/, drafted on 30June, 2021.
2. "Understanding Amazon Web Services", https://aws.amazon.com/, drafted on 30June, 2021.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	1	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	2	2	2	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-	2	2	2	-
CO4	1	2	2	-	-	-	-	-	-	-	-	-	1	1	3	-
CO5	1	2	3	-	-	-	-	-	-	-	-	-	1	2	3	-
Average	2.2	2.6	2.5	-	-	-	-	-	-	-	-	-	1.4	1.8	3	-
Level of correlation of the course	3	3	3	-	-	-	-	-	-	-	-	-	2	2	2	-

Mapping Level: 3- High; 2-Medium; 1- Low

III B.Tech. II Semester

(19BT61507) **CLOUD SECURITY**

(Honors Degree)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Cloud Computing.

COURSE DESCRIPTION: Introduction to Cloud Security, Cloud Security Mechanisms, Understanding Cloud Security, Infrastructure and Data Security and Identity and Access and Security Management.

COURSE OUTCOMES: *After successful completion of this course, the students will be able to*:

CO1. Demonstrate knowledge on basic concepts and terminologies of Cloud Security and Mechanisms.
CO2. Demonstrate knowledge on Symmetric and Asymmetric cryptography, Identity and Access Management concepts in Cloud environment.
CO3. Analyze Cloud Infrastructure and Data Security.
CO4. Apply suitable Access Management and Security Management Standards and Protocols for Cloud application authorization.

DETAILED SYLLABUS

UNIT-I: FUNDAMENTALS OF CLOUD SECURITY (10 Periods)

Basic Terms and Concepts: Confidentiality, Integrity, Authenticity, Availability, Threat, Vulnerability,Risk, Security Controls, Security Mechanisms and Security Policies; Threat Agents: Anonymous Attacker, Malicious Service Agent, Trusted Attacker and Malicious Insider; Cloud Security Threats: Traffic Eavesdropping, Malicious Intermediary, Denial of Service, Insufficient Authorization, Virtualization Attack and Overlapping Trust Boundaries; Additional Considerations: Flawed Implementations, Security Policy Disparity Contracts, Risk Management and Case Study Example.

UNIT-II: CLOUD SECURITY MECHANISMS (9 Periods)

Encryption, Symmetric Encryption, Asymmetric Encryption, Case Study Example; Hashing with Case Study Example, Digital Signature with Case Study Example, Public Key Infrastructure (PKI) with Case Study Example, Identity and Access Management (IAM) with Case Study Example, Single Sign-On (SSO) with Case Study Example, Cloud-Based Security Groups with Case Study Example, Hardened Virtual Server Images with Case Study Example; Security Compliances: HIPAA, NIST, and CIS.

UNIT-III: SECURING CLOUD AND DATA (10 Periods)

Securing the Cloud: The security boundary, Security service boundary, Security mapping; Securing Data: Brokered cloud storage access, Storage location and tenancy, Encryption, Auditing and compliance; Establishing Identity and Presence: Identity protocol standards, Windows Azure identity standards, Presence.

UNIT-IV: INFRASTRUCTURE AND DATA SECURITY (9Periods)

InfrastructureSecurity*:* The Network Level, Host Level and Application Level; Data Security: Aspects of Data Security, Data Security Mitigation, Provider Data and Its Security.

UNIT-V: IDNTITY AND ACCESS AND SECURITY MANAGEMENT (8periods)

Identity and Access Management (IAM): Challenges, Definitions, Architecture and Practice, IAM Standards and Protocols for Cloud Services, IAM Standards, Protocols, and Specifications for Consumers, IAM Practices in the Cloud, Cloud Authorization Management, Cloud Service Provider IAM Practice;Security Management in the Cloud: Introduction, Security Management Standards, Security Management in the Cloud.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Tim Mather, Subra Kumarswamy and Shahed Latif*, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance,* O'Reilly, 2009.
2. Thomas Erl and RicardoPuttini, *Cloud Computing- Concepts, Technology and Architecture,* Pearson, 2014 (Seventh Impression 2017).
3. Barrie Sosinsky, *Cloud Computing Bible,* Wiley India Pvt Ltd, 2011 (Reprint 2017).

REFERENCE BOOK:

1. Ronald L. Krutz, Russell Dean Vines, *Cloud Security: A Comprehensive Guide to Secure Cloud Computing,* 2010.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	1	1	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	1	1	2	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-	2	1	2	-
CO4	1	2	3	-	-	-	-	-	-	-	-	-	2	2	3	-
Average	2.25	2.5	3	-	-	-	-	-	-	-	-	-	1.5	1.25	3	-
Level of correlation of the course	3	3	3	-	-	-	-	-	-	-	-	-	2	2	3	-

Mapping Level: 3- High; 2-Medium; 1- Low

III B.Tech. II Semester

(19BT61207) CLOUD STORAGE AND COMPUTING

(Honors Degree)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Cloud Computing

COURSE DESCRIPTION: Introduction to Cloud Computing, Data Storage Networking fundamentals, Cloud Services and Platforms, Cloud Application Design.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to*:**

CO1. Demonstrate basic concepts and terminologies of Cloud Computing,Cloud-based Services and Applications.
CO2. Demonstrate Cloud, Virtualization and Data Storage Networking concepts.
CO3. Analyze Cloud Services, Platforms and Applications.
CO4. Apply different Cloud Services and Platforms to construct Cloud applications.
CO5. Design Cloud applications as per societal needs through different design approaches.

DETAILED SYLLABUS

UNIT-I: INTRODUCTION TO CLOUD COMPUTING (7 Periods)

Introduction, Characteristics of Cloud Computing. Cloud Models, Cloud Services Examples, Cloud-based Services and Applications.

UNIT-II: CLOUD, VIRTUALIZATION, AND DATA STORAGENETWORKING FUNDAMENTALS (9 Periods)

Cloud Concepts and Technologies: Virtualization, Load Balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software Defined Networking, Network Function Virtualization, MapReduce, Identity and Access Management, Service Level Agreements and Billing.

Data Storage Fundamentals: Server and I/O Architectures, Storage Hierarchy, From Bits to Bytes, Disk Storage Fundamentals, Initiators and Targets, How Data Is Written to and Read from a Storage Device, Storage Sharing vs. Data Sharing, Different Types of Storage.

UNIT-III: CLOUD SERVICES AND PLATFORM -I (10 Periods)

Amazon Elastic Compute Cloud, Google Compute Engine, Windows Azure Virtual Machines, Amazon Simple Storage Service, Google Cloud Storage, Windows Azure Storage, Amazon Relational Data Store, Amazon DynamoDB, Google Cloud SQL, Google Cloud Datastore, Windows Azure SQL Database and Windows Azure Table Service.

UNIT-IV: CLOUD SERVICES AND PLATFORM -II (10 Periods)

Application Runtimes and Framework, Queuing Services, Email Services, Notification Services, Media Services, Amazon CloudFront, Windows Azure Content Delivery Network, Amazon Elastic MapReduce, Google MapReduce Service, Google BigQuery, Amazon Elastic Beanstalk and Amazon CloudFormation.

UNIT-V: CLOUD APPLICATION DESIGN (9 Periods)

Introduction, Design Considerations for Cloud Applications, Reference Architectures for Cloud Applications, Cloud Application Design Methodologies and Data Storage Approaches.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. ArshdeepBahga and Vijay Madisetti, *Cloud Computing – A Hands-on Approach,*Universities Press (India) Private Limited, 2014.
2. Greg Schulz,*Cloud and Virtual Data Storage Networking,*CRC Press Taylor & Francis Group, 2012.

REFERENCE BOOKS:

1. Barrie Sosinsky, *Cloud Computing Bible,* Wiley India Pvt Ltd, 2011 (Reprint 2017).
2. Thomas Erl and RicardoPuttini, *Cloud Computing- Concepts, Technology and Architecture,* Pearson, 2014 (Seventh Impression 2017).

ADDITIONAL LEARNING RESOURCES:

1. "Exploring the Google Toolkit", https://code.google.com/, drafted on 21June, 2021.
2. "Understanding Amazon Web Services", https://aws.amazon.com/, drafted on 21June, 2021.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	1	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	2	2	2	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-	2	2	2	-
CO4	1	2	2	-	-	-	-	-	-	-	-	-	1	1	3	-
CO5	1	2	3	-	-	-	-	-	-	-	-	-	1	2	3	-
Average	2	3	3	-	-	-	-	-	-	-	-	-	1.4	1.8	3	-
Level of correlation of the course	2	3	3	-	-	-	-	-	-	-	-	-	1.4	1.8	3	-

Mapping Level: 3- High; 2-Medium; 1- Low

III B. Tech. – II Semester
(19BT61234) CLOUD APPLICATION DEVELOPMENT LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	2	1

PRE-REQUISITES: A course on Cloud Computing.

COURSE DESCRIPTION: The course is designed to provide hands on practice on Zoho, Google, Amazon Web Services, Salesforce.com, Google app Engine and GridSim Clouds.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate hands-on experience on Zoho and Google Cloud Environment.
CO2. Apply Amazon Elastic Compute Cloud (EC2) and Elastic IP to configure Web Server on Amazon Linux Instance and Virtual Private Cloud(VPC).
CO3. Apply Alexa Skills kit and AWS Lambda to perform different operations in Amazon Alexa Cloud Environment.
CO4. Develop and deploy different web applications using Salesforce.com Cloud Platform.
CO5. Create Grid resources and instances for simulating and hosting of Cloud data through GridSim and Google app Engine Cloud Platforms.
CO6. Work independently or in teams to solve problems with effective communication.

List of Exercises/List of Experiments:

Programs on SaaS

1. Create a word document of your class time table and store locally and on the cloud with doc, and pdf format. (use **www.zoho.com** and***docs.google.com)***
2. Create a spread sheet which contains employee salary information andcalculate gross and total sal using the formula:
   DA=10% OF BASIC, HRA=30% OF BASIC, PF=10% OF BASIC IF BASIC<=300012% OF BASIC IF BASIC>3000, TAX=10% OF BASIC IF BASIC<=1500=11% OF BASIC IF BASIC>1500 AND BASIC<=2500=12% OF BASIC IF BASIC>2500
   NET_SALARY=BASIC_SALARY+DA+HRA-PF-TAX.
   (use**www.zoho.com** and ***docs.google.com)***
3. Prepare a ppt on cloud computing – introduction, models, services, and architecture. ***Ppt should contain explanations, images and at least 20 pages***(use **www.zoho.com** and ***docs.google.com)***
4. Create your resume in a neat format using google and zoho cloud.
5. Develop a simple web application for student details and operative usingSalesforce.com in Cloud Platform under Software as a Service (SaaS).
6. Develop a web application for performing calculator operations. Deploy this application on Salesforce.comCloud Platform under Software as a Service (SaaS).

Programs on PaaS

7. Write a Google app engine program to generate n even numbers and deploy it to google cloud.
8. Write a Google app engine program to generate multiply of two matricesand deploy it to google cloud.

Programs using GRIDSIM

9. (a) Program to creates one Grid resource with three machines.
   (b) Program to create one or more Grid users. A Grid user contains one or more Gridlets.
10. (a) Program to shows how two GridSim entities interact with each other; main class creates Gridlets and sends them to the other GridSim entities.
    (b) Program shows how a grid user submits its Gridlets or tasks to one grid resource entity.

Programs using Amazon Web Services (AWS)

11. To configure Web Server on Amazon Linux instance with Elastic IP
12. To Configure Amazon Virtual Private Cloud (VPC)

12.1. To Create your own VPC
12.2. To Create public subnet
12.3. To Create private subnet
12.4. Create an Internet gateway and attach to your VPC
12.5. Create a Public Routing Table, associate subnet and add routing rules
12.6. Create Private Routing Table, associate subnet and add routing rules
12.7. To launch Windows instance in Public subnet
12.8. To launch Windows instance in private Subnet under your VPC
12.9. To Connect to Public subnet instance
12.10. To Connect to Private subnet instance
12.11. To Connect Linux instance in private subnet
12.12. To Connect Linux instance in public subnet

Programs using Amazon Alexa

13. Introduction to Amazon Alexa
    13.1. Introduction to Alexa Skills Kit
    13.2. Working procedure
    13.3. Features
    13.4. Creation of Amazon Developer Account
14. Introduction to AWS Lambda
    14.1. Creating Lambda function using python
15. Database operations using Alexa skills
16. Mini Project: Form a group of maximum 3 members as a team and assign UNIT-V of Cloud Application Development Course Apps for each team.

REFERENCE BOOKS/LABORATORY MANUALS:

1. ArshdeepBahga and Vijay Madisetti, *Cloud Computing – A Hands-on Approach,*Universities Press (India) Private Limited, 2014.
2. Barrie Sosinsky, *Cloud Computing Bible,* Wiley India Pvt Ltd, 2011 (Reprint 2017).
3. Rajkumar Buyya, Christian Vecchiloa and S ThamaraiSelvi, *Mastering Cloud Computing*, McGraw Hill Education, 2013 (Reprint 2017).
4. Lab Manual on Cloud Application Development.

ADDITIONAL LEARNING RESOURCES:

1. "Understanding Amazon Web Services", https://aws.amazon.com/, drafted on 30 June, 2021.
2. "Qwiklabs – Hands-on Cloud Environment", https://www.qwiklabs.com/, drafted on 30 June, 2021.
3. "GridSim", http://www.cloudbus.org/gridsim/, drafted on 30 June, 2021.
4. "Zoho Cloud", https://www.zoho.com/, drafted on 30 June, 2021.
5. "Google Cloud", https://www.google.com/docs/about/, drafted on 30 June, 2021.
6. "Exploring Microsoft Cloud Services", https://www.microsoft.com/windowsazure, drafted on 30 June, 2021.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	1	3	-
CO2	1	2	1	-	3	-	-	-	-	-	-	-	1	1	3	-
CO3	1	2	3	-	2	-	-	-	-	-	-	-	1	1	3	-
CO4	1	2	2	-	3	2	2	2	-	-	-	-	2	1	3	-
CO5	1	2	3	2	3	-	-	-	-	-	-	2	1	1	3	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-
CO7	-	-	-	-	-	-	-	-		3	-	-	-	-	-	-
Average	1.4	2	2.25	2	2.75	2	2	2	3	3	-	2	1.2	1	3	-
Level of correlation of the course	2	2	2	2	3	2	2	2	3	3	-	2	2	1	3	-

Mapping Level: 3- High; 2-Medium; 1- Low

IV B. Tech. – I Semester

(19BT71212) **BACKUP AND DISASTER RECOVERY**

(Honour Degree)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses onCloud Computing and Database Management Systems.

COURSE DESCRIPTION: Basics of Storage; Introduction to Business Continuity; Backup and Archive; Local and Remote Replication; Securing Storage Infrastructure.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to*:**

CO1: Understand the basics of Information Storage.
CO2: Identify, analyze and address risks in Business continuity.
CO3: Understand Backup and Archive.
CO4: Apply the technologies of Local and Remote Replication
CO5: Illustrate Securing storage Infrastructure

DETAILED SYLLABUS:

UNIT I – BASICS OF STORAGE (9 periods)

Data Center Infrastructure - Redundant Array of Inexpensive Disk: Implementation Methods Techniques- Levels- Components of an Intelligent storage Systems - Components of Intelligent Storage Systems - Storage Provisioning

UNIT II – INTRODUCTION TO BUSINESS CONTINUITY (9 periods)

Information Availability - BC Terminology - BC Planning Life Cycle - Failure Analysis - Business Impact Analysis - BC Technology Solutions - Concept in Practice

UNIT III – BACKUP AND ARCHIVE (9 periods)

Backup purpose – Considerations – Granularity - Recovery considerations – Methods - Backup Architecture - Restore Operations - Backup in NAS environments - Backup Targets - Data Deduplication - Backup in virtualized environment - Data Archive.

UNIT IV – LOCAL AND REMOTE REPLICATION (10 periods)

Replication Terminology - Replica Consistency - Local replication Technologies - Tracking changes to source ad Replica - Restore and Restart Considerations - Creating multiple replicas - Local replication in virtualized environment - Remote replication modes and technologies - Three site replication

UNIT V – SECURING STORAGE INFRASTRUCTURE (8 periods)

Risk Triad - Security implementations in FC SAN – NAS - Securing storage infrastructure in virtualized and cloud environments

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Somasundaram Gnanasundaram, Alok Shrivastava, *Information Storage and management, Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments*, 2nd Edition, John Wiley & Sons, Inc. 2012

REFERENCE BOOKS:

1. Andrew Hiles, *The Definitive Handbook of Business Continuity Management*, 3rd Edition, 2010, Wiley
2. Nitin Vengurlekar, Prasad Bagal, *Database Cloud Storage: The essential guide to Oracle Automatic Storage Management*, McGrawHill Education, 2013

ADDITIONAL LEARNING RESOURCES:

E-BOOKS

1. https://pages.awscloud.com/rs/112TZM766/images/AWS004%20B%26R%20eBook%20R4i.pdf

MOOC

1. https://www.udemy.com/course/computercavalry-it-administrator-backups/

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	2	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
Average	3	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
Level of correlation of the course	3	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-

Correlation Levels: 3- High 2-Medium 1- Low

IV B.Tech. I Semester
(19BT71213) **CLOUD AND DEVOPS**
(Honors Degree)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

Pre-Requisite: Courses on Software Engineering and Cloud Computing

COURSE DESCRIPTION: DevOps Fundamentals; Software Development Methodologies; DevOps with Cloud, Collaboration; Architecture Building, Testing And Deployment; Automation, Tools; Operational Issues.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to*:**
CO1. Demonstrate knowledge onconcepts of DevOps practices in Software Development Lifecycle models.
CO2. Apply Cloud platforms to perform DevOps operations**.**
CO3. Apply software Architectural Design, Deployment and testing approaches in Building an efficient software system.
CO4. Use automation tools for software development.
CO5. Understand Operational issues of DevOps.

DETAILED SYLLABUS:

UNIT- I: FOUNDATION TERMINOLOGY AND CONCEPTS (9 Periods)
Introduction: What is Devops, A History of Devops, Foundational Terminology and Concepts
Software Development Methodologies: Operations Methodologies; Systems Methodologies: Development, Release and Deployment Concepts; Infrastructure Concepts; Cultural Concepts; Devops Misconceptions and Anti-Patterns; The Four Pillars of Effective Devops.

UNIT- II: THE CLOUD AS A PLATFORM AND OPERATIONS (9 Periods)
Features of the Cloud: DevOps Consequences of the Unique Cloud Features; Operations Services: Service Operation Functions; Continual Service Improvement: Operations and DevOps.
Collaboration: Defining Collaboration: Individual Differences and Backgrounds; Opportunities for Competitive Advantage: Mentorship; Introducing Mindsets: Mindsets and Learning Organizations: Reviews and Rankings, Communication and Conflict Resolution Styles: Empathy and Trust; Collaboration Misconceptions: Collaboration Troubleshooting.

UNIT- III: ARCHITECTURE BUILDING, TESTING AND DEPLOYMENT(9 Periods)
Overall Architecture: Structure Quality Discussion of Microservice Architecture; Amazon's Rule for teams; Microservice Adoption for Existing Systems.
Building and Testing: Moving a System through the Deployment Pipeline; Cross cutting Aspects; Development and Pre-commit Testing; Build and integration Testing.
Deployment: Strategies for Managing a Deployment; Logical Consistency, Packaging; Deploying to multiple Environments, Partial Deployment, Rollback.

UNIT- IV: TOOLS AND ECOSYSTEM (9 Periods)
Software Development: Automation, and Monitoring;
Evolution of the Ecosystem: Automation; The Impacts of Tools on Culture, Selection of Tools; Auditing Your Tool Ecosystem.
Case Studies: Examining DramaFever, Examining Etsy.

UNIT- V: BUILDING BRIDGES WITH THE FOUR PILLARS OF EFFECTIVE DEVOPS
(9 Periods)

Explicit and Implicit Stories: Devops in Theory and in Practice, Interorganizational Interactions, Encouraging Interorganizational Affinity.

Operations as a Process: Motivation and Overview, Offline Activities, Online Activities; Error Diagnosis, Monitoring; The Future of DevOps: Organizational Issues, Process Issues, Technology Issues.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Jennifer Davis, Ryn Daniels, *Effective DevOps*, First Edition, O'Reilly Media, Inc. June 2016.
2. Len Bass, Ingo Weber and Liming Zhu, *DevOps: A Software Architect's Perspective*, Pearson Education, 2016.

REFERENCES:

1. Bernd Bruegge, Alan H Dutoit, *Object-Oriented Software Engineering*, 2nd edition, PearsonEducation, 2004.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	1	3	-
CO2	3	2	3	-	2	-	-	-	-	-	-	-	2	2	2	-
CO3	2	3	3	-	2	-	-	-	-	-	-	-	2	2	2	-
CO4	2	2	2	-	3	-	-	-	-	-	-	-	1	1	3	-
CO5	2	-	-	-	2	-	-	-	-	-	-	-	1	2	3	-
Average	2.4	2.3	2.6	-	2.3	-	-	-	-	-	-	-	1.4	1.6	2.6	-
Level of correlation of the course	3	3	3	-	3	-	-	-	-	-	-	-	2	2	3	-

Correlation Levels: 3- High 2-Medium 1-Low

IV B. Tech. –I Semester
(19BT71235)**CLOUD AND DEVOPS LAB**
(Honors Degree)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

Pre-requisite of course: A Course on Software Engineering and Cloud and DevOps.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to*:**
CO1. Understand DevOps as a practice, methodology and process for fast collaboration, integration and communication between Development and Operations team.
CO2. Demonstrate skills in Continuous Integration, Continuous Deployment, Continuous Delivery,Configuration Management and Continuous Monitoring of software application.
CO3. Deploy the web application package to Azure environments with a Continuous Delivery (CD) Release Pipeline
CO4. Build a web application package in a Continuous Integration (CI) Build Pipeline
CO5. Work independently or in teams to solve problems with effective communication skills.

LIST OF EXPERIMENTS:
1. Create and Set up Azure environment for DevOps using Azure Cloud Shell
2. Agile Project Management: Planning and Portfolio Management with Azure Boards
    a. Working with teams, areas, and iterations
    b. Working with work items
    c. Managing sprints and capacity
    d. Customizing Kanban boards
    e. Defining dashboards
    f. Customizing team process
3. Create a build and release agent using Azure Cloud
4. Import Code and Create the Azure DevOps Build Pipeline
5. Create an App Service Plan and an Azure Function App
6. Add an Azure Function, a subscription key to application settings using Azure Cloud
7. Test the Azure Function, View blob metadata in Azure Cloud Environment
8. Use a Logic App for a custom workflow in Azure Cloud

REFERENCES:

1. Jennifer Davis, Ryn Daniels, - Effective DevOps, First Edition, O'Reilly Media, Inc. June 2016.
2. Len Bass, Ingo Weber and Liming Zhu, —DevOps: A Software Architect‟s Perspective‖, Pearson Education, 2016
3. Azure Portal: https://portal.azure.com
4. Azure Docs: https://docs.microsoft.com/en-us/azure/
5. Azure Architecture Centre: https://docs.microsoft.com/en-us/azure/architecture/
6. https://olohmann.github.io/azure-hands-on-labs/
7. https://github.com/olohmann/azure-hands-on-labs
8. Azure-DevOps-CI-CD-Pipeline-Practical-Guide.pdf
9. https://docs.microsoft.com/en-us/azure/architecture/

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	1	3	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	2	2	-
CO3	2	3	2	2	3	-	-	-	-	-	-	-	-	2	2	-
CO4	3	2	2	2	3	-	-	-	-	-	-	-	-	1	3	-
CO5	3	2	2	-	-	2	-	-	3	3	-	-	-	2	3	-
Average	2.6	2.6	2	2	3	2	-	-	3	3	-	-	-	1.8	3	-
Level of correlation of the course	3	3	2	2	3	2	-	-	3	3	-	-	-	2	2	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

MINOR DEGREE

(SVEC-19 Regulations)

MINOR DEGREE IN
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Offering Department: Computer Science and Engineering
Students of Eligible Branches: ECE, EEE, EIE, ME and CE

COURSE STRUCTURE

Year &Semester	Course Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
III B.Tech. I-Sem (2 Theory + 1 Lab)	19BT50502	Artificial Intelligence	3	-	-	3	3	40	60	100
	19BT60505	Soft Computing	3	-	-	3	3	40	60	100
	19BT50507	Python for Data Science	3	-	-	3	3	40	60	100
	19BT50534	Python for Data Science Lab	-	-	2	2	1	50	50	100
III B.Tech. II-Sem (2 Theory + 1 Lab)	19BT70502	Data Science	3	-	-	3	3	40	60	100
	19BT60507	Nature Inspired Algorithms	3	-	-	3	3	40	60	100
	19BT60502	Machine Learning	3	-	-	3	3	40	60	100
	19BT60531	Machine Learning Lab	-	-	2	2	1	50	50	100
IV B.Tech. I-Sem (1 Theory + 1 Lab)	19BT71503	Deep Learning	3	-	-	3	3	40	60	100
	19BT70533	Deep Learning Lab	-	-	2	2	1	50	50	100

Note: If any student has chosen a course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s for the Minordegree.It is the responsibility of the student to acquire/complete prerequisite before taking therespective course.

III B. Tech. – I Semester
(19BT50502) ARTIFICIAL INTELLIGENCE

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Introduction to artificial intelligence, Designing intelligent agents, Solving general purpose problems, Search in complex environments, Probabilistic reasoning, Represent knowledge and reason under uncertainty, Robotics, Ethics and safety in AI.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Architect intelligent agents using artificial intelligence techniques and principles.
CO2. Analyze and interpret the problem, identify suitable solutions using heuristic functions, optimization algorithms and search algorithms.
CO3. Select and apply appropriate knowledge representation to build Bayesian network models to reason under uncertainty.
CO4. Investigate robot hardware and frameworks for intelligent robotic perception.
CO5. Demonstrate knowledge on ethical implications of intelligent machines for providing privacy, trust, security and safety.

DETAILED SYLLABUS:

UNIT–I: INTRODUCTION TO ARTIFICIAL INTELLIGENCE (10 periods)
Foundations of artificial intelligence, History of artificial intelligence, State of the art, Risks and benefits of AI, Intelligent agents – Agents and environments, The concept of rationality, Structure of agents.

UNIT–II: PROBLEM SOLVING BY SEARCHING (9 periods)
Problem solving agents, Search algorithms, Uninformed search strategies, Informed search strategies – Greedy best-first search, A* search; Heuristic functions.

UNIT–III: SEARCH IN COMPLEX ENVIRONMENTS (9 periods)
Local search algorithms and optimization problems – Hill-climbing search, Simulated annealing, Local beam search, Evolutionary algorithms; Optimal decisions in games – The minimax search algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Move ordering; Monte Carlo tree search.

UNIT–IV: PROBABILISTIC REASONING (9 periods)
Representing Knowledge in an uncertain domain, Semantics of Bayesian networks, Probabilistic reasoning over time – Time and uncertainty, Inference in temporal models, Hidden Markov models, Kalman Filter.

UNIT–V: ROBOTICS, ETHICS AND SAFETY IN AI (8 periods)
Robotics: Robots, Robot hardware, Robotic perception, Alternative robotic frameworks, Application domains.
Ethics and Safety in AI: Limits of AI, Ethics of AI – Surveillance, security and privacy, Fairness and bias, Trust and transparency, AI safety.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Stuart Russell, Peter Norvig, *Artificial Intelligence: A Modern Approach*, Prentice Hall, 4th Edition, 2020.

REFERENCE BOOKS:

1. Stephen Lucci, Danny Kopec, *Artificial Intelligence in the 21st Century*, Mercury Learning and Information, 3rd Edition, 2018.
2. Rich, Knight, Nair, *Artificial intelligence*, Tata McGraw Hill, 3rd Edition, 2009.
3. Deepak Khemani, *A First Course in Artificial Intelligence*, McGraw Hill, 2017.
4. Saroj Kaushik, *Artificial Intelligence,* Cengage Learning, 2011.

ADDITIONAL RESOURCES:

- https://searchenterpriseai.techtarget.com/definition/AI-Artificial-Intelligence
- http://aima.cs.berkeley.edu/
- https://ai.google/education/
- https://www.coursera.org/courses?query=artificial%20intelligence
- https://www.edureka.co/blog/artificial-intelligence-with-python/

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	-	-	-	-	1	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-
Average	3	2.3	2	-	-	1	-	2	-	-	-	-	-	3	-	-
Level of correlation of the course	3	3	2	-	-	1	-	2	-	-	-	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester
(19BT60505)**SOFT COMPUTING**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Soft computing technique concepts, Supervised learning networks, Unsupervised learning networks, Genetic algorithms, Fuzzy logic, Hybrid soft computing techniques and applications.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Investigate soft computing techniques for solving computational problems.
CO2. Design efficient neural architectures to model patterns for a given learning problem.
CO3. Investigate and solve optimization problems using genetic algorithms.
CO4. Apply fuzzy logic and reasoning to handle uncertainty in engineering problems.
CO5. Develop intelligent solutions using hybrid soft computing techniques to solve problems of multidisciplinary domains.

DETAILED SYLLABUS:

UNIT–I: INTRODUCTION TO SOFT COMPUTING AND SUPERVISED LEARNING NETWORKS (10 periods)

Introduction to Soft Computing: Neural networks, Application scope of neural networks, Fuzzy logic, Genetic algorithm, Hybrid systems, Soft computing.

Artificial Neural Networks: Fundamentals, Basic Models, Terminologies, Linear Separability, Hebb network.

Supervised Learning Networks: Perceptron Networks- Theory, Perceptron learning rule, Architecture, Flowchart for training process, Perceptron training algorithm for single and multiple output classes, Perceptron network testing algorithm; Back-Propagation Network - Theory, Architecture, Flow chart for training process, Training algorithm, Learning factors of back-propagation network, Testing algorithm for back-propagation network.

UNIT–II: UNSUPERVISED LEARNING NETWORKS (8 periods)

Fixed weight competitive nets – Maxnet, Mexican Hat Net, Hamming network; Kohonen self-organizing feature maps – Theory, Architecture, Flowchart, Training algorithm; Learning vector quantization – Theory, Architecture, Flowchart, Training algorithm, Variants; Counterpropagation networks – Theory, Full counterpropagation Net, Forward-only counterpropagation Net; Adaptive resonance theory network – Fundamental architecture, Fundamental operating principle, Fundamental algorithm.

UNIT–III: GENETIC ALGORITHMS (9 periods)

Genetic algorithms - Biological background, Traditional optimization and search techniques, Genetic algorithm and search space, Genetic algorithms vs. traditional algorithms, Basic terminologies in genetic algorithm, Simple GA, General genetic algorithm, Operators in genetic algorithm, Stopping condition for genetic algorithm flow, Constraints in genetic algorithm, Problem solving using genetic algorithm, Adaptive genetic algorithms, Hybrid genetic algorithms, Advantages and limitations of genetic algorithm, Applications of genetic algorithm.

UNIT–IV: FUZZY LOGIC (11 periods)

Introduction to fuzzy logic, Classical sets, Fuzzy sets, Membership function – Features, Fuzzification, Methods of membership value assignments; Fuzzy arithmetic and measures – Fuzzy arithmetic, Extension principle, Fuzzy measures, Measures of fuzziness, Fuzzy integrals; Fuzzy rule base and approximation reasoning - Truth values and tables in fuzzy logic, Fuzzy propositions, Formation of rules, Compound rules, Aggregation of fuzzy rules,

Fuzzy reasoning, Fuzzy inference systems, Overview of fuzzy expert system; Fuzzy decision making, Fuzzy logic control systems.

UNIT–V: HYBRID SOFT COMPUTING TECHNIQUES AND APPLICATIONS

(7 periods)

Hybrid Soft Computing Techniques: Genetic neuro hybrid systems, Genetic fuzzy hybrid and fuzzy genetic hybrid systems.

Applications of Soft Computing: Optimization of traveling salesman problem using genetic algorithm approach, Genetic algorithm-based internet search technique, Soft computing-based hybrid fuzzy controllers, Soft computing-based rocket engine control.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. S. N. Sivanandam and S. N. Deepa, *Principles of Soft Computing*, Wiley, 3rd Edition, 2019.

REFERENCE BOOKS:

1. S. Rajasekaran and G. A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic and Genetic Algorithms:* Synthesis and Applications, PHI Learning Private Ltd, 2011.
2. Udit Chakraborty, Samir Roy, *Soft Computing: Neuro-Fuzzy and Genetic Algorithms,* Pearson, 2013.
3. Saroj Kaushik, Sunita Tewari, *Soft Computing: Fundamentals, Techniques and Applications*, McGraw Hill, 2018.

ADDITIONAL LEARNING RESOURCES:

- https://nptel.ac.in/courses/106105173/

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	1	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	-	-	2	-	-	-	-	-	-	-	3	-	-
Average	3	2.5	3	1	-		-	-	-	-	-	-	-	3	-	-
Level of correlation of the course	3	3	3	1	-	2	-	-	-	-	-	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester
(19BT50507) PYTHON FOR DATA SCIENCE

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Basics of Data Science, Computation using NumPy, Data exploration using Pandas, Data transformation, Plotting and visualization using Matplotlib, Time series analysis.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on the concepts of data science to perform mathematical computations using efficient storage and data handling methods in NumPy.
CO2. Apply data preparation and exploration methods using Pandas to perform data manipulation.
CO3. Create data visualization using charts, plots and histograms to identify trends, patterns and outliers in data using Matplotlib and Seaborn.
CO4. Develop methods to analyze and interpret time series data to extract meaningful statistics.

DETAILED SYLLABUS:

UNIT–I: INTRODUCTION (10 periods)
Basic terminologies of data science, Types of data, Five steps of data science, The NumPy ndarray, Fast element-wise array functions, Array-oriented programming with arrays, File input and output with arrays, Linear algebra, Pseudorandom number generation.

UNIT–II: DATA EXPLORATION WITH PANDAS (10 periods)
Process of exploring data, Pandas data structures – Series, Data frame, Index objects; Essential functionality, Summarizing and computing descriptive statistics, Data loading, storage, and file formats – Reading and writing data in text format, Reading text files in pieces, Writing data to text format; Reading Microsoft Excel files.

UNIT–III: DATA CLEANING AND PREPARATION (8 periods)
Handling missing data – Filtering out missing data, Filling in missing data; Data transformation – Removing duplicates, Transforming data using a function or mapping, Replacing values, Renaming axis indexes, Discretization and binning, Detecting and filtering outliers, Permutation and random sampling, Computing indicator/dummy variables; String manipulation – String object methods, Regular expressions, Vectorized string functions in Pandas.

UNIT–IV: DATA VISUALIZATION WITH MATPLOTLIB (8 periods)
Plotting with Matplotlib – Figures and subplots, Colors, markers and line styles, Ticks, labels and legends, Annotations and drawing on a subplot, Saving plots to file; Plotting with Pandas and Seaborn – Line plots, Bar plots, Histograms and density plots, Scatter plots, Facet grids and categorical data.

UNIT–V: TIME SERIES ANALYSIS (9 periods)
Date and time data types and tools, Time series basics, Date ranges, frequencies, and shifting, Time zone handling, Periods and period arithmetic, Resampling and frequency conversion, Moving window functions.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Wes McKinney, *Python for Data Analysis*, O'Reilly Publishers, 2nd Edition, 2017.

REFERENCE BOOKS:

1. Sinan Ozdemir, *Principles of Data Science*, Packt Publishers, 2nd Edition, 2018.
2. John Paul Mueller, Luca Massaron, Python for Data Science for Dummies, 2nd Edition, Wiley, 2015.
3. Rachel Schutt, Cathy O'Neil, *Doing Data Science: Straight Talk from the Frontline*, O'Reilly, 2014.

ADDITIONAL LEARNING RESOURCES:

- https://swayam.gov.in/nd1_noc19_cs60/preview
- https://towardsdatascience.com/
- https://www.w3schools.com/datascience/
- https://github.com/jakevdp/PythonDataScienceHandbook
- https://www.kaggle.com

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	1	3	-	-	-	-	-	-	-	3	-	2	2
CO2	3	3	2	2	3	-	-	-	-	-	-	-	3	-	2	2
CO3	3	3	2	2	3	-	-	-	-	-	-	-	3	-	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	-	2	2
Average	3	3	2	2	3	-	-	-	-	-	-	-	3	-	2	2
Level of correlation of the course	3	3	2	2	3	-	-	-	-	-	-	-	3	-	2	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester

(19BT50534) **PYTHON FOR DATA SCIENCE LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Python for Data Science

COURSE DESCRIPTION: Hands on practice on the concepts of data science using Python - Computations using NumPy, Data manipulation using Pandas, Data cleaning and preparation, Data visualization using Matplotlib and Seaborn, Time series analysis.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate efficient storage and data handling methods in NumPy to perform mathematical computations vital for data science.
CO2. Apply data preparation and data exploration methods using Pandas to perform data manipulation.
CO3. Create data visualization using charts, plots and histograms to identify trends, patterns and outliers in data importing Matplotlib and Seaborn.
CO4. Develop methods to analyze and interpret time series data to extract meaningful statistics.
CO5. Work independently to solve problems with effective communication.

LIST OF EXERCISES:

1. Array Computations using NumPy
   a) Perform arithmetic operations using array.
   b) Perform slicing and indexing on multi-dimensional arrays.
   c) Perform computations on multi-dimensional array using universal functions (ufunc).
   d) Compute arithmetic mean, standard deviation, variance, percentile, minimum and maximum, cumulative sum and product using statistical functions in NumPy.
   e) Perform set theory operations such as union, intersection, symmetric difference and fetching unique values.
2. Linear Algebra and Random Number generation using linalg and random module in NumPy
   a) Compute dot product, vector product and inner product of two arrays.
   b) Perform matrix operations such as multiplication, determinant, sum of diagonal elements and inverse.
   c) Compute eigenvalues, eigenvectors and singular value decomposition for a square matrix.
   d) Generate random samples from uniform, normal, binomial, chi-square and Gaussian distributions using numpy.random functions.
   e) Implement a single random walk with 1000 steps using random module and extract the statistics like minimum and maximum value along the walk's trajectory.
3. Data Manipulation using pandas
   a) Create DataFrame from List, Dict, List of Dicts, Dicts of Series and perform operations such as column selection, addition, deletion and row selection, addition and deletion.
   b) Create a DataFrame and perform descriptive statistics functions such as sum, mean, median, mode, standard deviation, skewness, kurtosis, cumulative sum, cumulative product and percent changes.
   c) Implement the computation of correlation and covariance by considering the DataFrames of stock prices and volumes obtained from Yahoo Finance! Using pandas-datareader package.

4. Working with different data formats using pandas
    a) Perform reading and writing data in text format using read_csv and read_table considering any online dataset in delimited format (CSV).
    b) Perform reading and writing of Microsoft Excel Files (xslx) using read_excel.
5. Data Cleaning and Preparation
    a) Perform data cleaning by creating a DataFrame and identifying missing data using NA(Not Available) handling methods, filter out missing data using dropna function, fill the missing data using fillna function and remove duplicates using duplicated and drop_duplicates functions.
    b) Perform data transformation by modifying set of values using map and replace method and create transformed version of original dataset without modification using rename method.
    c) Create a DataFrame with normally distributed data using random sampling and detect possible outliers.
6. Perform Data Visualization with Matplotlib and Seaborn considering online dataset for processing.
    a) Create a Line Plot by setting the title, axis labels, ticks, ticklabels, annotations on subplots and save to a file.
    b) Create Bar Plots using Series and DataFrame index.
        i) Create bar plots with a DataFrame to group the values in each row together in a group in bars side by side for each value.
        ii) Create stacked bar plots from a DataFrame.
    c) Create Histogram to display the value frequency and Density Plot to generate continuous probability distribution function for observed data.
    d) Create Scatter Plot and examine the relationship between two one-dimensional data series.
    e) Create Box plots to visualize data with many categorical variables.
7. Time Series Analysis
    a) Create time series using datetime object in pandas indexed by timestamps.
    b) Use pandas.date_range to generate a DatetimeIndexwith an indicated length.
    c) Perform period arithmetic such as adding and subtracting integers from periods and construct range of periods using period_range function.
    d) Convert Series and DataFrame objects indexed by timestamps to periods with the to_periodmethod.
    e) Perform resampling, downsampling and upsampling for the time series.

REFERENCE BOOKS:

1. Wes McKinney, *Python for Data Analysis*, O'Reilly, 2nd Edition,2017.
2. John Paul Mueller, Luca Massaron, Python for Data Science For Dummies, 2nd Edition, Wiley, 2015.

SOFTWARE/TOOLS:

- Python 3.8
- Python Libraries – NumPy, Pandas, Matplotlib,
- Anaconda Framework

ADDITIONAL LEARNING RESOURCES:

- https://swayam.gov.in/nd1_noc19_cs60/preview
- https://towardsdatascience.com/
- https://www.w3schools.com/datascience/
- https://github.com/jakevdp/PythonDataScienceHandbook
- https://www.kaggle.com

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	1	3	-	-	-	-	-	-	-	3	-	2	2
CO2	3	3	2	2	3	-	-	-	-	-	-	-	3	-	2	2
CO3	3	3	2	2	3	-	-	-	-	-	-	-	3	-	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	-	2	2
CO5	-	-	-	-	-	-	-	-	3	3	-	-	3	-	2	2
Average	3	3	2	2	3	-	-	-	3	3	-	-	3	-	2	2
Level of correlation of the course	3	3	2	2	3	-	-	-	3	3	-	-	3	-	2	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – II Semester
(19BT70502) DATA SCIENCE

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Concepts of data science, Extracting meaning from data, The dimensionality problem, Plotting with pandas and seaborn, Probability distributions, Time series analysis, Predictive modeling.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on the concepts of data science to perform data analysis.
CO2. Develop methods to extract meaning from data using feature selection techniques.
CO3. Create data visualization using charts, plots and histograms to identify trends, patterns and outliers in data using Matplotlib and Seaborn.
CO4. Develop distribution functions to analyze and interpret data to extract meaningful statistics.
CO5. Design and develop predictive models for a given problem to support prediction and forecasting.

DETAILED SYLLABUS:

UNIT–I: INTRODUCTION (9 periods)

Definition of data science, Skills for data science, Tools for data science, Data types, Data collections, Data preprocessing, Data analysis and data analytics, Descriptive analysis, Diagnostic analytics, Predictive analytics, Prescriptive analytics, Exploratory analysis, Mechanistic analysis.

UNIT–II: DATA EXTRACTION (9 periods)

Extracting meaning from data – Feature selection, User retention, Filters, Wrappers, Entropy, Decision tree algorithm; Random forests, The dimensionality problem, Single value decomposition, Principal component analysis.

UNIT–III: DATA VISUALIZATION (8 periods)

A Brief matplotlib API primer, Plotting with Pandas and Seaborn – Line plots, Bar plots, Histograms and density plots, Scatter plots, Facet grids and Categorical data; Other Python visualization tools.

UNIT–IV: STATISTICAL THINKING (11 periods)

Distributions – Representing and plotting histograms, Outliers, Summarizing distributions, Variance, Reporting results; Probability mass function – Plotting PMFs, Other visualizations, The class size paradox, Data frame indexing; Cumulative distribution functions - Limits of PMFs, Representing CDFs, Percentile based statistics, Random numbers, Comparing percentile ranks; Modeling distributions - Exponential distribution, Normal distribution, Lognormal distribution.

UNIT–V: TIME SERIES ANALYSIS AND PREDICTIVE MODELING (8 periods)

Time series analysis – Importing and cleaning, Plotting, Moving averages, Missing values, Serial correlation, Autocorrelation; Predictive modeling – Overview, Evaluating predictive models, Building predictive model solutions, Sentiment analysis.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Chirag Shah, *A Hands-on Introduction to Data Science*, Cambridge University Press, 2020.
2. Alen B. Downey, *Think Stats: Exploratory Data Analysis*, O'Reilly, 2nd Edition, 2014.

REFERENCE BOOKS:

1. Wes McKinney, *Python for Data Analysis*, O'Reilly, 2nd Edition, 2017.
2. OferMendelevitch, Casey Stella, Douglas Eadline, *Practical Data science with Hadoop and Spark: Designing and Building Effective Analytics at Scale*, Addison Wesley, 2017.
3. Rachel Schutt, Cathy O'Neil, *Doing Data Science: Straight Talk from the Frontline*, O'Reilly, 2014.
4. Jake VanderPlas, *Python Data Science Handbook: Essential Tools for Working with Data*, O'Reilly, 2017.

ADDITIONAL LEARNING RESOURCES:

- https://swayam.gov.in/nd1_noc19_cs60/preview
- https://towardsdatascience.com/
- https://www.w3schools.com/datascience/
- https://github.com/jakevdp/PythonDataScienceHandbook
- https://www.kaggle.com

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	1	-	-	-	-	-	-	-	-	3	-	-	2
CO2	3	3	2	2	1	-	-	-	-	-	-	-	3	-	-	2
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	-	-	2
CO4	3	3	2	2	2	-	-	-	-	-	-	-	3	-	-	2
CO5	3	3	2	2	2	1	-	-	-	-	-	-	3	-	-	2
Average	3	3	2.25	2.25	1.75	1	-	-	-	-	-	-	3	-	-	2
Level of correlation of the course	3	3	3	3	2	1	-	-	-	-	-	-	3	-	-	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – II Semester
(19BT60507) NATURE INSPIRED ALGORITHMS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Optimization, Classical optimization techniques, Nature inspired algorithms, Genetic algorithm, Particle swarm optimization, Ant colony optimization, Bee colony optimization, Cuckoo search algorithm, Firefly algorithm, Bat algorithm, Gray wolf optimization, Elephant herding optimization, Applications of nature inspired algorithms.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on optimization and classical optimization techniques to find optimal solutions for a given problem.
CO2. Analyze the key components and mathematical aspects of nature inspired algorithms.
CO3. Design efficient solutions for optimization problems using nature inspired algorithms.
CO4. Investigate the applications of nature inspired algorithms to solve wide range of optimization problems.

DETAILED SYLLABUS:

UNIT–I: INTRODUCTION TO OPTIMIZATION (9 periods)

Introduction to Optimization: Fundamentals of optimization, Types of optimization problems, Examples of optimization, Formulation of optimization problems, Classification of optimization algorithms, Traveling salesman problem, Knapsack problem.

Classical Optimization Techniques: Mathematical model of optimization, Linear programming – Simplex method, Revised simplex method, Kamarkar's method, Duality theorem, Decomposition principle, Transportation problem; Nonlinear Programming – Quadratic programming, Geometric programming; Dynamic programming, Integer programming, Stochastic programming, Lagrange multiplier method.

UNIT–II: NATURE INSPIRED ALGORITHMS AND GENETIC ALGORITHM (8 periods)

Nature Inspired Algorithms: Traditional vs nature inspired algorithms, Bioinspired algorithms, Swarm intelligence, Metaheuristics, Diversification and intensification, No free lunch theorem, Parameter tuning and control, Algorithm.

Genetic Algorithm: Basics, Genetic operators, Example of GA, Algorithm, Schema theory, Prisoner's dilemma problem, Variants and hybrids of GA.

UNIT–III: PARTICLE SWARM, ANT COLONY, BEE COLONY AND CUCKOO SEARCH OPTIMIZATION ALGORITHMS (10 periods)

Particle Swarm Optimization: Swarm behavior, Algorithm, Variants of algorithm.

Ant Colony Optimization: Ant colony characteristics, Ant colony optimization – Travelling salesman problem, algorithm; Variants of algorithm.

Bee Colony Optimization: Honey bee characteristics, Algorithm, Variants of algorithm.

Cuckoo Search Algorithm: Cuckoo bird behavior, Levy flights, Algorithm, Variants of algorithm.

UNIT–IV: FIREFLY, BAT, GRAY WOLF AND ELEPHANT HERDING OPTIMIZATION ALGORITHMS (9 periods)

Firefly Algorithm: Firefly behavior and characteristics, Algorithm, Variants and applications.

Bat Algorithm: Behavior of bats in nature, Algorithm, Variants and applications.

Gray Wolf Optimization: Gray wolf characteristics, Gray wolf optimization, Variants and applications.
Elephant Herding Optimization: Elephant herding behavior, Algorithm, Pseudocode, Variants of the algorithm.

UNIT–V: APPLICATIONS OF NATURE INSPIRED ALGORITHMS (9 periods)
Image processing, Classification, clustering and feature selection, Traveling salesman problem, Vehicle routing, Scheduling, Software testing, Deep belief networks, Swarm robots, Data mining and deep learning – Clustering, Support vector machines, Artificial neural networks, Optimizers for machine learning, Deep learning.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:
1. A. Vasuki, *Nature-Inspired Optimization Algorithms,* CRC Press, 2020.
2. Xin-She Yang, *Nature-Inspired Optimization Algorithms,* Elsevier, 2nd Edition, 2020.

REFERENCE BOOKS:
1. Xin-She Yang, Xing-Shi He, *Mathematical Foundations of Nature-Inspired Algorithms*, Springer, 2019.
2. George Lindfield, John Penny, *Introduction to Nature-Inspired Optimization,* Elsevier, 2017.

ADDITIONAL LEARNING RESOURCES:
- Xin-She Yang, *Nature-Inspired Computation and Swarm Intelligence: Algorithms, Theory and Applications,* Elsevier, 2020.
- Hema Banati, Shikha Mehta, Parmeet Kaur, *Nature-Inspired Algorithms for Big Data Frameworks*, IGI Global, 2019.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	3	3	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2
Average	2.75	2.5	3	-	-	-	-	-	-	-	-	-	-	2	-	2
Level of correlation of the course	3	3	3	-	-	-	-	-	-	-	-	-	-	2	-	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – II Semester
(19BT60502) **MACHINE LEARNING**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Concept learning, General to specific ordering, Decision tree learning, Support vector machine, Artificial neural networks, Multilayer neural networks, Bayesian learning, Instance based learning, reinforcement learning.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze the concept learning algorithms to automatically infer a general description for a given learning problem.
CO2. Analyze the underlying mathematical models within machine learning algorithms and learning tasks.
CO3. Evaluate and apply suitable machine learning algorithms for various types of learning tasks.
CO4. Design efficient neural architectures to model patterns for a given learning problem.
CO5. Select and apply machine learning algorithms to solve societal problems such as face recognition, text classification.

DETAILED SYLLABUS:

UNIT–I: CONCEPT LEARNING AND GENERAL-TO-SPECIFIC ORDERING (9 periods)

Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning, Concept learning task, Concept learning as search, FIND-S, Version spaces and candidate elimination algorithm, Inductive bias.

UNIT–II: DECISION TREE LEARNING AND KERNEL MACHINES (9 periods)

Decision Tree Learning: Decision tree representation, Problems for decision tree learning, Decision tree learning algorithm, Hypothesis space search, Inductive bias in decision tree learning, Issues in decision tree learning.

Kernel Machines: Support vector machines – SVMs for regression, SVMs for classification, Choosing C, A probabilistic interpretation of SVMs.

UNIT–III: ARTIFICIAL NEURAL NETWORKS (9 periods)

Neural network representations, Appropriate problems for neural network learning, Perceptrons, Multilayer networks and Backpropagation algorithm, Convergence and local minima, Representational power of feedforward networks, Hypothesis space search and inductive bias, Hidden layer representations, Generalization, Overfitting, Stopping criterion, An Example - Face Recognition.

UNIT–IV: BAYESIAN LEARNING (10 periods)

Bayes theorem and concept learning, Maximum likelihood and least-squared error hypothesis, Maximum likelihood hypotheses for predicting probabilities, Minimum Description Length principle, Bayes optimal classifier, Gibbs algorithm, Naive Bayes classifier, An Example – Learning to classify text; Bayesian belief networks, EM Algorithm.

UNIT–V: INSTANCE BASED LEARNING AND REINFORCEMENT LEARNING (8 periods)

Instance Based Learning: k-Nearest Neighbor learning, Locally weighted regression, Radial basis functions, Case-based reasoning.

Reinforcement Learning: The learning task, Q-learning, Nondeterministic rewards and actions, Temporal difference learning, Generalizing from examples, Relationship to dynamic programming.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Tom M. Mitchell, *Machine Learning*, McGraw Hill, 2013.
2. Kevin P. Murphy, *Machine Learning*: *A Probabilistic Perspective*, MIT Press, 2012.

REFERENCE BOOKS:

1. EthemAlpaydin, *Introduction to Machine Learning*, MIT Press, 4th Edition, 2020.
2. Shai Shalev Shwartz, Shai Ben David, *Understanding Machine Learning: From Theory to Algorithms,* Cambridge University Press, 2014.

ADDITIONAL LEARNING RESOURCES:

- https://swayam.gov.in/nd1_noc19_cs52/preview
- https://www.udemy.com/course/machinelearning/

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	1	-	-	-	-	-	-	-	-	-	3	-	-
CO5	2	3	2	-	-	2	-	-	-	-	-	-	-	3	-	-
Average	2.4	2.8	2.3	1	-	2	-	-	-	-	-	-	-	3	-	-
Level of correlation of the course	3	3	3	1	-	2	-	-	-	-	-	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – II Semester
(19BT60531) MACHINE LEARNING LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Machine Learning.

COURSE DESCRIPTION: Implementation of Back propagation algorithm, Decision tree learning, Neural networks, k-NN from scratch algorithm, Naïve Bayes classifier, Radial basis function neural network, SVM based classifier, Maximum likelihood estimation using statistical techniques.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze the given problem and identify appropriate machine learning technique to provide an intelligent solution.
CO2. Design and implement machine learning solutions for classification, regression, and clustering problems.
CO3. Develop intelligent solutions to solve societal problems related to computer vision, information security, healthcare and other areas.
CO4. Work independently to solve problems with effective communication.

LIST OF EXERCISES:

1. Solve classification problem by constructing a feedforward neural network using Backpropagation algorithm. (Wheat Seed Data)
2. Implement ID3 (information gain) algorithm for decision tree learning for transforming continuous variables into discrete variables.
3. Explore the problem of overfitting in decision tree and develop solution using pruning technique.
4. Build a neural network that will read the image of a digit and correctly identify the number.
5. Implement k-NN algorithm to solve classification problem.
6. Use Naïve Bayes classifier to solve the credit card fraud detection problem over a skewed dataset.
7. Design and implement a radial basis function neural network to solve function approximation or regression problem.
8. Compare and analyze the performance of optimal Bayes classifier and Naïve Bayes using simulated Gaussian Data.
9. Train an SVM based classifier to predict whether the cancer is malignant or benign.
10. Solve the stock price forecasting problem using statistical techniques – Maximum Likelihood estimation after understanding the distribution of the data.

REFERENCE BOOKS:

1. Sebastian Raschka, Vahid Mirjalili, *Python Machine Learning*, Packt Publishing, 3rd Edition, 2019.
2. AurelienGeron, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems*, 2nd Edition, O'Reilly, 2019.

SOFTWARE/TOOLS:

- Python
- Scikit-learn/Keras/TensorFlow

ADDITIONAL LEARNING RESOURCES:

- https://www.coursera.org/learn/machine-learning
- https://nptel.ac.in/courses/106106202/

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	1	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	3	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Average	1.33	3	3	3	3	3	-	-	3	3	-	-	-	-	-	-
Level of correlation of the course	2	3	3	3	3	3	-	-	3	3	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

IV B. Tech. – I Semester
(19BT71503) **DEEP LEARNING**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Overview of machine learning; Fundamentals of deep learning; Modern approaches in deep learning; Feedforward neural network architectures; Deep learning Models and Applications.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze a neural network by applying the basics of mathematics and machine learning.
CO2. Analyze the data using multilayer perceptron and backpropagation algorithms.
CO3. Apply regularization and optimization techniques to improve the performance of Deep neural networks.
CO4. Identify appropriate deep learning model for text, multimedia, and biological data analysis.
CO5. Compare deep neural networks and deep learning models to infer the suitable learning algorithm on large scale data.
CO6. Develop a model for domain specific applications by applying various network models in deep learning.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION (9 Periods)

Historical Trends in Deep Learning – Machine Learning basics - Learning algorithms: Supervised and Unsupervised Training - Linear Algebra for Machine Learning - Testing - Cross Validation - Dimensionality Reduction - Over fitting /Under Fitting - Hyper parameters and validation sets - Estimators – Bias – Variance - Loss Function-Regularization.

UNIT-II: NEURAL NETWORKS (9 Periods)

Biological Neuron – Idea of Computational units - Linear Perceptron - Perceptron Learning Algorithm - Convergence theorem for Perceptron Learning Algorithm - Linear Separability - Multilayer perceptron – Backpropagation.

UNIT-III: MODERN PRACTICES IN DEEP NETWORKS (10 Periods)

Introductions to Simple DNN - Platform for Deep Learning - Deep Learning Software Libraries - Deep Feed forward networks – Gradient-Based Learning - Architecture Design –Various Activation Functions, ReLU, Sigmoid – Error Functions - Regularization methods for Deep Learning - Early Stopping - Drop Out - Optimization methods for Neural Networks-Adagrad, Adam.

UNIT-IV: DEEP LEARNING MODELS (9 Periods)

Convolutional Neural Networks (CNNs): CNN Fundamentals – Architectures – Pooling – Visualization – Sequence Modeling: Recurrent Neural Networks (RNN) - Long-Short Term Memory (LSTM) – Bidirectional LSTMs-Bidirectional RNNs -Deep Unsupervised Learning: Autoencoders – Auto Encoder Applications -Deep Boltzmann Machine (DBM).

UNIT-V: CASE STUDY AND APPLICATIONS (8 Periods)

Application Case Study - Handwritten digits recognition using deep learning - LSTM with Keras – Sentiment Analysis – Image Dimensionality Reduction using Encoders LSTM with Keras – Alexnet – VGGnet.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, *Deep Learning*, 4th Edition, MIT Press, 2016.

REFERENCE BOOKS:

1. Kevin P. Murphy, *Machine Learning: A Probabilistic Perspective*, MITPress,2012.
2. Michael A. Nielsen, *Neural Networks and Deep Learning, Determination* Press, 2015.
3. Deng & Yu, *Deep Learning: Methods and Applications*, Now Publishers, 2013.

ADDITIONAL RESOURCES:

1. https://www.youtube.com/watch?reload=9&v=aPfkYu_qiF4
2. http://www.deeplearning.net/tutorial/
3. https://www.guru99.com/deep-learning-tutorial.html
4. https://www.coursera.org/courses?query=deep%20learning

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	1	-	-	-	-	-	-	-	2	-	-	2
CO2	2	3	2	2	2	-	-	-	-	-	-	-	2	-	-	2
CO3	2	2	2	2	1	-	-	-	-	-	-	-	2	-	-	2
CO4	2	3	2	2	1	-	-	-	-	-	-	-	2	-	-	2
CO5	1	2	3	2	2	-	-	-	-	-	-	-	2	-	-	2
CO6	2	2	3	2	3	1	1	-	-	-	-	-	2	-	-	2
Average	2	2.5	2.5	2	1.67	1	1	-	-	-	-	-	2	-	-	2
Level of correlation of the course	2	3	3	2	2	1	1	-	-	-	-	-	2	-	-	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

IV B. Tech. – I Semester
(19BT70533) **DEEP LEARNING LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Deep Learning

COURSE DESCRIPTION: Implementation of deep learning architectures, Modern approaches in deep learning, Feedforward neural network architectures, Deep learning models and applications.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Identify optimal hyperparameter values and appropriate architecture for a given problem and data using optimization techniques.
CO2. Analyze the characteristics of the given data and perform necessary pre-processing tasks to structure the data using Python libraries.
CO3. Utilize Python machine learning libraries and packages for building deep neural architectures to solve AI problems.
CO4. Work independently to solve problems with effective communication.

LIST OF EXERCISES:

1. Perform splitting of data for training, testing, and validation using k-fold cross validation.
2. Construct and implement multi-layer feed forward neural network for hand written digit classification problem.
3. Implement a binary and multi class image classification using Convolution Neural Network.
4. Perform hyper parameter tuning using Bayesian optimization technique for a Convolution Neural Network.
5. Analyze the effectiveness of various optimization algorithms with an image classification problem.
6. Solve the overfitting problem in a neural architecture using DropOut technique.
7. Study the efficiency of the transfer learning approach for a classification problem on the following architectures; VGG-16, Alexnet, and Inception-V3.
8. Solve a seq2seq problem (machine translation) using LSTM Recurrent Neural Architecture.
9. Solve a time series forecasting (stock prediction) using LSTM RNN.
10. Implement the image dimensionality reduction problem using a AutoEncoder architecture.

REFERENCE BOOKS:

1. Ian Goodfellow, YoshuaBengio and Aaron Courville, *Deep Learning,* MIT Press, 2016.
2. S Lovelyn Rose, L Ashok Kumar, D Karthika Renuka, *Deep Learning Using Python*, Wiley, 2019.
3. François Chollet, *Deep Learning with Python*, Manning Publications, 2017.
4. JojoMoolayil, *Learn Keras for Deep Neural Networks: A Fast-Track Approach to Modern Deep Learning with Python*, Apress, 2018.

SOFTWARE/TOOLS:

- Environment: Google CoLab
- Programming Language: Python 3.8
- Machine Learning Library: Tensor Flow 2.1 and Keras

ADDITIONAL LEARNING RESOURCES:

- Bharath Ramsundar, Reza Bosagh Zadeh, *TensorFlow for Deep Learning,* O'reilly, 2018.
- https://www.coursera.org/professional-certificates/tensorflow-in-practice
- https://www.coursera.org/learn/introduction-tensorflow

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	3	3	-	-	-	-	-	-	-	2	-	-	2
CO2	2	3	3	3	3	-	-	-	-	-	-	-	2	-	-	2
CO3	2	3	3	3	3	3	-	-	-	-	-	-	2	-	-	2
CO4	-	-	-	-	-	-	-	-	3	3	-	-	2	-	-	2
Average	2	3	3	3	3	3	-	-	3	3	-	-	2	-	-	2
Level of correlation of the course	2	3	3	3	3	3	-	-	3	3	-	-	2	-	-	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

MINOR DEGREE IN
INTERNET OF THINGS

Offering Department: INFORMATION TECHNOLOGY
Students of Eligible Branches: CSE, CSSE,ECE, EEE, EIE, ME and CE

COURSE STRUCTURE

Year & Semester	Course Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
III B.Tech. I-Sem (2 Theory + 1 Lab)	19BT51208	Embedded System Design and Architecture	3	-	-	3	3	40	60	100
	19BT51209	IoT Architecture and Protocols	3	-	-	3	3	40	60	100
	19BT51210	Sensor Technologies	3	-	-	3	3	40	60	100
	19BT51234	Sensors based IoT Lab	-	-	2	2	1	50	50	100
III B.Tech. II-Sem (2 Theory + 1 Lab)	19BT61207	Cloud Storage and Computing	3	-	-	3	3	40	60	100
	19BT61208	Privacy and Security in IoT	3	-	-	3	3	40	60	100
	19BT61209	Software Defined Networks for IoT	3	-	-	3	3	40	60	100
	19BT61233	IoT Application Development Lab	-	-	2	2	1	50	50	100
IV B.Tech. I-Sem (1 Theory + 1 Lab)	19BT71210	Advanced IoT	3	-	-	3	3	40	60	100
	19BT71211	Big Data Analytics for IoT	3	-	-	3	3	40	60	100
	19BT71234	Advanced IoT Lab	-	-	2	2	1	50	50	100

Note: If any student has chosen a course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s for the Minor degree. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course.

III B. Tech. – I Semester
(19BT51208) EMBEDDED SYSTEM DESIGN AND ARCHITECTURE

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES:-

COURSE DESCRIPTION: Concepts of Embedded systems and its computing; The programming of 8051; The Embedded C and Applications; Applications of RTOS and Embedded Software Development Tools; The ARM and SHARC Processor's Architectures.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on Fundamental concepts of Embedded Systems in Real-time.
CO2. Demonstrate programming skills using 8051.
CO3. Develop the Embedded Systems applications.
CO4. Demonstrate knowledge on RTOS concepts and Embedded Software Development Tools through RTOS.
CO5. Demonstrate knowledge on advanced processors architecture such as ARM and SHARC and the bus protocols such as I2C and CAN bus.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO EMBEDDED COMPUTING (08 periods)
Definition of embedded system, embedded systems vs. general computing systems, history of embedded systems, complex systems and microprocessor, classification, major application areas, the embedded system design process, formalisms for system design, design examples

UNIT-II: THE 8051 ARCHITECTURE (09 periods)
Introduction, 8051 Micro controller Hardware, Input/output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/output, Interrupts.The Assembly Language Programming Process, Instructions of 8051 Programming Tools and Techniques, Simple Programs.

UNIT-III: INTRODUCTION TO EMBEDDED C AND APPLICATIONS (10 periods)
Embedded systems programming in C, binding and running embedded C program in Keil IDE, dissecting the program, building the hardware. Basic techniques for reading and writing from I/O port pins, LED interfacing, interfacing with keyboards, displays, D/A and A/D conversions, using embedded C interfacing.

UNIT-IV: INTRODUCTION TO REAL – TIME OPERATING SYSTEMS (10 periods)
Tasks and Task States, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Semaphores and Queues, Hard Real-Time Scheduling Considerations, Interrupt Routines in an RTOS Environment.
EMBEDDED SOFTWAREDEVELOPMENT TOOLS: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System; Debugging Techniques: Testing on Host Machine.

UNIT-V: INTRODUCTION TO ADVANCED ARCHITECTURES (08 periods)
ARM and SHARC, Processor and memory organization and Instruction level parallelism; Networked embedded systems: Bus protocols, I2C bus and CAN bus.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Wayne Wolf, *Principles of Embedded Computing System Design*, 2nd Edition, Elsevier, 2014.
2. Kenneth J. Ayala, *The 8051 Microcontroller*, Thomson, 2nd Edition, 2016.

REFERENCE BOOKS:

1. David E. Simon, *An Embedded Software Primer*, Pearson Education, 2009.
2. Dr. KVKKPrasad, *Embedded/Real-Time Systems: Concepts, Design And Programming*, Black Book, DreamTech Press, 2003.

ADDITIONAL LEARNING RESOURCES:

Web References:

1. https://www.smartzworld.com/notes/embedded-systems-es/
2. http://notes.specworld.in/embedded-systems-es/
3. http://education.uandistar.net/jntu-study-materials
4. http://www.nptelvideos.in/2012/11/embedded-systems.html

E-TextBooks:

1. https://www.scribd.com/doc/233633895/Intro-to-Embedded-Systems-by-Shibu-Kv
2. http://www.ee.eng.cmu.ac.th/~demo/think/_DXJSq9r3TvL.pdf
3. https://www.scribd.com/doc/55232437/Embedded-Systems-Raj-Kamal
4. https://docs.google.com/file/d/0B6Cytl4eS_ahUS1LTkVXb1hxa00/edit

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-		-	-	-	-	-	-	2	2	-	-
CO2	2	3	2	2	2	2	-	-	-	-	-	-	2	2	3	2
CO3	2	2	3	2	2	2	-	-	-	-	-	-	2	2	2	3
CO4	2	2	-	-	3	-	-	-	-	-	-	-	2	2	2	-
CO5	2	2	-	-	3	-	-	-	-	-	-	-	2	2	2	-
Average	2	2.25	2.5	2	2.5	2	-	-	-	-	-	-	2	2	2.25	2.5
Level of correlation of the course	2	3	3	2	3	2	-	-	-	-	-	-	2	2	3	3

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester
(19BT51209) IoT ARCHITECTURE AND PROTOCOLS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION:
M2M to IoT An Architectural Overview and M2M and IoT Technology Fundamentals, IoT Architecture State of the Art, IoT Reference Architecture and Real-World Design Constraints, IoT Data Link Layer & Network Layer Protocols, Session Layer Protocols and Application Layer Protocols, Security in IoT Protocols and Case studies.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***
CO1. Demonstrate knowledge on architecture and technology of M2M to IoT.
CO2. Demonstrate knowledge on IoT architectures and identify design constraints of IoT.
CO3. Select suitable protocols of data link and network layer protocols for different applications of IoT.
CO4. Identify appropriate protocols of session and application layer protocols for different applications of IoT.
CO5**:** Evaluate security issues and challenges during implementation of real world models.

DETAILED SYLLABUS:

UNIT-I: (9 Periods)
M2M TO IoT AN ARCHITECTURAL OVERVIEW: Building architecture, Main design principles and needed capabilities, An IoT architecture outline, Standards considerations.
M2M AND IoT TECHNOLOGY FUNDAMENTALS: Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a service (XaaS), M2M and IoT analytics, Knowledge management.

UNIT II: (9 Periods)
IoT ARCHITECTURE STATE OF THE ART: Introduction, State of the art, Architecture Reference Model- Reference model and architecture, IoT reference model.
IoT REFERENCEARCHITECTURE: Functional view, Functional view, Deployment and operational view, Other relevant architectural views
REAL-WORLD DESIGN CONSTRAINTS: Technical design constraints hardware is popular again, Data representation and visualization, Interaction and remote control

UNIT III: (9 Periods)
IoT DATA LINK LAYER: IEEE 802.15.4, IEEE 802.11ah, LoRaWAN, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy; **Network Layer Encapsulation Protocols:** 6LoWPAN, 6TiSCH, 6Lo;
NETWORK LAYER ROUTING PROTOCOLS: RPL, CORPL, CARP.

UNIT IV: (10 Periods)
SESSION LAYER PROTOCOLS: MQTT, AMQP, CoAP, XMPP, DDS;
APPLICATION LAYER PROTOCOLS: SCADA, Generic Web-Based Protocol.

UNIT V: (8 Periods)
SECURITY IN IoT PROTOCOLS: MAC 802.15.4, 6LoWPAN, RPL, IoT Challenges
CASE STUDIES: Smart Metering, Smart House, Smart Cities

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Jan Holler and VlasiosTsiatsis, *From Machine-to-Machine to the Internet of Things Introduction to a New Age of Intelligence,* Elsevier, 2014.
2. David Hanes and Gonzalo Salgueiro, *IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things,* Cisco Press, 2017

REFERENCE BOOKS:

1. Peter Waher, *Learning Internet of Things*, PACKT publishing, 2015.
2. Olivier Hersent and David Boswarthick, *The Internet of Things Key Applications and Protocols*, John Wiley & Sons Ltd Publication, 2012.

ADDITIONAL LEARNING RESOURCE:

1. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	2	-	3
CO2	2	3	2	-	-	-	-	-	-	-	-	-	-	2	-	3
CO3	2	3	2	-	-	-	-	2	-	-	-	-	-	2	-	3
CO4	2	3	2	-	-	-	-	2	-	-	-	-	-	2	-	3
CO5	2	3	2	-	-	-	-	2	-	-	-	-	-	2	-	3
Average	2.2	3	2	-	-	-	-	2	-	-	-	-	-	2	-	3
Level of correlation of the course	2	3	2	-	-	-	-	2	-	-	-	-	-	2	-	3

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester
(19BT51210) **SENSOR TECHNOLOGIES**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Physics.

COURSE DESCRIPTION: Sensor fundamentals and characteristics, Optical Sources and Detectors; Intensity Polarization and Interferometric Sensors, Phase sensor, Strain, Force, Torque and Pressure sensors; Position, Direction, Displacement and Level sensors, Velocity and Acceleration sensors, Electromagnetic velocity sensor, Light and Sound Sensors; Flow, Temperature and Acoustic sensors; Wearable Sensors.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on the characteristics of Sensors and principles of Optical Sources and Detectors.
CO2. Apply the principles of Intensity Polarization, Interferometric, Phase, Strain, Force, Torque and Pressure sensors in Sensor applications.
CO3. Apply the principles of Position, Direction, Displacement, Level, Velocity and Acceleration, Electromagnetic velocity, Sound and Light Sensors in Sensor applications.
CO4. Analyze the principles of Flow, Temperature and Acoustic sensors to build Sensor applications.
CO5**:** Analyze the principles of Wearable Sensors and identify suitable sensors for real time applications.

DETAILED SYLLABUS:

UNIT-I: (9 Periods)

SENSOR FUNDAMENTALS AND CHARACTERISTICS: Sensor Classification, Performance and Types, Error Analysis characteristics,

OPTICAL SOURCES AND DETECTORS: Electronic and Optical properties of semiconductor as sensors, LED, Semiconductor lasers, Fiber optic sensors, Thermal detectors, Photo multipliers, photoconductive detectors, Photo diodes, Avalanche photodiodes, CCDs.

UNIT-II: (9 Periods)

INTENSITY POLARIZATION AND INTERFEROMETRIC SENSORS: Intensity sensor, Microbending concept, Interferometers, Mach Zehnder, Michelson, FabryPerot and Sagnac.

PHASE SENSOR: Phase detection, Polarization maintaining fibers.

STRAIN, FORCE, TORQUE AND PRESSURE SENSORS: Strain gages, strain gage beam force sensor, piezoelectric force sensor, load cell, torque sensor, Piezo-resistive and capacitive pressure sensor, optoelectronic pressure sensors, vacuum sensors.

UNIT-III: (9 Periods)

POSITION, DIRECTION, DISPLACEMENT AND LEVEL SENSORS: Potentiometric and capacitive sensors, Inductive and magnetic sensor, LVDT, RVDT, eddy current, transverse inductive, Hall effect, magneto resistive, magneto strictive sensors.

Fiber optic liquid level sensing, Fabry Perot sensor, ultrasonic sensor, capacitive liquid level sensor.

VELOCITY AND ACCELERATION SENSORS:

Electromagnetic velocity sensor, Doppler with sound, light, Accelerometer characteristics, capacitive, piezo-resistive, piezoelectric accelerometer, thermal accelerometer, rotor, monolithic and optical gyroscopes.

UNIT-IV: (9 Periods)

FLOW SENSORS: pressure gradient technique, thermal transport, ultrasonic, electromagnetic and Laser anemometer. microflow sensor, coriolis mass flow and drag flow sensor.

TEMPERATURE SENSORS: thermoresistive, thermoelectric, semiconductor and optical. Piezoelectric temperature sensor.

ACOUSTIC SENSORS: microphones-resistive, capacitive, piezoelectric, fiber optic, solid state electrect microphone.

UNIT-V: WEARABLE SENSORS (9 Periods)

From fibers to textile sensors - Interlaced network -Textile sensors for physiological state monitoring - Biomechanical sensing - Noninvasive sweat monitoring by textile sensors and other applications. FBG sensor in Intelligent Clothing and Biomechanics.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. J. Fraden, *Handbook of Modern Sensors: Physical, Designs, and Applications*, AIP Press, 2004.
2. D. Patranabis, *Sensors and Transducers*, PHI Publication, 2nd Edition, 2014.

REFERENCE BOOKS:

1. Patranabis D, *Principles of Industrial Instrumentation*, Tata McGrawHill, End edition, 1997
2. Ganesh S. Hegde, *Mechatronics*, Published by University Science Press,2008.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2			-	-	-	-	-	-	-	-	-	-	3	-	2
CO2	2	2	3	-	-	2	1	1	-	-	-	-	-	3	-	2
CO3	1	2	3	-	-	2	1	1	-	-	-	-	-	3	-	2
CO4	2	3	3	2		2	1	1	-	-	-	-	-	3	-	2
CO5	2	3	3	2		2	1	1	-	-	-	-	-	3	-	2
Average	1.8	2.5	3	2	-	2	1	1	-	-	-	-	-	3	-	2
Level of correlation of the course	2	3	3	2	-	2	1	1	-	-	-	-	-	3	-	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. –I Semester
(19BT51234) **SENSOR BASED IoT LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: -

COURSE DESCRIPTION: Hands-on experience on connecting IoT devices using Sensors, Arduino/Raspberry Pi, Bread Board.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Identify different types of Sensors and study their functionality in IoT
CO2. Demonstrate skills in connecting peripherals to Arduino/Raspberry Pi for data exchange.
CO3. Develop a Cloud platform to upload and analyze any sensor data
CO4. Demonstrate skills in connecting GSM, GPS, Gateways to micro controllers and perform Data Management in IoT.
CO5. Build a complete working IoT system involving prototyping, programming and data analysis.
CO6. Work independently or in teams to solve problems with effective communication.

LIST OF EXPERIMENTS:

1. Study of Different types of Sensors and Introduction to Arduino platform and programming.
2. Interfacing Arduino to Zigbee module.
3. Interfacing Arduino to GSM module and Bluetooth Module.
4. Introduction to Raspberry PI platform and python programming.
5. Interfacing sensors to Raspberry PI.
6. Communicate between Arduino and Raspberry PI using any wireless medium.
7. Log Data using Raspberry PI and upload to the cloud platform.
8. Design an IoT based system.

REFERENCE BOOKS:

1. ArshdeepBahga, Vijay Madisetti, *Internet of Things- A hands on approach*, 1st edition, VPI publications, 2014.
2. Adrian McEwen, HakinCassimally, *Designing the Internet of Things*, Wiley India, 2013
3. Massimo Banzi and Michael Shiloh, *Getting Started with Arduino*, 3rd Edition, Maker Media, 2015
4. Getting Started with Raspberry pi, Matt Richardson & Shawn Wallace, O'Reilly, 2014.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	2	-	3
CO2	2	3	-	2	-	-	-	-	-	-	-	-	-	2	-	3
CO3	1	2	3	-	-	-	-	-	-	-	-	-	-	2	-	3
CO4	2	3	-	-	-	-	-	-	-	-	-	-	-	2	-	3
CO5	2	2	2	-	-	-	3						-	2	-	3
Average	2	2.6	2.5	2	-	-	3	-	-	-	-	-	-	2	-	3
Level of correlation of the course	2	3	3	2	-	-	3	-	-	-	-	-	-	2	-	3

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. –II Semester
(19BT61207) CLOUD STORAGE AND COMPUTING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Introduction to Cloud Computing, Data Storage Networking fundamentals, Cloud Services and Platforms, Cloud Application Design.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to*:**

CO1. Demonstrate basic concepts and terminologies of Cloud Computing, Cloud-based Services and Applications.
CO2. Demonstrate Cloud, Virtualization and Data Storage Networking concepts.
CO3. Analyze Cloud Services, Platforms and Applications.
CO4. Apply different Cloud Services and Platforms to construct Cloud applications.
CO5. Design Cloud applications as per societal needs through different design approaches.

DETAILED SYLLABUS

UNIT-I: INTRODUCTION TO CLOUD COMPUTING (9 Periods)
Introduction, Characteristics of Cloud Computing. Cloud Models, Cloud Services Examples, Cloud-based Services and Applications.

UNIT-II: CLOUD AND DATA STORAGE (9 Periods)
CLOUD CONCEPTS AND TECHNOLOGIES: Virtualization, Load Balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software Defined Networking, Network Function Virtualization, MapReduce, Identity and Access Management, Service Level Agreements and Billing.
DATA STORAGE FUNDAMENTALS: Server and I/O Architectures, Storage Hierarchy, From Bits to Bytes, Disk Storage Fundamentals, Initiators and Targets, How Data Is Written to and Read from a Storage Device, Storage Sharing vs. Data Sharing, Different Types of Storage.

UNIT-III: CLOUD SERVICES AND PLATFORM -I (9 Periods)
Amazon Elastic Compute Cloud, Google Compute Engine, Windows Azure Virtual Machines, Amazon Simple Storage Service, Google Cloud Storage, Windows Azure Storage, Amazon Relational Data Store, Amazon DynamoDB, Google Cloud SQL, Google Cloud Datastore, Windows Azure SQL Database and Windows Azure Table Service.

UNIT-IV: CLOUD SERVICES AND PLATFORM -II (9 Periods)
Application Runtimes and Framework, Queuing Services, Email Services, Notification Services, Media Services, Amazon CloudFront, Windows Azure Content Delivery Network, Amazon Elastic MapReduce, Google MapReduce Service, Google BigQuery, Amazon Elastic Beanstalk and Amazon CloudFormation.

UNIT-V: CLOUD APPLICATION DESIGN (9 Periods)
Introduction, Design Considerations for Cloud Applications, Reference Architectures for Cloud Applications, Cloud Application Design Methodologies and Data Storage Approaches.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. ArshdeepBahga and Vijay Madisetti, *Cloud Computing – A Hands-on Approach,* Universities Press (India) Private Limited, 2014.
2. Greg Schulz, *Cloud and VirtualDataStorageNetworking,* CRC PressTaylor& Francis Group, 2012.

REFERENCE BOOKS:

1. Barrie Sosinsky, *Cloud Computing Bible,* Wiley India Pvt Ltd, 2011 (Reprint 2017).
2. Thomas Erl and RicardoPuttini, *Cloud Computing- Concepts, Technology and Architecture,* Pearson, 2014 (Seventh Impression 2017).

ADDITIONAL LEARNING RESOURCES:

1."Exploring the Google Toolkit", https://code.google.com/, drafted on 21 June, 2021.
2."Understanding Amazon Web Services", https://aws.amazon.com/, drafted on 21 June, 2021.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-		-	-	-	-	-	-	-	1	1	3	-
CO2	3	-	-	-		-	-	-	-	-	-	-	2	2	2	-
CO3	2	3	-	-	2	-	-	-	-	-	-	-	2	2	2	-
CO4	1	2	2	-	2	-	-	-	-	-	-	-	1	1	3	-
CO5	1	2	3	-	2	-	-	-	-	-	-	-	2	2	3	-
Average	2	2.3	2.5	-	2	-	-	-	-	-	-	-	1.6	1.6	2.6	-
Level of correlation of the course	2	3	3	-	2	-	-	-	-	-	-	-	2	2	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. –II Semester
(19BT61208) PRIVACY AND SECURITY IN IoT

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Internet of Things Lab.

COURSE DESCRIPTION: Introduction of IoT; Securing The Internet Of Things; Cryptographic Fundamentals for IoT; Identity & Access Management Solutions for IoT; Privacy Preservation And Trust Models for IoT; Cloud Security for IoT.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***
CO1.Demonstrate knowledge on Security issues of IoT.
CO2. Apply Cryptographic Principles for IoT Security.
CO3. Identify suitable Access Management Solutions for IoT.
CO4. Apply Privacy Preservation and Trust Models for IoT.
CO5. Demonstrate knowledge on Cloud Security for IoT.

DETAILED SYLLABUS:

UNIT I– INTRODUCTION: SECURING THE INTERNET OF THINGS (9 periods)
Security Requirements in IoT Architecture, Security in Enabling Technologies, Security Concerns in IoT Applications; Security Architecture in the Internet of Things, Security Requirements in IoT, Insufficient Authentication/Authorization, Insecure Access Control, Threats to Access Control, Privacy, and Availability, Attacks Specific to IoT; Vulnerabilities, Secrecy and Secret-Key Capacity, Authentication/Authorization for Smart Devices; Transport Encryption; Attack & Fault trees

UNIT II – CRYPTOGRAPHIC FUNDAMENTALS FOR IoT (9periods)
Cryptographic primitives and its role in IoT, Encryption and Decryption, Hashes, Digital Signatures, Random number generation, Cipher suites, key management fundamentals, cryptographic controls built into IoT messaging and communication protocols, IoT Node Authentication.

UNIT III – IDENTITY & ACCESS MANAGEMENT SOLUTIONS FOR IoT (9 periods)
Identity lifecycle, authentication credentials, IoT IAM infrastructure; Authorization with Publish/Subscribe schemes; access control.

UNIT IV – PRIVACY PRESERVATION AND TRUST MODELS FOR IoT (9 periods)
Concerns in data dissemination, Lightweight and robust schemes for Privacy protection, Trust and Trust models for IoT, self-organizing Things, Preventing unauthorized access

UNIT V – CLOUD SECURITY FOR IoT (9 periods)
Cloud services and IoT - offerings related to IoT from cloud service providers, Cloud IoT security controls; An enterprise IoT cloud security architecture – New directions in cloud enabled IoT computing.

Total Periods: *45*

Topics for self-study are provided in the lesson plan

TEXT BOOK:
1. Brian Russell, Drew Van Duren, *Practical Internet of Things Security*, Kindle Edition, 2016.

REFERENCE BOOK:
1. Fei Hu, *Security and Privacy in Internet of Things (IoTs)- Models, Algorithms, and Implementations*, CRC Press, 1st Edition, 2016

ADDITIONAL LEARNING RESOURCES:
1. https://www.fortinet.com/resources/cyberglossary/iot-security

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-		-	-	-	-	-	-	-	-	3	-	-
CO2	2	2	3	-	2	-	-	-	-	-	-	-	-	3	-	-
CO3	2	2	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO4	2	2	3	2	2	-	-	-	-	-	-	-	-	3	-	-
CO5	2	-	-		2	-	-	-	-	-	-	-	-	3	-	-
Average	2.2	2	3	2.5	2	-	-	-	-	-	-	-	-	3	-	-
Level of correlation of the course	2	2	3	3	2	-	-	-	-	-	-	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. –II Semester
(19BT61209)**SOFTWARE DEFINED NETWORKS FOR IoT**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Internet of Things Lab.

COURSE DESCRIPTION: Packet Switching Terminology, Traditional Switch architecture, Fundamental Characteristics of SDN, SDN Controller, SDN Applications, SDN in the data center**,** Use Cases in the Data Center, Scope of the Internet of Things, SDN for IoT.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on characteristics of Data center and Network Technologies.
CO2. Demonstrate skills on Operating and performing Data flow in Software Defined Networks
CO3. Identify suitable Data Center topologies for virtualized environment.
CO4. Apply Software defined Networks concepts for the Internet of Things
CO5. Apply suitable addressing schemes and routing protocols to achieve QoS in SDN based IoT.

DETAILED SYLLABUS:

UNIT- I: INTRODUCTION TO SOFTWARE DEFINED NETWORKS (9 Periods)

Basic Packet-Switching Terminology, The Modern Data Center, Traditional Switch architecture, Autonomous and Dynamic Forwarding Tables, Evolution of Switches and Control Planes ,SDN Implications for Research and Innovation, Data Center Innovation, Data Center Needs, The Evolution of Networking Technology, Forerunners of SDN, Software Defined Networking is Born, Sustaining SDN Interoperability, Open Source Contributions, Legacy Mechanisms Evolve Toward SDN, Network Virtualization.

UNIT- II: FUNDAMENTAL CHARACTERISTICS OF SDN (9 Periods)

SDN Operation, SDN Devices, SDN Controller, SDN Applications, Alternate SDN Methods, OpenFlow, OpenFlow Limitations, Potential Drawbacks of Open SDN,SDN via APIs, SDN via Hypervisor-Based Overlays, SDN via Opening Up the Device, Network Functions Virtualization, Alternatives Overlap and Ranking. Real-World Data Center Implementations, applications and SDN features.

UNIT-III: SDN IN THE DATA CENTER (9 Periods)

Data Center Definition, Data Center Demands, Tunneling Technologies for the Data Center, Path Technologies in the Data Center, Ethernet Fabrics in the Data Center, SDN Use Cases in the Data Center, Open SDN versus Overlays in the Data Center.

UNIT-IV: THE INTERNET OF THINGS (9 Periods)

Scope of the Internet of Things, Key Features of IoT Data, Technical requests for Openstack as a IoT-Cloud Platform, Feature of Message Broking, IoT architecture in NTT DATA, IoT architecture on Openstack, Endpoint-Aware Service Function Chaining, Service function chaining for the IoT data plane, Mobile Network Slicing for IoT, Introduction to IoTivity.

UNIT- V: SDN for IoT: **(9 Periods)**

SDN based IoT, IoT Host Management System Architecture, Network Topology, Experiment Environment, Host Address collection, Host blocking, Host address translation, Dynamic QoS Routing Algorithm in SDN,SDN based Dynamic QoS Routing Framework, Mobility Support in SDN IoT networks, SDN and Cloud based Forest Fire Detection System using IoT devices.

Total Periods: *45*

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Paul Goransson and Chuck Balck, *Software Defined Networks -A comprehensive Approach*, 1st Edition, 2014.
2. Sunyoung Han, Software Defined Network for Internet of Things, Chulalongkorn University, Thailand, 2016.

REFERENCE BOOKS:

1. William Stallings, Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud, Addison-Wesley, 2015.
2. Jim Doherty, SDN and NFV Simplified: A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization, Pearson, 2017.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	2	3	3	-	-
CO2	2	3	-	-	2	-	-	-	-	-	-	2	3	2	-	-
CO3	1	2	3	-	-	-	-	-	-	-	-	2	3	1	-	-
CO4	1	2	3		-	1	-	-	-	-	-	2	3	1	-	-
CO5	2	3	3	1	2	-	2	-	-	-	-	2	3	2	-	-
Average	1.6	2.5	3	-	2	1	2	-	-	-	-	2	3	1.6	-	-
Level of correlation of the course	2	3	3	-	2	1	2	-	-	-	-	2	3	2	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. –II Semester
(19BT61233) IoT APPLICATION DEVELOPMENT LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A course on Internet of Things Lab.

COURSE DESCRIPTION: Hands-on practice on Internet of Things (IoT); Usage of Sensors, Arduino microcontroller and Raspberry Pi microprocessor; Development of IoT Applications for societal needs; IoT with Cloud environments.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate hands-on experience on IoT.
CO2. Use Sensors, Arduino microcontroller and Raspberry Pi microprocessor for the development of IoT applications.
CO3. Analyze the user requirements for the development of IoT applications.
CO4. Develop IoT applications to solve societal problems using cloud environment.
CO5. Work independently or in teams to solve problems with effective communication.

LIST OF EXPERIMENTS:

1. Develop an IoT application to control servo motor using Arduino/Raspberry Pi.
2. Develop an IoT application using Arduino/Raspberry Pi for fire alarm.
3. Develop an IoT application to measure temperature, humidity, light and distance using Arduino/Raspberry Pi.
4. Develop an IoT application to control home appliances using a smart phone.
5. Develop an IoT application to measure soil moisture, air and water quality using Arduino/Raspberry Pi.
6. Develop an IoT application to control and monitor Street lights using Arduino/Raspberry Pi.
7. Develop an IoT application to detect obstacles using Arduino/Raspberry Pi.
8. Develop an IoT application using Arduino/Raspberry Pi to monitor heartbeat, blood pressure, etc. of a person and to upload health information to thingspeak cloud.
9. Develop an Alexa based Home Automation System using IoT.

REFERENCE BOOKS:

1. ArshdeepBahga and Vijay Madisetti, *Internet of Things(A hands on approach),* 1st Edition, VPI Publications, 2014.
2. Adrian McEwen and HakinCassimally, *Designing the Internet of Things,* Wiley India.
3. Massimo Banzi and Michael Shiloh*, Getting Started with Arduino*, Third Edition, Maker Media.
4. Matt Richardson and Shawn Wallace, *Getting Started with Raspberry Pi*, O'Reilly, 2014.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3	3
CO2	1	2	3	3	3	3	3	3	-	-	-	-	-	-	3	3
CO3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	3	3
CO4	1	2	3	3	3	3	3	3	-	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	3	3	-	-	-	-	3	3
Average	1.75	2.25	3	3	3	3	3	3	3	3	-	3	-	-		
Level of correlation of the course	2	3	3	3	3	3	3	3	2	3	-	3	-	-	3	3

Level of Correlation: 3 - High 2 - Medium 1 - Low

IV B. Tech. - I Semester
(19BT71210) **ADVANCED IoT**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Internet of Things Lab.

COURSE DESCRIPTION: Introduction to the Industrial Internet; Industrial Internet Use-Cases; Technical and Business Innovators of the Industrial Internet; IIoT Reference Architecture, Designing Industrial Internet Systems; Examining the Access Network Technology & Protocols; Examining the Middleware Transport Protocols; Middleware Software Patterns; Middleware Industrial Internet of Things Platforms; IIoT WAN Technologies and Protocols; Securing the Industrial Internet; Introducing Industry 4.0; Smart Factories.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on IIoT Concepts, applications, Technical requirements.
CO2. Design and develop IIoT applications, using different architectures and protocols.
CO3. Identify suitable middleware Transport Protocols, and Software Patterns to design APIs and Platforms.
CO4. Demonstrate knowledge on WAN Technologies & Protocols and security management in IIoT.
CO5. Demonstrate knowledge on Industry 4.0 and smart factories

DETAILED SYLLABUS:

UNIT-I: **(9 Periods)**

INTRODUCTION TO THE INDUSTRIAL INTERNET: What is IIoT, Key IIoT Technologies Catalysts and Precursors of the IIoT, Innovation and the IIoT, Key Opportunities and Benefits, The Digital and Human Workforce.

INDUSTRIAL INTERNET USE-CASES: Healthcare, Oil and Gas Industry, Smart Office, Logistics and the Industrial Internet, Retail

THE TECHNICAL AND BUSINESS INNOVATORS OF THE INDUSTRIAL INTERNET: Miniaturization, Cyber Physical Systems (CPS), Wireless Technology, IP Mobility, Network Functionality Virtualization(NFV), Network Virtualization, The Cloud and Fog, Big Data and Analytics, M2M Learning and Artificial Intelligence, Augmented Reality, 3D Printing, People versus Automation

UNIT-II: **(9 Periods)**

IIoT REFERENCE ARCHITECTURE: The IIC Industrial Internet Reference Architecture, Industrial Internet Architecture Framework (IIAF), Architectural Topology, The Three-Tier Topology, Connectivity, Key System Characteristics, Data Management.

DESIGNING INDUSTRIAL INTERNET SYSTEMS: The Concept of the IIoT, The Proximity Network, WSN

Edge Node, Legacy Industrial Protocols, Modern Communication Protocols, Wireless Communication Technologies, Proximity Network Communication Protocols, Gateways

EXAMINING THE ACCESS NETWORK TECHNOLOGY AND PROTOCOLS: The Access Network, Access Networks Connecting Remote Edge Networks

UNIT-III: **(9 Periods)**

EXAMINING THE MIDDLEWARE TRANSPORT PROTOCOLS: TCP/IP, UDP, Reliable Transport Protocol (RTP), CoAP (Constrained Application Protocol).

MIDDLEWARE SOFTWARE PATTERNS: Publish/Subscribe Pattern: MQTT, XMPP, AMQP, DDS, Delay Tolerant Networks (DTN).

SOFTWARE DESIGN CONCEPTS: API (Application Programming Interface), API: A Technical Perspective, Web Services.

MIDDLEWARE INDUSTRIAL INTERNET OF THINGS PLATFORMS: Middleware Architecture, IIoT Middleware Platforms.

UNIT-IV: **(9 Periods)**

IIoT WAN TECHNOLOGIES AND PROTOCOLS: IIoT Device Low-Power WAN Optimized Technologies for M2M, Low Power Wi-Fi, LTE Category-M, Weightless, Millimeter Radio.

SECURING THE INDUSTRIAL INTERNET: Security in Manufacturing: PLCs and DCS, Securing the OT, Network Level: Potential Security Issues, System Level: Potential Security Issues, Identity Access Management

UNIT-V: **(9 Periods)**

INTRODUCING INDUSTRY 4.0: Defining Industry 4.0, Four Main Characteristics of Industry 4.0, The Value Chain, Industry 4.0 Design Principles, Building Blocks of Industry 4.0, Smart Manufacturing.

SMART FACTORIES: Introducing the Smart Factory, Smart Factories in Action, Importance of Smart Manufacturing, Real-World Smart Factories - GE's Brilliant Factory, Airbus: Smart Tools and Smart Apps, Siemens' Amberg Electronics Plant (EWA), Industry 4.0: The Way Forward

Total Periods: *45*

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Alasdair Gilchrist, *Industry 4.0: The Industrial Internet of Things*, Apress Publications, 2016.

REFERENCE BOOKS:

1. Giacomo Veneri and Antonio Capasso, *Hands-on Industrial Internet of Things: Create a powerful Industrial IoT infrastructure using Industry 4.0*, Ingram Academic Services, 2018.
2. Vijay Madisetti and ArshdeepBahga, *Internet of Things A Hands-On- Approach*, Orient Blackswan Private Limited, 2015.
3. Francis daCosta, *Rethinking the Internet of Things: A Scalable Approach to Connecting Everything*", 1st edition, Apress Publications, 2014.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-		-	-	-	-	-	3	-	3
CO2	2	2	3	3	2	-	-	2	-	-	-	-	-	3	-	2
CO3	2	2	-	-	2	-	-	2	-	-	-	-	-	3	-	2
CO4	2	-	-	-	2	-	-	2	-	-	-	-	-	3	-	2
CO5	2	-	-	-	2	-	-	2	-	-	-	-	-	3	-	2
Average	2.2	2	3	3	2	-	-	2	-	-	-	-	-	3	-	2.2
Level of correlation of the course	2	2	3	3	2	-	-	2	-	-	-	-	-	3	-	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

IV B. Tech. - I Semester
(19BT71210)**BIG DATA ANALYTICS FOR IoT**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	1	-	4

PRE-REQUISITES: A course on Internet of Things Lab.

COURSE DESCRIPTION: The course provides introduction to IoT Analytics andBig Data Analytics, Sensors and Tools of IoT Analytics, Services of IoT, Big Data Storage Systems for IoT, Case Studies and Applications of IoT

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1.Use Analytical Architecture and its exploration in Data Analytics for IoT
CO2. Analyze and Visualize the Sensor data for IoT.
CO3. Apply Advanced Analytical Architectures as a service for IoT.
CO4. Analyze Big data storage systems in IoT.
CO5. Develop Real Time solutions for given societal problems.

DETAILED SYLLABUS:

UNIT-I: **INTRODUCING IoT ANALYTICS (9 periods)**

Introduction: IoT Data and BigData, Challenges of IoT Analytics Applications,IoT Analytics Lifecycle and Techniques.

IoT, Cloud and Big Data Integration for IoT Analytics: Cloud-based IoT Platform,Data Analytics for the IoT,Data Collection Using Low-power, Long-range Radios,WAZIUP Software Platform, iKaaS Software Platform.

UNIT-II: SENSORS AND TOOLS OF IoT ANALYTICS (9 periods)

Sensors: Architecture for Social and Physical Sensors, Local Event Retrieval, Using Sensor Metadata Streams to Identify Topics of Local Events in the City, Venue Recommendation. **Development Tools for IoT Analytics Applications:** VITAL Development Environment,Tools for IoT Semantic Analytics**,** Development Examples:Predict the Footfall,Find a Bike.

UNIT-III: IoT ANALYTICS AS A SERVICE (9 periods)

Architecture for IoT Analytics-as-a-Service, Sensing-as-a-Service Infrastructure Anatomy, Scheduling, Metering and Service Delivery, Sensing-as-a-Service Examples, From Sensing-as-a-Service to IoT-Analytics-as-a-Service, Data Collection to Deployment and Operationalization, Ethical IoT.

UNIT-IV: BIG DATA STORAGE SYSTEMS AND CASE STUDIES FOR IoT (9 periods)

Perspectives and Challenges: Big data analytics for IoT,Data Storage and Access for IoT,Dynamic-Data Handling in Big Data Storage Systems,Heterogeneous Datasets in IoT Big Data,Semantic Analytics for Big Data.

Case Studies: Data Analytics in Smart Buildings, Internet-of-Things Analytics for Smart Cities.

UNIT V – APPLICATIONS OF IoT AND BIG DATA SOLUTIONS (9 Periods)

IoTBDs Applications: Smart Transportation**,** Smart Healthcare, Smart Grid, Smart Inventory System, Smart Manufacturing, Smart Retail, Smart agriculture.

Big Data Management Solutions for IoT: Case Study – Connected Car.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. John Soldatos, *Building Blocks for IoT Analytics*, River Publishers, 2017.
2. Pethuru Raj, T. Poongodi, Balamurugan Balusamy, and Manju Khari*, Internet of Things and Big Data Analytics Integrated Platforms and Industry Use Cases*, 1st edition, CRC Press, 2020.

REFERENCE BOOKS:

1. HwaiyuGeng, P.E., *Internet of Things and Data Analytics Handbook*, Wiley Publishing, 2017.
2. Dey. N, Hassanien A.E, Bhatt C, Ashour A.S, Satapathy S.C, *Data Analytics: Internet of Things and Big Data Analytics Toward Next-Generation Intelligence*, Springer, 2018.

ADDITIONAL LEARNING RESOURCES:

1. https://www.tutorialspoint.com/excel_data_analysis/data_analysis_overview.html
2. https://data-flair.training/blogs/data-analytics-tutorial/
3. https://pythonprogramming.net/data-analysis-tutorials/

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	-	-			-	-	-	-	-	3	-	-	-
CO2	2	3	-	-	-	2	1	-	-	-	-	-	3	-	-	-
CO3	1	2	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	3	-	-	-
CO5	2	2	3	-	-	-	-	2	-	-	-	-	3	-	-	-
Average	1.8	2.2	2.75	2	3	2	1	2	-	-	-	-	3	-	-	-
Level of correlation of the course	2	2	3	2	3	2	1	2	-	-	-	-	3	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

IV B. Tech. –I Semester
(19BT71234) **ADVANCED IoT LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Internet of Things Lab.

COURSE DESCRIPTION: Hands-on practice on Internet of Things (IoT); IBM Bluemix; Amazon AWS cloud; Google Firebase; Git hub IoT packages; Python IoT libraries for the development of IoT applications.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate hands-on experience on IoT.
CO2. Use IBM Bluemix, Amazon AWS cloud, Google Firebase, Git hub IoT packages and Python libraries for the development of IoT applications.
CO3. Analyze the user requirements for the development of IoT applications.
CO4. Develop IoT applications to solve societal problems using cloud environment.
CO5. Work independently or in teams to solve problems with effective communication.

LIST OF EXPERIMENTS:

1. Study of AT89S52 Ultra Development Kit with Development Tool /Environment of Kiel Software for Microcontroller programming
2. Familiarize with Intel Galileo Gen2 board and understand the procedure of creation and compilation of C source code.
3. Study of IoT Data Logging using Beaglebone Black and Thingspeak.
4. Turn your smartphone into an IoT device using the IBM Watson IoT Platform cloud-hosted service.
5. Controlling home light using WiFi Node MCU, and Relay module
6. Develop an application using the Google Firebase NodeMCU ESP8266
   a) Connecting Arduino Node-MCU with Google Firebase
   b) Control Led Using Firebase Console
   c) Control Led with Android App using Firebase database
7. Develop an application using the Google Firebase for controlling LED and Android App with NodeMCU
8. Configuring IOT Based DHT Sensor using AWS
9. Design and develop Alexa based Home Automation System using AWS.

REFERENCE BOOKS:

1. ArshdeepBahga and Vijay Madisetti, *Internet of Things(A hands on approach),* 1st Edition, VPI Publications, 2014.
2. Adrian McEwen and HakinCassimally, *Designing the Internet of Things,* Wiley India.
3. Massimo Banzi and Michael Shiloh*, Getting Started with Arduino*, 3rd Edition, Maker Media.

ADDITIONAL LEARNING RESOURCES:

1. https://aws.amazon.com/iot-core/getting-started/
2. https://www.balena.io/docs/learn/develop/integrations/bluemix/
3. https://github.com/thingsboard
4. https://www.javatpoint.com/iot-internet-of-things

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	2	-	-	-	-	-	-	-	-	3	-	3
CO2	2	2	3	-	2	-	-	-	-	-	-	-	-	3	-	2
CO3	2	2	3	3	2	-	-	-	-	-	-	-	-	3	-	2
CO4	2	2	3	2	2	-	-	-	-	-	-	-	-	3	-	2
CO5	2	-	-	-	2	-	-	-	-	-	-	-	-	3	-	2
Average	2.2	2	3	2.5	2	-	-	-	-	-	-	-	-	3	-	2.2
Level of correlation of the course	2	2	3	3	2	-	-	-	-	-	-	-	-	3	-	2

Level of Correlation: 3 - High 2 - Medium 1 - Low

MINOR DEGREE IN
CYBER SECURITY

Offering Department: COMPUTER SCIENCE AND SYSTEMS ENGINEERING
Students of Eligible Branches: ECE, EEE, EIE, ME and CE

COURSE STRUCTURE

Year &Semester	Course Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
III B.Tech. I-Sem (2 Theory + 1 Lab)	19BT40501	Computer Networks	3	-	-	3	3	40	60	100
	19BT60541	Adhocand Wireless Sensor Networks	3	-	-	3	3	40	60	100
	19BT31502	Operating Systems	3	-	-	3	3	40	60	100
	19BT40531	Computer Networks Lab	-	-	2	2	1	50	50	100
III B.Tech. II-Sem (2 Theory + 1 Lab)	19BT61201	Cloud Computing	3	-	-	3	3	40	60	100
	19BT51501	Modern Cryptography	3	-	-	3	3	40	60	100
	19BT50503	Cyber security	3	-	-	3	3	40	60	100
	19BT61534	Modern Cryptography Lab	-	-	2	2	1	50	50	100
IV B.Tech. I-Sem (1 Theory + 1 Lab)	19BT61509	IoT Security	3	-	-	3	3	40	60	100
	19BT61502	Information Security	3	-	-	3	3	40	60	100
	19BT71534	Information Security Lab	-	-	2	2	1	50	50	100

Note: If any student has chosen a course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s for the Minor degree. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course.

III B. Tech. - I Semester
(19BT40501) **COMPUTER NETWORKS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Introduction to computer networks; Protocols of physical layer, data link layer, medium access control sub layer, network layer, transport layer, application layer.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze the types of network topologies, layers and protocols.
CO2. Evaluate subnetting and routing algorithms for finding optimal paths in networks.
CO3. Solve problems related to flow control, error control and congestion control in data transmission.
CO4. Assess the impact of wired and wireless networks in the context of network protocols Like DNS, SMTP, HTTP, and FTP.
CO5. Apply ethical principles and standards for developing network-based solutions.

DETAILED SYLLABUS:

UNIT- I: INTRODUCTION AND PHYSICAL LAYER (9 Periods)

Network hardware, Network software, Reference models - OSI, TCP/IP; Example networks – Internet; Wireless LANs - 802.11.

Physical Layer - Guided transmission media, Wireless transmission, Switching - Circuit switching, Packet switching.

UNIT- II: DATA LINK LAYER AND MEDIUM ACCESS CONTROL SUBLAYER (9 Periods)

Data Link Layer: Data link layer design issues, Error detection and correction - CRC, Hamming codes; Elementary data link protocols, Sliding window protocols.

Medium Access Control Sub layer: ALOHA, Carrier sense multiple access protocols, Collision free protocols, Ethernet, Data link layer switching - Repeaters, Hubs, Bridges, Switches, Routers, Gateways.

UNIT- III: NETWORK LAYER (9 Periods)

Network layer design issues, Routing algorithms - Shortest path algorithm, Flooding, Distance vector routing, Link state routing, Hierarchical routing, Broadcast routing, Multicast routing, Anycast routing; Congestion control algorithms, Network layer in the internet - The IP version 4 protocol, IP addresses, IP version 6, Internet control protocols, OSPF, BGP.

UNIT- IV: TRANSPORT LAYER (9 Periods)

UDP – Segment header, Remote procedure call, Real-time transport protocols; TCP – service model, Protocol, Segment header, Connection establishment, Connection release, Sliding window, Timer management, Congestion control.

UNIT- V: APPLICATION LAYER (9 Periods)

Domain Name System (DNS) - Name space, Domain resource records, Name servers; Electronic mail - Architecture and services, User agent, Message formats, Message transfer, Final delivery; The World Wide Web - Architectural overview, HTTP, FTP.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK(S):

1. Andrew S. Tanenbaum and David J. Wetherall, *Computer Networks*, Pearson, 5th Edition, 2015.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, *Data Communications and Networking*, McGraw Hill, 5th Edition, 2013.
2. James F. Kurose and Keith W. Ross, *Computer Networking: A Top-Down Approach*, Pearson, 7th Edition, 2017.

ADDITIONAL LEARNING RESOURCES:

- https://www.cisco.com/c/en/us/solutions/small-business/resourcecenter/networking/networking-basics.html
- https://memberfiles.freewebs.com/00/88/103568800/documents/Data.And.Computer.Communications.8e.WilliamStallings.pdf

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
Average	3	2.3	2	2.5	-	2	-	3	-	-	-	-	-	-	-	-
Level of correlation of the course	3	3	2	3	-	2	-	3	-	-	-	-	-	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – I Semester
(19BT60541) ADHOC AND WIRELESS SENSOR NETWORKS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Ad hoc Wireless Networks, Medium Access Control Protocols for Ad hoc Wireless Networks, Routing Protocols for Ad hoc Wireless Networks, Wireless Sensor Networks, Medium Access Control Protocols for WSN's.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Investigate ad hoc and wireless sensor networks to improve the network performance.
CO2. Analyze the issues in MAC, routing protocols in Ad hoc wireless networks.
CO3. Apply routing protocols of MAC Layer in sensor networks to provide networking solutions.
CO4. Follow norms and standards in engineering practice to solve ad hoc and wireless sensor network problems.

DETAILED SYLLABUS:

UNIT–I: AD HOC WIRELESS NETWORKS (8 periods)
Fundamentals of wireless communication technology, the electromagnetic spectrum, Radio propagation mechanisms, Characteristics of the wireless channel, Applications, Issues, Ad hoc wireless Internet.

UNIT–II: MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS (8 periods)
Issues in designing a MAC protocol, Classification of MAC protocols, Contention based protocols, Contention based protocols with reservation mechanisms, and Contention based protocols with scheduling mechanisms.

UNIT–III: ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS (9 periods)
Issues in designing routing and transport layer protocol for Ad hoc networks, Classification of routing protocols, Table driven routing protocols, On demand routing protocols, Hybrid routing protocols.

UNIT–IV: WIRELESS SENSOR NETWORKS (9 periods)
Vision of ambient intelligence, Application examples, Types of applications, Challenges of WSN's, Why are sensor networks different, Enabling technologies, Hardware components, Energy consumption of sensor nodes.

UNIT–V: MEDIUM ACCESS CONTROL PROTOCOLS FOR WIRELESS SENSOR NETWORKS (11 periods)
Fundamentals of MAC protocols, Low duty cycle protocols and wake up concepts, Contention based protocols, Schedule based protocols, IEEE 802.15.4 MAC protocol, 802.11 and Bluetooth, Case study on tele healthcare – Introduction , MASN hardware design, Reliable MASN communication protocols, MASN software design, Integration of RFID and wearable sensors.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. C. Siva Ram Murthy, B.S. Manoj, *Ad Hoc Wireless Networks: Architectures and Protocols*, Pearson, 2012.
2. Holger Karl and Andreas Willig, *Protocols and Architectures for Wireless Sensor Networks*, Wiley, 2017.

REFERENCE BOOKS:

1. Fei Hu and Xiaojun Cao, *Wireless Sensor Networks: Principles and Practice*, CRC Press, 2010.
2. Yi Qian, Peter Muller and Hsiao–Hwa Chen, *Security in Wireless Networks and Systems*, Wiley, 2011.

ADDITIONAL LEARNING RESOURCES:

- https://www.tyndall.ie/wireless-sensor-networks-2
- https://www.elprocus.com/introduction-to-wireless-sensor-networks-types-and-applications/
- https://www.analog.com/en/design-center/landing-pages/002/apm/wsn-solution-2014.html

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	-	-	-	-	-	2	-	2	-	-	-	-	-	-	-	3
Average	2.6	2.3	1.5	-	-	2	-	2	-	-	-	-	-	-	-	3
Level of correlation of the course	3	3	2	-	-	2	-	2	-	-	-	-	-	-	-	3

Level of Correlation: 3 - High 2 - Medium 1 - Low

II B. Tech. – I Semester
(19BT31502)**OPERATING SYSTEMS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Operating Systems Operations; Process Scheduling; Process Synchronization, Deadlocks; Paging and Segmentation, Disk Scheduling; File Concepts, I/O Interface; Concepts of Protection and Security.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze performance of CPU scheduling algorithms.
CO2. Design solutions for process synchronization problems by using semaphores and monitors.
CO3. Devise solutions for deadlocks using deadlock handling mechanisms.
CO4. Solve memory management problems using page replacement and disk scheduling algorithms.
CO5. Identify efficient file allocation methods for optimal disk utilization.
CO6. Analyze services of I/O subsystems and mechanisms of security & protection.

DETAILED SYLLABUS:

UNIT I: INTRODUCTION TO OPERATING SYSTEM AND PROCESS MANAGEMENT (8 periods)

INTRODUCTION: Definition, Operating System Structure and Services, System Calls.
PROCESS MANAGEMENT: Process Scheduling, Process Control Block, Inter Process Communication, Threads, Multithreading Models, CPU Scheduling Criteria, Scheduling Algorithms, Multiprocessor Scheduling.

UNIT II: PROCESS SYNCHRONIZATION AND DEADLOCKS (10 periods)

PROCESS SYNCHRONIZATION: Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Synchronization Problems, Monitors.
DEADLOCKS: System Model, Deadlock characterization, Methods for handling deadlocks, Prevention, Detection, Avoidance, Recovery from deadlock.

UNIT III: MEMORY MANAGEMENT AND SECONDARY STORAGE (10 periods)

MEMORY MANAGEMENT: Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging.
VIRTUAL MEMORY: Demand Paging, Page Replacement Algorithms, Copy-on-Write, Thrashing.
SECONDARY STORAGE STRUCTURE: Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Disk Management.

UNIT IV: File and I/O Systems (8 periods)

FILE SYSTEM: File concept, Access Methods, Directory Structure, File System Structure, i-node, File System Implementation, Directory Implementation, Allocation Methods.
I/O SYSTEM: I/O Hardware, Application I/O Interface, Kernel I/O subsystem

UNIT V – PROTECTION AND SECURITY (9 periods)

PROTECTION: Goals, Principles, Domain of Protection, Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights.

SECURITY: Security Problem, Program Threats, System and Network Threats, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and Networks, Computer-Security Classifications.

Total Periods: 45

Topics for Self Study are provided in Lesson Plan

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, *Operating System Concepts*, Wiley India Edition, 9th Edition, 2016.

REFERENCE BOOKS:

1. William Stallings, *Operating Systems, Internals and Design Principles*, Pearson Education, 7th Edition, 2013.

2. Andrew S. Tanenbaum, *Modern Operating Systems*, PHI, 3rd Edition, 2009.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2	2	-	-	-	-	-	-	-	3	-	-	-
CO2	2	2	3	-	2	-	-	-	-	-	-	-	3	-	-	-
CO3	2	2	3	-	2	-	-	-	-	-	-	-	3	-	-	-
CO4	2	2	3	-	2	-	-	-	-	-	-	-	3	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO6	2	3	-	3	-	-	-	-	-	-	-	-	3	-	-	-
Average	2.16	2.5	2.75	2.5	2	-	-	-	-	-	-	-	3	-	-	-
Level of correlation of the course	2	3	3	3	2	-	-	-	-	-	-	-	3	-	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. - I Semester
(19BT40531) **COMPUTER NETWORKS LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Computer Networks.

COURSE DESCRIPTION: Hands on practice with NS3; Packet Tracer network simulation tools; Simulation of network topologies; ARP protocol; CSMA/CD protocol; Distance Vector/Link State Routing protocols; Transmission errors; Sliding window protocol; TCP; UDP.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Apply mathematical foundations to solve computational problems in computer networks.
CO2. Select and apply network simulation tools like NS3, Packet Tracer to simulate networking protocols.
CO3. Simulate and analyze network topologies, network protocols to provide efficient networking solutions.
CO4. Work independently and communicate effectively in oral and written forms.

LIST OF EXERCISES:

12. a) Study of network devices and network IP in detail.
    b) Simulate a peer to peer topology of a computer network.
    c) Simulate IPv4 addressing in a computer network (give IP Address of different classes in given Network id).

Exercises on Packet Tracer Simulator Tool:

13. Introduction to Packet Tracer
14. a) Study of basic network commands and network configuration commands.
    i) ping ii) nslookup iii) netstat iv) ifconfig
    b) Create a network topology and configure a network topology with four PCs, two switches, and two routers.

Exercises on NS3 Simulator Tool:

15. a) Introduction to NS3 tool.
    b) Create a network with three nodes namely 0, 1 and 2. Establish a TCP connection between node 0 and node 2 such that node 0 will send TCP packets to node 2 via node 1.
16. a) Create a simple topology of two nodes (Node1, Node2) separated by a point-to-point link. Setup a UDP Client on one Node1 and a UDP Server on Node2. Consider a fixed data rate Rate1.
    iv) Measure end to end throughput whilst varying the latency of the link.
    v) Add another client application to Node1 and a server instance to Node2. What do you need to configure to ensure that there is no conflict?
    vi) Repeat step 3 with the extra client and server application instances. Show screenshots of pcap traces which indicate that delivery is made to the appropriate server instance.
    b) Simulate a Local Area Network. Consider a local area network formed by nodes 3, 4, and 5. This LAN communicates with the external world through a router denoted by node 2. There are two servers connected to the router and represented by nodes 0 and 1. Node 0 is running an application over TCP, which is accessed by node 4. Node 1 is running an application on UDP, which is accessed by node 5. Analyze the trace file.

17. Simulate link errors. Presence of link errors cause one or more packets to be retransmitted. Consider the following topology.

Node #2 act as a router. Any traffic to or from the LAN passes through it. Consider node #1 running a FTP server, and node #5 is downloading a file of size 4 MB. However, the link between node #2 and #3 is fault. It drops packets with a fixed probability of 0.2. Implement a link error model to reflect this. Try different values of the simulation time to ensure that the file has been entirely transferred. Has the plot of bytes received a linear curve or non-linear? Why?

18. Simulate Address Resolution Protocol (ARP) to associate a logical address with a physical address and Reverse Address Resolution Protocol (RARP) allows a host to discover its Internet address when it knows only its physical address.

19. Simulate packet transmission over a CSMA/CD based LAN with NS3. Consider the LAN with seven nodes to be an isolated one i.e. not connected to the Internet. Node #0 in the LAN acts as a UDP traffic source, and node #6 is the destination node. Assume CBR traffic to be flowing between the nodes. The simulation lasts for 25 seconds. In Ethernet a packet is broadcasted in the shared medium, and only the destination node accepts the packet. Other nodes simply drop it. What should be the number of hops a packet from node #0 to node # 6 travel? Verify this from the "Hop Count" plot.

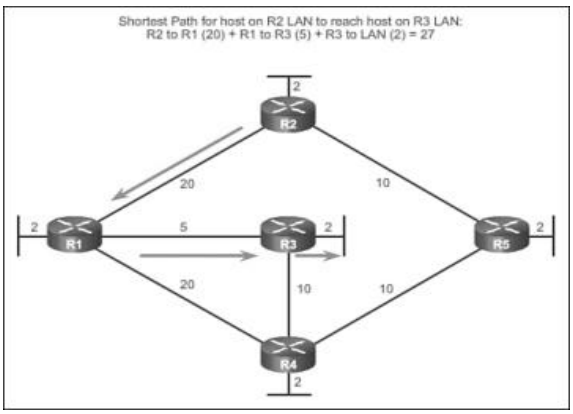
20. a) UDP uses a simple connectionless communication model with a minimum of protocol mechanism. The implementation provides checksums for data integrity, and port numbers for addressing different functions at the source and destination of the datagram. Simulate half duplex chat User Datagram Protocol.

    b) TCP model supports a full bidirectional TCP with connection setup and close logic. Simulate full duplex chat Transmission Control Protocol.

21. a) In a typical FTP session, the user is sitting in front of one host (the local host) and wants to transfer files to or from a remote host. Implement File Transfer Protocol
    to move files between local and remote file systems.

    b) Sliding window protocol supports reliable and efficient transmission between nodes and it also obtains higher throughput than that of stop-n-wait protocol. Simulate sliding window protocol normal operation and timeout operations.

22. Configure the following network to find shortest path between R2 LAN to R3 LAN using Distance Vector / Link State Routing Protocol.



REFERENCE BOOKS:

1. Andrew S. Tanenbaum and David J. Wetherall, *Computer Networks*, Pearson, 5th Edition, 2015.
2. A. Jesin, *Packet Tracer Network Simulator*,Packt Publishing, 2014.
3. Jack L. Burbank, *An Introduction to Network Simulator 3,* Wiley, 2018.

Software/Tools used:

- Network simulator tools - NS3, Packet Tracer
- Virtual Labs (Computer Networks Lab – http://vlabs.iitb.ac.in/vlabs-dev/labs_local/ computer-networks/ labs/explist.php)
- Virtual Labs (Advanced Network Technologies Virtual Lab - http://vlabs.iitkgp.ernet.in/ant)

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	-	-	3	-	-	-	-	-	-	-	-	2	-	-
CO3	1	3	3	3	3	-	-	2	-	-	-	-	-	2	-	-
CO4	-	-	-	-	-	-	-	3	3	-	-	-	-	2	-	-
Average	2	3	3	3	3			2	3	3	2			2		
Level of correlation of the course	3	2	3	3	3	-	-	2	3	3	2	-	-	2	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. – II Semester
(19BT61201) CLOUD COMPUTING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Fundamental Cloud Computing and Virtualization; Understanding Cloud Models and Architectures; Understanding Cloud Services, Applications and Capacity Planning; Exploring Platform as a Service (PaaS); Exploring Infrastructure as a Service (IaaS).

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on basic concepts and terminologies of Cloud Computing and Virtualization.
CO2. Select appropriate Cloud deployment models, Service models and Architectures in Cloud Application development.
CO3. Analyze Cloud services, Applications and Capacity Planning.
CO4. Apply different PaaS application frameworks to construct Cloud applications.
CO5. Develop web applications through Google, Microsoft and Amazon web services as per societal needs.

DETAILED SYLLABUS:

UNIT I–FUNDAMENTAL CLOUD COMPUTING AND VIRTUALIZATION (10 periods)

Cloud Computing: Origin and influences, Basic concepts and terminology, Goals and benefits, Risks and challenges, Roles and boundaries and Cloud characteristics.

Introduction to Virtualization: Characteristics, Taxonomy of virtualization technologies, Pros and cons of virtualization, Virtualization Technologies:Xen**,** VMware and Hyper-V.

UNIT II– UNDERSTANDINGCLOUD MODELS AND ARCHITECTURES (8 periods)

Cloud Models: NIST model, Cloud Cube model, Deployment models: Public, Private, Hybrid and Community; Service models: IaaS, PaaS and SaaS.

Understanding Cloud Architecture: Exploring the Cloud Computing Stack: Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications; Connecting to the Cloud: The Jolicloud Netbook OS and Chromium OS - The Browser as an Operating System.

UNIT III – UNDERSTANDING CLOUD SERVICES, APPLICATIONS AND CAPACITY PLANNING (9 periods)

Understanding Cloud Services and Applications Infrastructure as a Service (IaaS): IaaS workloads, Pods, aggregation, and silos; Platform as a Service (PaaS), Software as a Service (SaaS): SaaS characteristics, Open SaaS and SOA, Salesforce.com and CRM SaaS; Identity as a Service (IDaaS): Identity, Networked identity service classes, Identity system codes of conduct, IDaaS interoperability; Compliance as a Service (CaaS).

CapacityPlanning: Defining Baseline and Metrics: Baseline measurements, System metrics, Load Testing, Resource ceilings, Server and instance types; Network Capacity and Scaling.

UNIT IV – EXPLORING PLATFORM AS A SERVICE (PaaS) (10 periods)

PaaS Application Frameworks: Drupal, EccentexAppBase 3.0, Long Jump, Square space, WaveMaker and Wolf Frameworks.

Exploring Platform as a Service using Google Web Services: Surveying the Google Application Portfolio, Google Toolkit and Working with the Google App Engine.

Exploring Platform as a Service using Microsoft Cloud Services: Exploring Microsoft Cloud Services, Defining the Windows Azure Platform, Windows Live: Windows Live Essentials, Windows Live Home and Windows Live for Mobile.

UNIT V – EXPLORING INFRASTRUCTURE AS A SERVICE (IaaS) (8 periods)

Understanding Amazon Web Services, Amazon Web Service Components and Services, Working with the Elastic Compute Cloud (EC2): Amazon Machine Images, Pricing models, System images and software, Creating an account and instance on EC2; Working with Amazon Storage Systems: Amazon Simple Storage System (S3), Amazon Elastic Block Store (EBS) and CloudFront; Understanding Amazon Database Services: Amazon SimpleDB, Amazon Relational Database Service (RDS) and Choosing a database for AWS.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan.

TEXT BOOKS:

1. Barrie Sosinsky, *Cloud Computing Bible,* Wiley India Pvt Ltd, 2011 (Reprint 2017).
2. Thomas Erl and RicardoPuttini, *Cloud Computing- Concepts, Technology and Architecture,* Pearson, 2014 (Seventh Impression 2017).

REFERENCE BOOKS:

1. Rajkumar Buyya, Christian Vecchiloa and S ThamaraiSelvi, *Mastering Cloud Computing*, McGraw Hill Education, 2013 (Reprint 2017).
2. George Reese, *Cloud Application and Architectures*, O'Relly, 2009 (Reprint 2017).

ADDITIONAL LEARNING RESOURCES:

1. "Exploring the Google Toolkit", https://code.google.com/, drafted on 23 December, 2019.
2. "Understanding Amazon Web Services", https://aws.amazon.com/, drafted on 23 December, 2019.
3. "Exploring Microsoft Cloud Services", https://www.microsoft.com/windowsazure, drafted on 23 December, 2019.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	1	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	1	3	-
CO3	2	3	3	2	-	-	-	-	-	-	-	-	-	1	3	-
CO4	1	2	3	-	3	-	-	1	-	-	-	-	-	1	3	-
CO5	1	2	3	-	-	1	1	-	-	-	-	-	-	1	3	-
Average	2	2.33	3	2	3	1	1	1	-	-	-	-	1	1	3	-
Level of correlation of the course	2	3	3	2	3	1	1	1	-	-	-	-	-	1	3	-

Correlation Level: 3- High 2-Medium 1- Low

III B. TECH. - II SEMESTER
(19BT51501) MODERN CRYPTOGRAPHY

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Cryptographic protocols; Encryption techniques for confidentiality; Mathematics of symmetric and asymmetric algorithms; Hash functions for integrity; digital signature schemes.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Apply cryptographic protocols to ensure authentication in network systems.
CO2. Analyze the efficiency of cryptographic techniques based on security attacks.
CO3. Choose suitable key management scheme for efficient key exchange between the authenticated parties.
CO4. Implement algorithms using information, complexity, and number theories for ensuring the security requirements-CIA.
CO5. Evaluate Message Digest and Secure Hash Algorithms using hash functions for data Integrity.
CO6. Analyze well known digital signature algorithms for securing communication.

DETAILED SYLLABUS:

UNIT I – FOUNDATIONS OF CRYPTOGRAPHY (8 Periods)

FOUNDATIONS OF CRYPTOGRAPHY: Steganography, Substitution ciphers and Transposition Ciphers, One Time Pads. **Protocol Building Blocks:** Introduction to protocols, communications using symmetric Cryptography, One-Way Hash Functions, Communications Using Public-Key Cryptography, Digital Signatures with Encryption, Random and Pseudo-Random-Sequence Generation, **Basic Protocols**: Key Exchange, Authentication and key Exchange.

UNIT II- CRYPTOGRAPHIC TECHNIQUES (8 Periods)

CRYPTOGRAPHIC TECHNIQUES: Key Management, Electronic Codebook Mode, Block Replay, Cipher Block Chaining Mode, Stream Ciphers, Self-Synchronizing Stream Ciphers, Cipher-Feedback Mode, Synchronous Stream Ciphers, Output-Feedback Mode, Counter Mode, Choosing a Cipher Mode, Interleaving, Block Ciphers versus Stream Ciphers.

UNIT III- MATHEMATICS FOR CRYPTOGRAPHIC ALGORITHMS (12 Periods)

MATHEMATICS FOR CRYPTOGRAPHIC ALGORITHMS: Mathematical background:Information Theory, Complexity Theory, Number Theory, Factoring, Prime Number Generation, Discrete Logarithms in a Finite Field, Data **Encryption** Standard (DES), DES decryption, Security of DES, DES variants, Public Key Algorithms: RSA, Pholig-Hellman, RABIN, Elliptic Curve Cryptosystems.

UNIT IV- HASH FUNCTIONS (8 Periods)

HASH FUNCTIONS: One Way Hash Functions, Snefru hash function, N- Hash, MD4, MD5, Secure Hash Algorithm (SHA), Security of SHA, One Way Hash Functions Using Symmetric Block Algorithms, Using Public-Key Algorithms, Message Authentication Codes (MAC).

UNIT V- DIGITAL SIGNATURES (9 Periods)

DIGITAL SIGNATURES: Digital Signature Algorithm (DSA), Security of DSA, Discrete Logarithm Signature Schemes, Ongchnorr-Shamir, SCHNORR authentication and signature scheme, Diffie-Hellman Key exchange, Station-to-Station Protocol, Shamir's Three-Pass Protocol.

Total Periods 45

Topics for self-study are provided in the lesson plan

TEXTBOOKS:

1. Bruce Schneier, *Applied Cryptography: Protocols, Algorithms and Source Code in C*, John Wiley and Sons, New York, 2009.

REFERENCE BOOKS:

1. Alfred J Menezes, Paul C van Oorschot and Scott A.Vanstone, *Handbook of Applied Cryptography*, CRC Press, New York, 2010.
2. Wenbo Mao, *Modern Cryptography Theory and Practice*, Pearson Education, 2004

ADDITIONAL LEARNING RESOURCES:

https://www.coursera.org/specializations/applied-crypto
https://www.udacity.com/course/applied-cryptography--cs387
https://www.classcentral.com/course/udacity-applied-cryptography-326
https://www.classcentral.com/course/udacity-applied-cryptography-326
https://wiki.openssl.org/index.php/Command_Line_Utilities
https://www.sslshopper.com/article-most-common-openssl-commands.html

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	1	3	1	-	1	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	2	2	3	1	1	-	-	-	-	-	-	-	-	1	-	-
CO5	2	2	3	1	1	-	-	-	-	-	-	--	-	2	-	-
CO6	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
Average	2.3	2.6	2	1	1	-	-	-	-	-	-	-	-	2.5	-	-
Level of correlation of the course	3	3	2	1	1	-	-	-	-	-	-	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech.–II Semester
(19BT50503)**CYBER SECURITY**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Cybercrime, Cyberoffenses, Phishing, Identity theft, Cybercrime in mobile and wireless devices, Organizational measures for handling mobile devices, Security implications on using mobile devices, Tools and methods used in cybercrime, Forensics of computer and handheld devices, Real-life examples of cybercrime.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze methods of cybercrime, cyberoffenses to maintain cybersecurity.
CO2. Investigate tools used for cybercrime to protect computational assets.
CO3. Apply appropriate authentication mechanisms to reduce attacks on mobile and wireless devices.
CO4. Use appropriate cyberforensics tools and techniques to maintain cybersecurity.
CO5. Recognize the need for cybersecurity and practice ethics to protect privacy, property rights in cyberspace.

DETAILED SYLLABUS:

UNIT–I: CYBERCRIME (8 periods)
Cybercrime and information security, Cybercriminals, Classifications of cybercrimes, Need for Cyberlaws in Indian context, Legal perspectives of cybercrime, Indian perspective of cybercrimes, Cybercrime and the Indian ITA 2000, Positive aspects andweak areas of ITA 2000, Amendments made in Indian ITA 2000 for admissibility of e-records, Amendments to the Indian IT Act, Global perspective on cybercrimes, Intellectual property in cyberspace, Ethical dimension of cybercrimes.

UNIT–II: CYBEROFFENSES (11 periods)
Categories of cybercrime, How criminals plan the attacks, Social engineering, Cyberstalking, Cybercafe and cybercrimes, Botnets, Attack vector, Cloud computing, Phishing – Methods, Techniques, Spear phishing, Phishing scams, Phishing toolkits, Spy phishing, Countermeasures; Identity Theft – Personally identifiable information, Types, Techniques, Countermeasures, Effacing online identity.

UNIT–III: CYBERCRIME IN MOBILE AND WIRELESS DEVICES (7 periods)
Proliferation of mobile and wireless devices, Trends in mobility, Credit card frauds in mobile and wireless computing era, Security challenges posed by mobile devices, Registry settings for mobile devices, Authentication service security, Attacks on mobile/cell phones, Security implications of mobile devices for organizations, Organizational measures for handling mobile devices related security issues.

UNIT–IV: TOOLS AND METHODS USED IN CYBERCRIME (10 periods)
Proxy servers and anonymizers, Password cracking, Keyloggers and spywares, Virus and worms, Trojan horses and backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow, Attacks on wireless networks.

UNIT–V: CYBERFORENSICS, CYBERCRIMEIN REAL-WORLD (9 periods)
Forensics of Computer and Handheld Devices: Cyberforensics, Cyberforensics and digital evidence, Forensics analysis of e-mail, Forensics and social networking sites, Forensics of handheld devices – Smartphone forensics, EnCase, Device Seizure, MOBILedit.

Cybercrime examples, mini-cases, online scams: Real-life examples - Official website of Maharashtra Government hacked, Indian banks lose millions of rupees, Game source code stolen; Mini-cases - Indian Case of online gambling, Indian case of intellectual property crime; Online scams - Cheque cashing scam, Charity scams.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Nina Godbole, SunitBelapure, *Cyber Security*: *Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Wiley, 2013.

REFERENCE BOOKS:

1. Nilakshi Jain, Ramesh Menon, *Cyber Security and Cyber Laws*, Wiley, 2020.
2. Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, *Cybersecurity Essentials*, 1st Edition, Sybex, 2018.
3. ErdalOzkaya, *Cybersecurity: The Beginner's Guide*, 1stEdition,Packt Publishing, 2019.

ADDITIONAL LEARNING RESOURCES:

- Yuri Diogenes, ErdalOzkaya, *Cybersecurity: Attack and Defense Strategies*, 2nd Edition, Packt Publishing, 2019.
- http://www.ignou.ac.in/upload/Announcement/programmedetails.pdf
- Alessandro Parisi, *Hands-On Artificial Intelligence for Cybersecurity*, Packt Publishing, 2019.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-		-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	1	-		-	-	-	-	-	-	-	-	3	-	-
CO4	3	2		-	2	-	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-		2		2	-	-	-	-	-	3	-	-
Average	3	2	1	-	2	2		2	-	-	-	-	-	3	-	-
Level of correlation of the course	3	2	1	-	2	2		2	-	-	-	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

III B. Tech. - II Semester
(19BT61534) MODERN CRYPTOGRAPHY LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Modern Cryptography

COURSE DESCRIPTION: Mono-alphabetic Ciphers; Poly-alphabetic Ciphers; Block modes; Block ciphers; Public Key Algorithms, Message Digest Algorithms, Diffie-Hellman Key Exchange; SHA; Digital Signature Standards.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze attack resiliency of classical encryption algorithms to provide security.

CO2. Develop block cipher modes of operations and stream ciphers to achieve confidentiality in network systems.

CO3. Analyze the strength of RSA using cryptanalysis.

CO4. Use Key Exchange algorithm to ensure security primitives.

CO5. Implement different Message digest algorithms and DSS to achieve authentication.

CO6. Work independently or communicate effectively in oral and written forms.

LIST OF PROGRAMMING EXERCISES:

1. Implement the following monoalphabetic Ciphers and analyze its attack resiliency.
   a. Shift Cipher
   b. Affine cipher
2. Implement the following Poly-alphabetic Ciphers and analyze its attack resiliency.
   a. Hill cipher
   b. Vigenere
3. Implement the following block cipher modes and analyze the role of Initialization Vector (IV)
   a. counter mode
   b. Output Feedback mode
4. Write a program to implement the Data Encryption Standard (DES).
5. Implement a stream cipher algorithm with running key generator.
6. Write a program to Implement RSA algorithm.
7. Write a program to find prime factors of a given large number and analyze the time complexity.
8. Write a program to determine the message digest of a given message using the SHA-1 algorithm.
9. Write a program to implement Diffie-Hellman Key Exchange mechanism.
10. Write a program to implement Digital Signature Standard.

REFERENCE BOOKS:

1. William Stallings, *Cryptography and Network Security: Principles and Practice*, Pearson Education, 7th Edition, 2017.
2. Douglas R. Stinson, *Cryptography: Theory and Practice*, CRC Press, 3rd Edition, 2005.

ADDITIONAL LEARNING RESOURCES:

https://www.classcentral.com/course/udacity-applied-cryptography-326
https://www.classcentral.com/course/udacity-applied-cryptography-326
https://wiki.openssl.org/index.php/Command_Line_Utilities
https://www.sslshopper.com/article-most-common-openssl-commands.html

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	-	2	-	-	-	-	-	-	-	-	3	3	-
CO2	1	3	3	-	2	-	-	-	-	-	-	-	-	3	3	-
CO3	1	2	1	2	1	1	-	-	-	-	-	-	-	3	3	-
CO4	2	3	2	2	2	2	-	-	-	-	-	-	-	3	3	-
CO5	2	3	3	-	3	-	-	-	-	-	-	-	-	3	3	-
CO6	-	-	-	-	-	-	-	-	3	3	2		-	3	3	-
Average	2.67	2.8	2.4	2	2	1.5	-	-	3	3	2	-	-	3	3	-
Level of correlation of the course	3	3	3	2	2	2	-	-	3	3	2	-	-	3	3	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

IV B. Tech. – I Semester
(19BT61509) **IoT SECURITY**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Securing the Internet of Things; Cryptographic Fundamentals for IoT; Identity & Access Management Solutions for IoT; Mitigating IoT Privacy Concerns; Cloud Security for IoT

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1: Analyze Attacks, threats and vulnerabilities to secure IoT devices.
CO2: Design IoT messaging and communication protocols using Cryptographic primitives
CO3: Apply authentication credentials and Identity Access Management infrastructure to manage IoT
CO4: Analyze privacy concerns in IoT devices by using PIA
CO5: Examine IoT threats in the cloud for effective utilization of cloud services
CO6: Analyze different cloud service providers to IoT computing

DETAILED SYLLABUS:

UNIT I– Securing the Internet of Things (9periods)

Security Requirements in IoT Architecture - Security in Enabling Technologies -Security Concerns in IoT Applications. Security Architecture in the Internet of Things -Security Requirements in IoT - Insufficient Authentication/Authorization – Insecure Access Control - Threats to Access Control, Privacy, and Availability - Attacks Specific to IoT. Vulnerabilities – Secrecy and Secret-Key Capacity -Authentication/Authorization for Smart Devices - Transport Encryption – Attack & Fault trees

UNIT II –Cryptographic Fundamentals for IoT (9periods)

Cryptographic primitives and its role in IoT – Encryption and Decryption – Hashes –Digital Signatures – Random number generation – Cipher suites – key management fundamentals – cryptographic controls built into IoT messaging and communication protocols – Zigbee, Bluetooth-LE, Near Field Communication (NFC).

UNIT III – Identity & Access Management Solutions for IoT (9periods)

Identity lifecycle – authentication credentials– passwords, Symmetric keys, certificates, Biometrics, IoTIAMinfrastructure Authorization and Access controls within publish/Subscribe protocols, access controls within communication protocols

UNIT IV – Mitigating IoT Privacy Concerns (9periods)

Privacy challenges introduced by IoT- A complex sharing environment- wearable's, smart homes, Guiding to perform an IoT PIA-Authorities, characterizing collected information, use of collected information, Security, Notice, Data retention Information sharing, redress, auditing and accountability

UNIT V –Cloud Security for IoT (9periods)

Cloud services and IoT – offerings related to IoT from cloud service providers – Cloud IoT security controls – An enterprise IoT cloud security architecture – New directions in cloud enabled IoT computing

Total Periods: *45*

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. Brian Russell and Drew Van Duren, *Practical Internet of Things Security: Design a security framework for an Internet connected ecosystem*, 2nd Edition, 2016.

REFERENCE BOOKS:

1. Fei Hu, *Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations*, CRC Press, 2016.
2. *Securing the Internet of Things,* Elsevier Publications.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	1	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	-	2	-	-	-	-	-	-	-	-	2	-	-
CO4	2	3	-	-	1	-	-	-	-	-	-	-	-	2	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO6	2	3	-	-	-	2	2	-	-	-	-	-	-	2	-	-
Average	2.2	2.8	3	3	1.3	2	2	-	-	-	-	-	-	2.3	-	-
Level of correlation of the course	3	3	3	3	2	2	2	-	-	-	-	-	-	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

IV B. TECH. – I SEMESTER
(19BT61502) INFORMATION SECURITY

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Computer security; Need of Security; Access Control; Security policies; Software vulnerabilities; Secure Electronic transactions; Secure socket layer; transport layer security; Privacy.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1: Apply the security requirements like confidentiality, integrity, and availability to secure network assets from threats and attacks.
CO2: Analyze virus, malicious software and worms for detecting distributed Daniel of service attacks.
CO3: Apply handshaking, alert and change cipher spec protocols and Coding function to secure SSL and TLS.
CO4: Apply PGP model and canonical forms to secure E-Mail data at transport layer.
CO5: Design firewall to secure the system by applying various intrusion detection systems.
CO6: Apply privacy techniques to protect information in the network.

DETAILED SYLLABUS:

UNIT I–INTRODUCTION (8 periods)
Computer Security Concepts, the OSI Security Architecture, Security Attacks, Security Mechanism, Standards.
Malicious Software: Types of Malicious Software, Viruses, Worms, Distributed Denial of Service Attacks.

UNIT II – SECURITY AT TRANSPORT LAYER: SSL & TLS (9 periods)
Web Security Consideration, Secure Socket Layer and Transport Layer Security, Transport Layer Security, HTTPS, Secure Shell.
Wireless Network Security: IEEE 802.11 Wireless LAN Overview, IEEE 802.11i LAN Security, Wireless Application Protocol Overview, Wireless Transport Layer Security, WAP end-to-end Security

UNIT III – SECURITY AT APPLICATION LAYER: PGP AND S/MIME (8 periods)
Pretty Good Privacy, S/MIME, Domainkeys Identified Mail
IP Security: IP Security Overview, IP Security Policy, IP Security Architecture, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.

UNIT IV– INTRUDERS AND FIREWALLS (8 periods)
Intrusion Detection System: Intruders, Intrusion Detection, Password Management.
Firewalls: The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Firewall location and configuration.

UNIT V- PRIVACY (9 periods)
Evade Traffic analysis, Tunnel SSH through Tor, Encrypt you file seamlessly, Guard against Phishing, Use the web with fewer passwords, Encrypt your E-mail with Thunderbird, Encrypt you E-mail in Mac OS X

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. William Stallings *Network Security Essentials (Applications and Standards)*, 4th Edition, Pearson Education 2011.
2. Andrew Lockhart, *Information security Hacks (Tips and Tools for protecting your privacy)*, O'Reilly Media publisher, 2nd Edition, 2004.

REFERENCE BOOKS:

1. Behrousz A Forouzan, D Mukhopadhyay, *Cryptography and network Security*, 1st Edition, McGraw Hill,2010.
2 CharlieKaufman, Radia Perlman and Mike Speciner, *Network Security – Private Communication in a Public World,*2nd Edition, Pearson/PHI.

ADDITIONAL RESOURCES:

1. http://www.inf.ufsc.br/~bosco.sobral/ensino/ine5680/material-cripto-seg/2014 1/Stallings/Stallings_Cryptography_and_Network_Security.pdf.
2. http://www.ijcsmc.com/docs/papers/January2015/V4I1201544.pdf.
3. http://nptel.ac.in/syllabus/106105031/.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	2	-	-	-	-	-	-	-	3	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	3	3	-	-
CO3	3	3	2	-	2	2	3	2	-	-	-	-	3	3	-	-
CO4	3	3	2	2	2	-	-	-	-	-	-	-	3	3	-	-
CO5	2	2	3	2	1	-	2	-	-	-	-	-	3	3	-	-
CO6	3	3	2	2	2	-	3	-	-	-	-	-	3	3	-	-
Average	2.7	2.8	2.25	2	1.8	2	2.7	2	-	-	-	-	3	3	-	-
Level of correlation of the course	3	3	2	2	2	2	3	2	-	-	-	-	3	3	-	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

IV B. TECH. – I SEMESTER
(19BT71534)INFORMATION SECURITY LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Information Security

COURSE DESCRIPTION:
Windows Firewall Security Features, Introduction to wireshark tool, Pretty Good Privacy (PGP), Intrusion Detection System, SSL Certificate, and TSL.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***
CO1. Apply the tools and techniques to ensure the information security and privacy for network applications.
CO2. Analyze SSL Certificate and encryption in web applications for security.
CO3. Analyze SSL and TLS protocols to secure TCP connections.
CO4: Implement IP Packet filtering for blocking in-bound packets.
CO5. Work independently or communicate effectively in oral and written forms.

List of Exercises/List of Experiments:
1. Find the Packet Information using Wireshark on our network.
2. Simulate traffic analyzing using wireshark.
3. Study of SSL (HTTPS) over HTTP to secure TCP connections.
4. Simulate Transport Layer Security protocol.
5. Create a simple web application and deploy it in Apache tomcat server and secure it using SSL certificates.
6. Simulate Pretty Good Privacy security protocol for email messages and individual files.
7. Simulate IP Packet filtering at host system in user Network.
8. Study windows firewall security features on the system allotted to you.
9. Create firewalls using ip tables in linux.

REFERENCE BOOKS/LABORATORY MANUALS:

1. Computer Security: Principles and Practices, William Stallings and Lawrie Brown, Pearson Education, ISBN 13-9780134794396
2. Computer Security: Art and Science, by Matt Bishop, Pearson Education, ISBN:9788177584257

SOFTWARE/Tools used:
- Windows Fire Wall
- PGP
- SSL
- Tomcat 7.0.104
- Snort
- Java
- Wireshark

ADDITIONAL LEARNING RESOURCES:
https://www.cengage.com/resource_uploads/downloads/1111138214_259146.pdf
https://www.cmu.edu/iso/aware/presentation/tepperphd.pdf
https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-12r1.pdf
https://www.cs.unibo.it/babaoglu/courses/security/resources/documents/intro-to-crypto.pdf
http://www.cs.kent.edu/~mallouzi/ccn%20Spring%202014/

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	-	2	-	-	-	-	-	-	-	3	3	2	-
CO2	2	2	3	2	1	2	3	-	-	-	-	-	3	3	2	-
CO3	2	2	3	-	3	1		-	-	-	-	-	3	3	2	-
CO4	2	2	3	-	1	2	3	-	-	-	-	-	3	3	2	-
CO5	-	-	-	-	-	-	-	-	3	3	2	-	3	3	2	-
Average	2.25	1.75	2.75	2	1.75	1.6	3		3	3	2	-	3	3	2	-
Level of correlation of the course	3	2	3	2	2	2	3		3	3	2	-	3	3	2	-

Level of Correlation: 3 - High 2 - Medium 1 - Low

MINOR DEGREE IN
VLSI AND EMBEDDED SYSTEMS

Offering Department: ELECTRONICS AND COMMUNICATION ENGINEERING
Students of Eligible Branches: CSE, CSSE, IT, EEE, EIE, ME and CE

COURSE STRUCTURE

Year &Semester	Course code	Course title	Contact Periods per week				Scheme of Examination Max. Marks		
			L	T	P	C	Int. Marks	Ext. Marks	Total Marks
III B.Tech. I-Sem (2 Theory+ 1 Lab)	19BT30404	Switching Theory and Logic Design	3	-	-	3	40	60	100
	19BT50403	VLSI Design	3	-	-	3	40	60	100
	19BT60402	Microcontrollers	3	-	-	3	40	60	100
	19BT50433	Digital design Lab	-	-	2	1	40	60	100
III B.Tech. II-Sem. (2 Theory+ 1 Lab)	19BT60404	ARM and AVR Microcontrollers	3	-	-	3	40	60	100
	19BT60409	Testing and Testability	3	-	-	3	40	60	100
	19BT70408	Low Power CMOS VLSI Design	3	-	-	3	40	60	100
	19BT60415	Microprocessors and Microcontrollers	3	-	-	3	40	60	100
	19BT60434	VLSI Lab	-	-	2	1	40	60	100
IV B.Tech. I-Sem. (1 Theory+ 1 Lab)	19BT70401	Embedded Systems	3	-	-	3	40	60	100
	19BT70409	Real Time Systems	3	-	-	3	40	60	100
	19BT70414	System-on-Chip Design and verification	3	-	-	3	40	60	100
	19BT70432	Embedded Systems Lab	-	-	2	1	40	60	100

Note: If any student has chosen a course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s for the Minor degree. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course.

III B. Tech. – I Semester
(19BT30404) SWITCHING THEORY AND LOGIC DESIGN

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Number system and Boolean algebra; Minimization; Analysis and synthesis of digital circuits; Asynchronous Sequential Logic & Programmable Memories.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate the knowledge of Boolean Algebra, various number systems and Logic gates to implement Digital Circuits.

CO2. Design subsystem by Analyzing combinational & sequential logic circuits for providing optimal solutions

CO3. Develop Asynchronous sequential logic and programmable memories for societal needs.

CO4. Design various programmable logic arrays using logic gates

DETAILED SYLLABUS:

UNIT- I: NUMBER SYSTEMS AND BOOLEAN ALGEBRA (10 Periods)

Digital systems, Binary Numbers, Number base conversions, Complements of numbers, Signed binary numbers, Binary codes, Error detection and correction codes. Boolean Algebra-Basic definition, Basic theorems and properties, Boolean Functions, Canonical & Standard forms, logic operations & Logic gates.

UNIT- II: GATE LEVEL MINIMIZATION (8 Periods)

The map method, four variable, Five variable K-map, POS & SOP Simplification, Don't care conditions, NAND & NOR Implementation, Other two level Implementation, Ex-or Function, Tabular Method- Simplification of Boolean function using tabulation Method.

UNIT- III: COMBINATIONAL LOGIC DESIGN (9 Periods)

Combinational circuits, Analysis & Design procedure, Binary Adder-Sub tractor, Decimal Adder, Binary Multiplier, Magnitude comparator, Decoder, Encoders, Multiplexers and De-Multiplexers.

UNIT- IV: SEQUENTIAL LOGIC DESIGN (11 Periods)

Sequential Circuits, Latches, Flip-Flops, Analysis of Clocked sequential circuits, State Reduction & Assignment, Design procedure, Introduction to Registers-Universal Shift Registers, Introduction to Counters, Ripple Counters-Binary and BCD Ripple Counter, Synchronous counters-Binary, Up-Down Binary Counter and BCD Counter and Other counters-Ring Counter, Johnson Counter.

UNIT- V: ASYNCHRONOUS SEQUENTIAL LOGIC AND PROGRAMMABLE MEMORIES (7 Periods)

Introduction, Analysis procedure, Design Procedure-Primitive Flow Table, Reduction of State and Flow Tables-Implication Table and Implied States, Hazards, ROM, PLA, PAL.

Total Periods: 45

Topics for Self Study are provided in the Lesson Plan

TEXT BOOK:

1. M. Morris Mano, Michael D. Ciletti, *Digital Design With an Introduction to the Verilog HDL*, Pearson,5th edition, 2017.

REFERENCE BOOKS:

1. A. Anand Kumar, *Switching Theory and Logic Design*, PHI Learning Private Limited, 3rd edition, India, 2017.
2. Charles H. Roth, Jr. and Larry L. Kinney, *Fundamentals of Logic Design*, Cengage Learning, 7th edition, 2015

III B. Tech. – I Semester
(19BT50403) **VLSI Design**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Switching Theory and Logic Design/Digital Logic Design.

COURSE DESCRIPTION: Logic Families; CMOS Technology; Stick Diagrams and Layouts; Subsystem design; Programmable Interconnect structures; Memories.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze logic families, steady state and dynamic characteristics of CMOS, to improve performance characteristics of digital ICs.
CO2. Analyze electrical properties of MOS circuits for VLSI/ULSI chip fabrication.
CO3. Develop stick diagrams and layouts of CMOS circuits for miniaturization by analyzing gate delays and scaling effects.
CO4. Design subsystems for High speed digital electronics to compensate tradeoff among area, speed and power requirements.

DETAILED SYLLABUS:

UNIT I - DIGITAL LOGIC FAMILIES (8 Periods)

Introduction to logic families, RTL, DTL, Transistor-Transistor logic, Emitter Coupled Logic, I^2L, CMOS logic, CMOS steady state and dynamic electrical behavior.

UNIT II - FABRICATION AND ELECTRICAL PROPERTIES OF MOS (10 Periods)

Fabrication Process for NMOS and CMOS technology, Basic Electrical Properties of MOS: I_{ds} – V_{ds} relationships, Second order effects of MOSFETs-Latch up, Hot carrier Effects, channel length modulation, Threshold Voltage V_T, g_m, g_{ds} and ω_0; Pass Transistor, NMOS inverter, Pull up to pull down ratio for an NMOS inverter, CMOS Inverter

UNIT III - CMOS CIRCUIT DESIGN PROCESS (10 Periods)

VLSI design flow, MOS layers, stick diagrams, NMOS design style, CMOS design style, lambda based design rules, layouts for inverters, sheet resistance, capacitances of layers, Gate delays, Delay estimation, Scaling, Limitations of Scaling.

UNIT IV - SUBSYSTEM DESIGN - I (08 Periods)

Adders – Transmission based Adder, Carry look-ahead adder, Manchester carry chain adder, Carry Skip Adder, Carry Select Adder; Barrel Shifter, Multipliers – Array Multiplier, Booth Multiplier; ALUs.

UNIT V - SUBSYSTEM DESIGN - II (09 Periods)

Counters- Synchronous and Asynchronous Counter; High Density Memory Elements - Design Approach, FPGAs, Programmable Interconnect structures - Fusible links, Antifuse via link, UV Erasable, Electrically Erasable; CPLDs, Cell based Design Methodology.

Total Periods: 45

Topics for Self Study are provided in the Lesson Plan

TEXT BOOKS:

1. Kamran Eshraghian, Douglas A. Pucknell and sholehEshraghian, *Essentials of VLSI Circuits and Systems*, PHI, 2005.
2. Morris Mano, *Digital Design*, Prentice Hall, 3rd Edition, 2003 .

REFERENCE BOOKS:

1. John F.Wakerly, *Digital Design Principles and Practices*, Pearson Education Asia, 4th Edition, 2008.
2. John M. Rabaey, *Digital Integrated Circuits: A Design Perspective*, PHI, 2nd Edition, 2003.

III B. Tech. - I semester
(19BT60402) **MICROCONTROLLERS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Switching Theory and Logic Design/Digital Logic Design.

COURSE DESCRIPTION: 8051 Microcontroller - Architecture, programming, interrupts and applications; PIC microcontroller architecture, Interrupts and timers of PIC microcontroller, interfacing

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze Architectural features and Instruction Set of 8051 for control applications.

CO2. Analyze PIC18 Architecture and Instruction Set to develop computing applications.

CO3. DevelopPrograms for PIC18 using ports, timers and associated on Chip resources for Specified Applications.

CO4. Design microcomputer based systems with the knowledge of Interfaces and Peripherals of PIC18 to Solve various engineering problems.

DETAILED SYLLABUS:

UNIT I: 80C51/31 (10 Periods)

Microprocessors vs Microcontrollers, 8051 Architecture, Internal and external memories, Addressing modes, Timers/Counters structure & configuration, Instruction set of 8051, simple programs using 8051.

UNIT II: PIC ARCHITECTURE & PROGRAMMING (10 Periods)

Architecture of PIC18, Register Organization, Memory Organization - ROM space & RAM; Data formats & Directives, Instruction Set: Arithmetic, Logic, branching, Bit wise, bank switching, Simple PIC Programs.

UNIT- III: PORTS, TIMERS & PROGRAMMING (10 Periods)

Pin description of PIC18F452, Basic Port Structure, I/O port programming; Macros and modules, Structure of Timer 0 & its Programming using Assembly and C, Counter programming, Structure of timers 1, 2 and 3 & their Programming.

UNIT- IV: PIC - SERIAL PORT AND INTERRUPTS (7 Periods)

Basics of communication – Serial/Parallel, RS232 & PIC18 connection to RS232, Serial Port Structure & programming; PIC18 interrupts, Programming timer interrupts, Programming serial interrupts.

UNIT- V: PIC INTERFACING (8 Periods)

7 segment LED and LCD interfacing, keyboard interfacing, interfacing ADC, DAC, Interfacing DC motor, stepper motor, PWM using CCP.

Total Periods: 45

Topics for Self Study are provided in the Lesson Plan

TEXT BOOKS:

1. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D, *The 8051 Microcontroller and Embedded Systems-using assembly and C,* PHI, 2006/ Pearson New International Edition 2014
2. Muhammad Ali Mazidi, Rolin D. McKinlay, Danny causey, *PIC Microcontroller and Embedded Systems: Using C and PIC18*, Pearson Education, 2015.

REFERENCE BOOKS:

1. Kenneth J. Ayala, *The 8051 Microcontroller-Architecture, Programming & Applications,* 3rd Edition, Cengage learning, June 2007.
2. Ramesh S. Gaonkar, *Fundamentals of Microcontrollers and Applications in Embedded Systems (With PIC18 Microcontroller Family),* Penram International, 2010.
3. M Rafiquzzaman, *Microcontroller Theory And Applications With The PIC, Wiley India Publications, March 2014*

ADDITIONAL LEARNING RESOURCES:

1. http://crystal.uta.edu/~zaruba/CSE3442/
2. https://owd.tcnj.edu/~hernande/ELC343/
3. http://www.ciebookstore.com/Content/Images/uploaded/PIC18-Study-Guide-CIE.pdf

III B. Tech. – I Semester
(19BT50433) **DIGITAL DESIGN LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	-	-	2	1

PRE-REQUISITES: -
COURSE DESCRIPTION: Design and verification of Digital Circuits, PCB Design of Electronic Circuits.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Design and Realize various Digital applications by using ICs for societal needs.
CO2. Implement Electronic Circuits using Passive and Active elements for specified applications.
CO3. Analyze performance parameters for PCB designed circuits using a simulation tool.
CO4. Work independently and in teams to solve problems with effective Communication.

LIST OF EXERCISES/LIST OF EXPERIMENTS:
Part-A: Realize the Following in Hardware

(Minimum **Six** Experiments are to be conducted)

1. Realize gates using NAND & NOR gates.
2. Optimize and Realize a given Boolean Function.
3. Design and Realize BCD to Excess-3 Code Converter.
4. Design and Realize Adder and Subtractor using Multiplexer based on logic gates/ IC74153.
5. Design and Realize a BCD to 7-Segment Decoder using Logic Gates/ ICs.
6. Design and Realize a Hexadecimal to Binary Encoder using IC74148 and IC74157.
7. Design and Realize a Sequence Generator using IC7495.
8. Design and Realize Asynchronous and Synchronous counters using IC7476 (JK-Flip Flop).

Part-B: PCB Layout Design of Electronic Circuits using TINAPRO/ eSIM-KiCAD/ TinyCAD/ Fritzing Software

*(Minimum **Four** Experiments are to be conducted)*

1. RC Filter.
2. Half Wave Precision Rectifier.
3. Zener Regulator.
4. Diode Clamper.
5. Transistor as a Switch.
6. CMOS Inverter.

REFERENCE BOOKS/LABORATORY MANUALS:
1. John F. Wakerly, *Digital Design Principles & Practices*, Pearson Education Asia, 4th Edition, 2008.

SOFTWARE/Tools used:
TINAPRO/ eSIM-KiCAD/ TinyCAD PCB Design Tool.

ADDITIONAL LEARNING RESOURCES:
1. http://vlabs.iitb.ac.in/vlabsdev/vlab_bootcamp/bootcamp/cool_developers/index.html - Virtual labs for digital circuits
2. https://nptel.ac.in/courses/108/108/108108031/
3. https://swayam.gov.in/nd2_aic20_sp59/preview

III B. Tech. – II Semester
(19BT60404) ARM AND AVR CONTROLLERS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Switching Theory and Logic Design/Digital Logic Design,& Microcontrollers.

COURSE DESCRIPTION: ARM Architecture; ARM Instruction Set; ARM Programming; AVR Architecture; AVR Programming in Assembly Language & C

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze ARM Architectures and Instruction Set to develop fundamental Programs .
CO2. Develop efficient ARM based Prototypes by analyzing modes of ARM operation to program ARM Cortex M3 at Assembly and high levels.
CO3. Realize efficient Embedded Systems with an understanding of limitations by evaluating architectural features of AVR Family Microcontrollers .
CO4. Apply Programming techniques at Assembly and High Level to develop industry standard microcontroller based systems.

DETAILED SYLLABUS:

UNIT- I: Introduction to ARM Architecture (9 Periods)

Introduction to ARM family of processors and controllers, Architecture of ARM Cortex M3, Cortex M3 fundamentals, registers, Operation modes, ARM Instruction Set: Data transfer, Data Processing Call & Branch, Bit Manipulation, Pseudo Instructions and other useful instructions in Cortex M3, ARM Assembly Language Programming.

UNIT -II: Thumb Programming & other ARM features (9 Periods)

Thumb Instruction Set, ARM Mode & Thumb mode Programming, ARM Programming in C. Memory system, memory map, Memory system attributes, ARM Pipeline, Exception types, Cortex M3 Processor applications.

UNIT III: INTRODUCTION to AVR MICROCONTROLLER (9 Periods)

Overview of AVR family, AVR Microcontroller architecture, status register, Special function registers, RAM, ROM & EEPROM space, On-Chip peripherals, ATmega32 pin configuration & function of each pin, Fuse bits of AVR.

UNIT IV: AVR ASSEMBLY LANGUAGE PROGRAMMING (10 Periods)

AVR data types and assembler directives, Addressing modes of AVR, Data transfer, Arithmetic, Logic and Compare, Rotate and Shift, Branch and Call instructions, AVR studio setup for assembly language programming, AVR I/O Port Programming, Time delay loop, Look-up table, Bit addressability, MACROs, Intel HEX file.

UNIT V: AVR PROGRAMMIN IN C (8 Periods)

AVR Data types, AVR I/O port programming, Timer programming, Input capture and Wave Generator, PWM programming External Interrupt programming, ADC programming, EEPROM programming.

Total Periods: 45

Topics for Self Study are provided in the Lesson Plan

TEXT BOOKS:

1. Joseph Yiu, *The Definitive Guide to the ARM Cortex-M3 & M4*, Elsevier, 3rd Edition, January 2014.
2. Muhammad Ali Mazidi, SarmadNaimi and SepehrNaimi*, The AVR Microcontroller and Embedded Systems Using Assembly and C*, Pearson Education, January 2014.

REFERENCE BOOKS:

1. Ramesh Gaonkar, *Fundamentals of Microcontrollers and Applications in Embedded Systems (with the PIC18 Microcontroller Family)*, Penram International, First edition,2010
2. Andrew Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide: Designing and Optimizing System Software (The Morgan Kaufmann Series in Computer Architecture and Design), October 2004.
3. AVR ATmega32 data sheet

III B. Tech. – II Semester
(19BT60409)**TESTING AND TESTABILITY**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on VLSI Design.

COURSE DESCRIPTION: Need for Testing, Types of Testing, Fault Modeling, Test Methods for evaluation, Test Generation Algorithms, Delay Tests, IDDQ Tests, Ad-Hoc DFT Methods, Scan Based Designs, Built-In Self Test.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Understand the importance of Testing, fault models and related theorems.
CO2. Analyze various test methods, combinational and sequential circuit test generation Algorithms for Functional Verification of Digital Circuits.
CO3. Analyze delay test algorithms and IDDQ test algorithms for at-speed testing of CMOS Integrated Circuits.
CO4. Understand the concepts and architectures for Built-In Self Testto satisfy industry specifications.

DETAILED SYLLABUS:

UNIT I– INTRODUCTION TO TESTING (9 Periods)
Role of Testing, VLSI Technology Trends Affecting Testing, Types of Testing, Test Economics, Yield, Fault Modeling, Fault Equivalence, Fault Collapsing, Fault Dominance and Checkpoint Theorem.

UNIT II – TEST METHODS (10 Periods)
Simulation for Design Verification and Test Evaluation, Algorithms for Fault Simulation – Serial, Parallel, Deductive, Concurrent Fault Simulations; Fault Sampling.

UNIT III – COMBINATIONAL AND SEQUENTIAL CIRCUIT TEST GENERATION (11 Periods)

ATPG Algorithms – D-Algorithm, PODEM, FAN; Test Compaction, Time Frame Expansion Method – Nine-Value Algorithm; Simulation Based Sequential ATPG - CONTEST Algorithm.

UNIT IV – DELAY AND IDDQ TESTS (6 Periods)
Delay Test – Path-Delay Test, Transition Faults, At-Speed Testing; IDDQ Test – Limitations, Delta IDDQ Testing, IDDQ Built-in Current Testing.

UNIT V – DESIGN FOR TESTABILITY (9 Periods)
Ad-Hoc DFT Methods, Full Scan Design, Partial Scan Design, Random Logic BIST – Test-per-Clock and Test-per-Scan BIST Systems; Boundary Scan Standard – TAP Controller and Port.

Total Periods: *45*

Topics for Self Study are provided in the Lesson Plan

TEXT BOOK:

1. Michael L. Bushnell, Vishwani D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Pulishers, Springer US, New York, 2006.

REFERENCE BOOKS:

1. MironAbramovici, Melvin A. Breur, Arthur D.Friedman, "Digital Systems Testing and Testable Design", Wiley, Jaico Publishing House, 1st Edition, 2001.
2. Alfred L. Crouch, "Design for Test for Digital ICs & Embedded Core Systems", Pearson Education, 1st Reprint Edition, 2007.
3. Robert J.Feugate, Jr., Steven M.Mclntyre, "Introduction to VLSI Testing", Prentice Hall, 1st Illustrated Edition,1998.

ADDITIONAL LEARNING RESOURCES:

1. https://www.classcentral.com/course/swayam-digital-vlsi-testing-7956

III B. Tech. - II semester
(19BT70408) **LOW POWER CMOS VLSI DESIGN**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on VLSI Design.

COURSE DESCRIPTION: Basic Principles; Methodologies and techniques of CMOS Circuit Designs; Need For Low Power VLSI Design; Principles Of Low Power Circuit Design; Simulation Analysis of Low Power; Logic and Circuit Analysis; Special Techniques and Advanced Techniques Of Low Power Design; Performance Management in Architecture or System level.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate low power design requirements for CMOS VLSI circuits.
CO2. Analyze and estimate power at Logic and Circuit abstraction levels of digital systems.
CO3. Develop alternate circuits and logic for analysis of low power circuits.
CO4. Apply special and advanced low power techniques at circuit, architecture and systemlevels to develop CMOS devices.

DETAILED SYLLABUS:

UNIT-I: BASICS OF LOW POWER DESIGN (07 Periods)

Needs For Low Power VLSI Chips, Charging And Discharging Capacitances, Short Circuit Current in CMOS, CMOS Leakage Current, Static Current, Basic Principles Of Low Power Design, Low Power Figure Of Merits, Low Power VLSI Design Limits.

UNIT-II: POWER ANALYSIS AND ESTIMATION (10 Periods)

Spice Circuit Simulation, Discrete Transistor Modeling and Analysis, Gate Level Logic Simulation, Architecture Level Analysis, Data Correlation Analysis, Monte Carlo Simulation.

UNIT-III: LOW POWER CIRCUITS (11 Periods)
CIRCUIT ANALYSIS: Transistor and Gate Sizing, Equivalent Pin Ordering, Network Restructuring and Reorganization, Special latches and Flip flops.

LOGIC ANALYSIS: Gate Reorganization, Signal Gating, Logic Encoding, State Machine Encoding, Pre computation Logic.

UNIT-IV: SPECIAL TECHNIQUES (08 Periods)

Power Reduction in Clock Networks, CMOS Floating Node, Low Power Bus, Delay Balancing, Low Power Techniques for SRAM.

UNIT-V: ARCHITECTURE, SYSTEM & ADVANCED TECHNIQUES (09 Periods)

Power and Performance Management, Switching Activity Reduction, Adiabatic Computation, Pass Transistor Logic Synthesis, Asynchronous Circuit.

Total Periods: 45

Topics for Self Study are provided in the Lesson Plan

TEXT BOOK:

1. Gary Yeap, *Practical Low-Power Digital VLSI Design*, Springer Publication, 2012.

REFERENCE BOOKS:

1. A.P.Chandrakasan, R.W.Broadersen, *Low Power Digital CMOS Design*, Kluwer, Springer US, 2012.
2. Kaushik Roy, Sharat Prasad, *Low-Power CMOS VLSI Circuit Design*, Wiley Student Edition, 2009.

ADDITIONAL LEARNING RESOURCES:

https://nptel.ac.in/courses/106/105/106105034/
https://nptel.ac.in/courses/117/101/117101004/

III B. Tech. - II semester
(19BT60415) MICROPROCESSORS AND MICROCONTROLLERS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Switching Theory and Logic Design/Digital Logic Design.

COURSE DESCRIPTION: Architecture, Instruction set and programming of 8086; Programmable interfacing devices - architecture and programming; Interfacing Memory and I/O devices with 8086; 8051 Microcontroller - Architecture, programming, interrupts and applications.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze Architectural features and Instruction Set of 8086 for computing applications.
CO2. Analyze Techniques for Interfacing various peripherals to realize Microcomputer based systems
CO3. Analyze Architectural features and Instruction Set of 8051 for control applications.
CO4. Design various embedded applications programming 8051 on-chip Resources and by interfacing various peripherals.

DETAILED SYLLABUS:

UNIT - I: 8086 ARCHITECTURE AND PROGRAMMING (10 Periods)

Microprocessor Evolution, Review of Intel 8085, 8086 internal Architecture - register organization, memory segmentation, memory organization; Introduction to programming the 8086 - Assembler directives, addressing modes, instruction set, simple programs, procedures and macros;

UNIT - II: 8086 INTERFACING AND INTERRUPTS (08 Periods)

Pin description, minimum & maximum mode operation of 8086, timing diagram. Interfacing memory (RAM and EPROM) to 8086. 8086 Interrupts - types and interrupt responses, Interrupt vector table, priority of interrupts; 8259 priority interrupt controller - architecture, system connections and cascading, initialization of 8529;

UNIT - III: PROGRAMMABLE DATA COMMUNICATION DEVICES (11 Periods)

Introduction to serial and parallel communication, methods of parallel data transfer. 8255 PPI - Internal architecture and system connections, operational modes and initialization, interfacing stepper motor, ADC, DAC, Optical Shaft Encoder; Methods of serial data transfer, 8251 USART - architecture and its initialization, sending and receiving characters; Serial communication standard - RS232C, USB; Architecture and operation of 8257 DMA controller.

UNIT - IV: MICROCONTROLLERS AND PROGRAMMING (08 Periods)

Microcontroller Vs. General purpose microprocessor, 8051/8052 Microcontroller – architecture, features, register organization, pin diagram, internal and external memories & their interfacing, instruction set, addressing modes, simple programs;

UNIT - V: 8051 INTERFACING **(08 Periods)**

Timer/Counters – Registers, modes and programming; Serial communication – registers, programming 8051 for serial communication; Interrupts – registers, programming; 8051 applications – Interfacing key board, LEDs and LCD;

Total Periods: 45

Topics for Self Study are provided in the Lesson Plan

TEXT BOOKS:

1. Douglas V. Hall, *Microprocessors and Interfacing: Programming and Hardware,* Tata McGraw-Hill, revised 2nd Edition, 2006.
2. Muhammad Ali Mazidi and Janice GillispieMazidi, *The 8051 Microcontroller and Embedded Systems,* Prentice Hall of India, 2000.

REFERENCE BOOKS:

1. A.K. Ray and K.M. Bhurchandi, *Advanced Microprocessors and Peripherals-Architecture, Programming and Interfacing,* Tata McGraw Hill, 2002 reprint.
2. Kenneth J. Ayala, *The 8051 microcontroller, Thomson Delmar learning,* 3rd Edition, 2004.

III B. Tech. – II Semester
(19BT60434) **VLSI LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	-	-	2	1

PRE-REQUISITES: A course on Switching Theory and Logic Design/ Digital Logic Design.

COURSE DESCRIPTION: Design and verification of various combinational & sequential digital circuits through source code.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze simplification methods in logic circuits and perform desired logical operations optimally using logic gates.

CO2. Design combinational circuits to perform arithmetic operations, data encoding and decoding, Multiplexing and Demultiplexing for engineering applications.

CO3. Design sequential circuits for realizing counters and registers using flip-flops.

CO4. Develop source code for Advanced Digital Design and perform functional verification.

CO5. Work independently or in teams to solve problems with effective Communication.

LIST OF EXERCISES/LIST OF EXPERIMENTS:

Part-A: Basic Digital Design

*(Minimum **SEVEN** experiments are to be conducted)*

Develop the source code for the following circuits and their test bench for verification. Also perform simulation, synthesis for given specifications

1. Buffer and basic gates.
2. Flip flops - RS, D, JK, T.
3. Adders and Subtractors.
4. 8-3 Encoder.
5. 3-8 Decoders.
6. 8x1 Multiplexer and 2x4 Demultiplexer.
7. Arithmetic and Logic Unit.
8. Synchronous &Asynchronous counter.
9. 4 Bit Comparator

Part-B: Advanced Digital Design (FPGA Implementation)

*(Minimum **THREE** Experiments are to be conducted)*

1. Write Verilog code for the design of 8-bit
i. Carry Ripple Adder
ii. Carry Look Ahead adder
iii. Carry Save Adder

2. Write Verilog Code for the design of 8-bit
i. Array Multiplier (Signed and Unsigned)
ii. Booth Multiplier (Radix-4)
3. Write Verilog code for the design of 4/8-bit
i. Universal Shift Register
ii. Parity Generator
4. Write Verilog code for the design of 4/8-bit

i. Pseudo Random Pattern Generator
ii. LFSR

5. Design a Mealy and Moore Sequence Detector using Verilog to detect Sequence.
Eg. 11101 (with and without overlap) any sequence can be specified

Note: (For the experiments listed above, students can make the following flow of study
-RTL synthesis
-creation of power Analysis
-use of I/O constrains)

REFERENCE BOOKS/LABORATORY MANUALS:

1. M. Morris Mano, Digital Design, Pearson Education, 5th edition, 2013.
2. Charles H. Roth, Fundamentals of Logic Design, Thomson Publications, 5th edition, 2004.
3. John F. Wakerly, Digital Design Principles & Practices, Pearson Education Asia, 4th Edition, 2008.
4. Stephen Brown and ZvonkoVramesic, Fundamentals of Digital Logic with VHDL Design, McGraw Hill, 2nd Edition, 2005.

SOFTWARE/Tools used:

CADENCE/SYNOPSYS/MENTOR GRAPHICS/TANNER or any other equivalent Tool FPGA/CPLD Boards with Xilinx or any other equivalent

ADDITIONAL LEARNING RESOURCES:

1. http://www.vlab.co.in
2. https://swayam.gov.in

IV B. Tech. – I Semester
(19BT70401) EMBEDDED SYSTEMS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Microcontrollers/Microprocessors and Microcontrollers.

COURSE DESCRIPTION: MSP430 Architecture; Instruction Set; Programming; On-Chip Resources; Communication with peripherals; Embedded system design approaches.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze MSP430 Architecture, Instruction Set, Addressing modes to develop programs for various control applications using Assembly and Embedded C.
CO2. Solve Problems by analyzing MSP430 On Chip Resources such as Timer, Clock System, Low Power Modes/techniques and Interrupt Structure.
CO3. Realize Mixed Signal Processing and Networking Applications, by analyzing on-Chip Resources such as Comparator, ADC, Temperature Sensor, PWM and Communication Peripherals.
CO4. Analyze Language, IDE Support, Processor IC & Design Technologies, and System Modeling Techniques to capture behavior of Embedded Prototype using suitable model.

DETAILED SYLLABUS:

UNIT- I: ARCHITECTURE OF MSP430 (09 periods)
Embedded Systems – Introduction, MSP430 - Anatomy of microcontroller, Memory, Software, Pin out (MSP430G2553), Functional Block diagram, Memory, CPU, and Memory mapped input and output, Clock generator; Exceptions- Interrupts and Resets.

UNIT- II: PROGRAMMING MSP430 (09 periods)
Development Environment, Aspects of C for Embedded Systems, Assembly Language, Register Organization, Addressing Modes, Constant Generator and Emulated Instructions, Instruction Set, Example programs- Light LEDs, Read input from a switch; Automatic Control-Flashing light by delay, use of subroutines and Functions; Basic Clock System, Interrupts and Low Power Modes.

UNIT- III: TIMERS AND MIXED SIGNAL SYSTEMS (09 periods)
Timers - Watchdog Timer, RTC, Timer A, Measurement in capture mode, PWM generation; Mixed Signal Systems- Comparator A, ADC10 SAADC –Architecture, operation- Single Conversion, Temperature Sensor on ADC10, DTC in ADC10; ADC12 – Comparison with ADC10.

UNIT- IV: COMMUNICATION PERIPHERALS & PROTOCOLS (09 periods)
MSP430 Communication Interfaces- USART,USCI, USI;
Communication Protocols- SPI, Inter-integrated Circuit Bus, USB, CAN

UNIT - V: EMBEDDED SYSTEM DESIGN (09 periods)
Processor Technology, IC Technology, Design Technology, Tradeoffs.
Model VS.Language, System Modelling – Data Flow Model, FSM, FSMD, HCFSM, PSM, Concurrent Process Model & implementation.

Total Periods: *45*

Topics for Self Study are provided in the Lesson Plan

TEXT BOOKS:

1. John H. Davies, *MSP430 Microcontroller Basics*, Newnes Publications, 1st Edition, 2008.
2. Santanu Chattopadyay, Embedded System Design, PHI, 2010.
3. Frank Vahid, Tony D. Givargis, *Embedded System Design – A Unified Hardware/Software Introduction,* John Wiley, January 2006

REFERENCE BOOKS:

1. Chris Nagy, *Embedded Systems Design using the TI MSP30 Series*, Newnes Publications, October 2003.
2. JorgeonStaunstrup, Wayne Wolf, *Hardware/Software Co-design Principles and Practice*,
   Springer 2009.
3. Patrick R Schamont, *A Practical Introduction to Hardware/Software Co-design, Springer publications*, January 2010.

IV B. Tech. – I Semester
(19BT70409) REAL TIME SYSTEMS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Microcontrollers/ Microprocessors and Microcontrollers and Embedded Systems.

COURSE DESCRIPTION: Real Time Systems Modeling; Scheduling Approaches;Multiprocessor and Distributed Scheduling Algorithms; Fault Tolerant Systems; Real Time Operating Systems.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze Real Time System Characterization, Workload and Resource management algorithms and apply suitable techniques to model hard and soft real time systems.

CO2. Solve scheduling problems and apply suitable techniques in constrained RT systems by Surveying various Real Time scheduling approaches for uniprocessor, Multiprocessor and distributed environments.

CO3. Evaluate appropriate Fault tolerant techniques and apply them to design fail safe RT systems.

CO4. Implement Efficient Real Time Systems porting suitable operating system on to hardware by Investigating POSSIX standard Kernel structure, services and Kernel objects.

DETAILED SYLLABUS:

UNIT-I: MODELING OF REAL TIME SYSTEMS (9 Periods)

Hard Vs Soft Real Time Systems, A Reference Model of Real Time Systems- Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency. Functional Parameters, Resource Parameters of Jobs and Parameters of Resources, Scheduling hierarchy.

UNIT-II: APPROACHES TO REAL TIME SCHEDULING (9 Periods)

Clock Driven, Weighted Round Robin, Priority Driven, Dynamic Vs Static Systems, Effective Release Times and Dead Lines, Optimality and Non-optimality of EDF and LST algorithms, Challenges in Validating Timing Constraints in Priority Driven Systems, Offline Vs Online Scheduling.

UNIT-III: SCHEDULING REAL TIME TASKS IN MULTIPROCESSOR AND DISTRIBUTED SYSTEMS (9 Periods)

Multiprocessor task allocation, Dynamic allocation of tasks, Fault tolerant scheduling of tasks, Clocks in distributed Real Time Systems, Centralized clock distribution, Distributed clock synchronization.

UNIT-IV: FAULT TOLERANCE TECHNIQUES (9 Periods)

Introduction, Failures- Causes, Types, Detection. Fault and Error Containment, Redundancy- Hardware, Software, Time, Integrated Failure Handling.

UNIT-V: OPERATING SYSTEMS (9 Periods)

Overview- Threads and Tasks, the Kernel. Time Services and Scheduling Mechanisms, Basic Operating System Functions- Communication and Synchronization, Event Notification and Software Interrupt Memory Management, I/O and Networking. Processor Reserves and Resource Kernel, Capabilities of Commercial Real Time Operating Systems.

Total Periods: 45

Topics for Self Study are provided in the Lesson Plan

TEXT BOOKS:

1. Jane W.S. Liu, *Real Time Systems*, Pearson Education, 1st Edition, 2006.
2. Rajib Mall, *Real Time Systems-Theory and Practice*, Pearson Education India, 1st Edition, Nov.2012.
3. C. M. Krishna, Kang G Shin, *Real Time Systems*, MCgraw-Hill Series, Dec. 1996.

REFERENCE BOOKS:

1. Phillip A. Laplante and Seppo J. Ovaska, *Real-Time Systems Design and Analysis: Tools for the Practitioner*, Wiley-IEEE Press, 4th edition, Nov. 2011.
2. Hermann Kopetz, *Real-Time Systems: Design Principles for Distributed Embedded Applications* , Springer; 2nd Edition, 2011.

IV B. Tech. – I Semester
(19BT70414) SYSTEM-ON-CHIP DESIGNAND VERIFICATION

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on VLSI Design.

COURSE DESCRIPTION: System on Chip Design (SOC) Process; System level Design Issues; Test Strategies; Macro Design and Verification; Reusable Macros; System on Chip Verification; Communication Architectures for SoCs.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate various SoC Design aspects and issues in low power and high speed Implementations.
CO2. Analyze the Macro Design Process to solve issues in usage of hard macros and Develop reusable macros for system integration.
CO3. Analyze verification methods at system level, block level and Hardware/Software Co-verification to reduce the test time.
CO4. Apply various communication architectures to design energy efficient systems.

DETAILED SYLLABUS:

UNIT I– SYSTEM ON CHIP DESIGN PROCESS (08 Periods)

A canonical SoC Design, SoC Design flow- waterfall vs spiral, top down vs Bottom up. Specification requirement, Types of Specification, System Design process, System level design issues - Soft IP Vs Hard IP, Design for timing closure - Logic design issues, Verification strategy, Onchip buses and interfaces, Design for Low Power, Manufacturing test strategies.

UNIT II – MACRO DESIGN PROCESS (07 Periods)

Overview of IP Design, planning and Specification, Macro Design and Verification, Soft Macro Productization, Developing hard macros - Design issues for hard macros, Model Development for Hard Macros. System Integration with reusable Macros.

UNIT III – SoC VERIFICATION - I (12 Periods)

Technology Challenges, Verification technology options, Verification methodology, Testbench Creation, Testbench Migration, Verification languages, Verification IP Reuse, Verification approaches, Verification and Device Test, Verification plans, Bluetooth SoC. System level verification – System Design, System Verification.
Block level verification – IP Blocks, Block Details of Bluetooth SoC, Lint Checking, Formal Model Checking, Functional Verification/Simulation, Protocol Checking, Directed Random Testing, Code Coverage Analysis

UNIT IV – SoC Verification - II (12 Periods)

Hardware/Software Co-verification- HW/SW Co-verification Environment, Emulation, soft or virtual Prototypes, Co-verification, UART Co-verification, Rapid Prototype Systems, Software Testing. Static netlist verification, Physical Verification and Design Signoff, Introduction to VMM (Verification Methodology Manual), OVM(Open Verification Methodology) and UVM (Universal Verification Methodology).

UNIT V – DESIGN OF COMMUNICATION ARCHITECTURES FOR SoCs(06 Periods)

On chip communication architectures, System level analysis for designing communication, Design space exploration, Adaptive communication architectures-Communication architecture tuners. Communication architectures for energy/battery efficient systems. Introduction to bus functional models and bus functional model based verification**.**

Total Periods: *45*

Topics for Self Study are provided in the Lesson Plan

TEXT BOOKS:

1. Michael Keating, Pierre Bricaud, *Reuse Methodology manual for System On A Chip Designs*, Kluwer Academic Publishers, Springer US, 3rd Edition, 2007.
2. Prakash Rashinkar, Peter Paterson and Leena Singh, *SoC Verification Methodology and Techniques*, Kluwer Academic Publishers, Springer US, 2013.
3. A.A. Jerraya, W.Wolf, *Multiprocessor Systems-on-chips*, M K Publishers, Elsevier Science, 2005.

REFERENCE BOOKS:

1. William K. Lam, *Hardware Design Verification: Simulation and Formal Method based Approaches*, Prentice Hall, 1st Edition, 2005.
2. FarzedNekoogar, FaranakNekoogar, *From ASICs to SOCs: A Practical Approach*, China Machine Press, 2006.

IV B. Tech. – I Semester
(19BT70432)EMBEDDED SYSTEMS LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	-	-	2	1

PRE-REQUISITES: A Course on Microcontrollers.

COURSE DESCRIPTION: Familiarization using IDE – CCS, Energia; Instruction Set usage; GPIO – programming; Watchdog timer; Timer, ADC, Comparator – Programming; Low Power Modes demonstration; PWM generation – Speed Control of DC Motor; Networking MSPs.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze MSP430 Architecture, Instruction Set and Demonstrate Competence in developing programs using Assembly and Embedded C.
CO2. Solve various Problems using CCS and Energia IDE effectively by evaluating various on-chip resources.
CO3. Develop programs to realize control applications such as Speed control of DC Motor, Reading Ambient Temperature by investigating various interfacing techniques.
CO4. Survey usage of MSP430 for Mixed Signal Processing and IOT Applications to establish communication deploying various protocols.
CO5. Work independently and in teams to solve problems with effective Communication.

LIST OF EXERCISES/LIST OF EXPERIMENTS:
(Minimum Ten Experiments to be done)

1. Introduction to MSP430 launch pad and Programming Environment.
2. Practice on usage of Instruction Set
3. Read input from switch and Automatic control/flash LED (software delay).
4. Interrupts programming example using GPIO.
5. Configure watchdog timer in watchdog & interval mode.
6. Configure timer block for signal generation (with given frequency).
7. Read Temperature of MSP430 with the help of ADC.
8. Test various Power Down modes in MSP430.
9. Generation of Pulse Width Modulation.
10. Use Comparator to compare the signal threshold level.
11. Speed Control of DC Motor
12. Master slave communication between MSPs using SPI.
13. Networking MSPs using Wi-Fi.

REFERENCE BOOKS/LABORATORY MANUALS:

1. John H Davies, *MSP430 Microcontrollers Basics*, Newnes Publishers, 1st Edition, 2008.
2. C P Ravikumar, *MSP430 Microcontrollers in Embedded System Projects*, Elite Publishing House , 1st Edition, 2012.

SOFTWARE/Tools used:
Code Composer Studio Version 6, Energia, MSP430 launch pads, Wi-Fi booster pack.

MINOR DEGREE IN
POWER SYSTEMS AND DRIVES

Offering Department: ELECTRICAL AND ELECTRONICS ENGINEERING
Students of Eligible Branches: CSE, CSSE, IT, ECE, EIE, ME and CE

COURSE STRUCTURE

Year &Semester	Course Code	Course Title	Contact Periods per week				Credits (C)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
III B.Tech. I-Sem (2 Theory + 1 Lab)	19BT50212	Electrical Engineering Materials	3	-	-	3	3	40	60	100
	19BT50213	Electricity Safety and Practices	3	-	-	3	3	40	60	100
	19BT50214	Sustainable Energy Resources	3	-	-	3	3	40	60	100
	19BT50232	Electrical workshop Practice	-	-	2	2	1	50	50	100
III B.Tech. II-Sem (2 Theory + 1 Lab)	19BT60213	Principles of Energy Auditing and Conservation	3	-	-	3	3	40	60	100
	19BT60214	Special Machines and their Controllers	3	-	-	3	3	40	60	100
	19BT60215	Utilization of Electrical Energy	3	-	-	3	3	40	60	100
	19BT60234	Auditing and Conservation Practice lab	-	-	2	2	1	50	50	100
IV B.Tech. I-Sem (1 Theory + 1 Lab)	19BT70213	Power Electronic Converters	3	-	-	3	3	40	60	100
	19BT70214	Fundamentals of Electric Vehicles	3	-	-	3	3	40	60	100
	19BT70215	Protection of Electrical Systems	3	-	-	3	3	40	60	100
	19BT70234	Simulation of Electrical Systems lab	-	-	2	2	1	50	50	100

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Note: If any student has chosen a course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s for the Minor degree. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course.

III B. Tech. – I Semester
(19BT50212) ELECTRICAL ENGINEERING MATERIALS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Basic Electrical and Electronics Engineering.

COURSE DESCRIPTION: Dielectric properties of organic and inorganic materials and their required properties; Dielectric properties of insulators in static fields and alternating fields; Breakdown of dielectric materials in presence of high voltages; polymer insulation materials and their behaviour in presence of High voltages; Applications of various dielectric materials in high voltage equipment.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. understand the dielectric properties of various organic and inorganic materials and their suitability for high voltage applications.
CO2. realize the behavior of dielectric materials in the presence of static and in alternating fields.
CO3. understand the breakdown mechanism of various dielectric materials in the presence of high voltages.
CO4. realize the various polymer type insulation system for high voltage applications and the breakdown mechanism in composite insulation system.
CO5. understand the suitability of various dielectric materials for various high voltage equipment.

DETAILED SYLLABUS:

UNIT-I: CONDUCTING AND SEMICONDUCTOR MATERIALS (07 Periods)
Ohms law and relaxation time of electrons, Electron scattering and resistivity of metals, thermal conductivity of metals, superconductivity; classification of semiconductors, Energy gap, conductivity in intrinsic semiconductors, Hall Effect and carrier density.

UNIT-II: DIELECTRIC PROPERTIES OF INSULATORS IN STATIC FIELDS AND ALTERNATING FIELDS (08 Periods)
Dielectric Properties of Insulating Materials, Various Types of Polarization in Dielectrics; Static dielectric constant, Polarization and dielectric constant, Internal fields in solids and liquids, static dielectric constant of solids, spontaneous polarization; Frequency dependency of polarization, Ionic polarization, complex dielectric constant, dipolar relaxation, dielectric losses.

UNIT-III: BREAKDOWNPHENOMENA OF DIELECTRIC MATERIALS (12 Periods)
BREAKDOWN IN GASES — Townsend's theory, Streamer's theory, breakdown in electro negative gases, Paschen's law, time lags of breakdown; insulation co-ordination.
BREAKDOWN IN SOLID DIELECTRICS — Thermal breakdown and electro mechanical breakdown, treeing and tracking, Internal discharges.
BREAKDOWN IN LIQUID DIELECTRICS — Suspended particle theory and stressed oil volume theory.

UNIT-IV POLYMER AND COMPOSITE INSULATING MATERIALS (09 Periods)
Polymeric Organic Materials, Thermoplastic Polymers, Thermoset Polymers, Polymer Compounds, Polyvinylchloride (PVC), Polyethylene (PE), Epoxy resins; Composite Insulating System—Impregnated Paper as a Composite Insulation System, Insulating Board Materials, Fiber Reinforced Plastics, Breakdown in composite insulators.

UNIT-V: APPLICATIONS OF INSULATION MATERIALS (09 Periods)

Applications in Power Transformers, Applications in Rotating Machines, Applications in Circuit Breakers, Applications in Cables, Applications in Power Capacitors, Applications in Electronic Equipment.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. Dekker, Adrianus J, *Electrical engineering materials*, Prentice-Hall, 1959.
2. Naidu MS, *High voltage engineering,* Tata McGraw-Hill Education, 2013.

REFERENCE BOOKS:

1. Arora, Ravindra, and Wolfgang Mosch. *High voltage and electrical insulation engineering*. Vol. 69. John Wiley & Sons, 2011.

III B. Tech. – I Semester
(19BT50213) ELECTRICITY SAFETY AND SAFE PRACTICES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Basic Electrical and Electronics Engineering.

COURSE DESCRIPTION: The course deals with the various aspects of potential risk due to electrical shock; safety precautions to be followed while working in hazardous zones; safe practices while handling various electrical equipment and during maintenance; and relevant electrical safety standards and Indian rules and acts.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. understand the Indian electricity rules, regulations and various standards to be maintained for safety of life and equipment.
CO2. understand the potential effects of electrical shock and safety measures to protect against such risk.
CO3. understand the safety aspects and safe practices to be followed while installing residential, commercial and agricultural appliances.
CO4. identify various hazardous working zones and take necessary precautionary measures while working in such areas.
CO5. follow safety measures during installation, testing, commissioning and maintenance of electrical equipment/plant.

DETAILED SYLLABUS:

UNIT-I: INDIAN ELECTRICITY RULES AND ACTS (09 Periods)
OSHA standards o electrical safety, Basic electrical safety rules as per OSHA; Objectives and scope of IE acts and IE rules; Significance of Equipment earthing, Earthing of equipment bodies, structures and non-current carrying metallic parts, earthing of system neutral; Rules regarding first aid and firefighting facility, Electrical safety general requirements as per IE rules.

UNIT-II: ELECTRICAL SAFETY AND SAFETY MANAGEMENT (10 Periods)
ELECTRIC SAFETY: Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, Protection against electrical hazards and types, Effect of current on human body, Principles of electrical safety and approach to prevent accidents.

ELECTRIC SHOCKS AND ITS PREVENTION: Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns.

UNIT-III: ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL INSTALLATIONS (08 Periods)
Introduction—Wiring and fitting; Domestic appliances—water tap giving shock, shock from wet wall, fan firing shock; Multi-storied building, Temporary installations, Agricultural pump installation; Do's and Don'ts for safety in the use of domestic electrical appliances; Principles of safety management in electrical plants.

UNIT-IV: ELECTRICAL SAFETY IN HAZARDOUS AREAS (08 Periods)
Hazardous zones—class 0, 1 and 2; Sparks, flashovers and corona discharge in electrical plants; equipment for hazardous locations; Equipment/Enclosures for hazardous gases and vapours; Classification of Enclosures for hazardous locations; Explosives and provisions of Explosives Act.

UNIT-V: SAFETY DURING INSTALLATION, TESTING AND MAINTENANC

(10 Periods)

Safety during installations: Preliminary preparations, preconditions for start of installation work and safe sequence, safety aspects during installations.

Safety during testing: Purpose of commissioning checks and tests, equipment tests, high voltage energization tests, performance and acceptance tests, safety aspects during commissioning.

Safety during maintenance: Operators safety, Types of safety maintenance, Safety procedures, safety precautions during maintenance, planning of maintenance.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. S.Rao, Prof. H.L.Saluja, "*Electrical Safety, Fire Safety Engineering and Safety Management"*, 2nd edition, Khanna Publishers. New Delhi, 2018 Reprint.

REFERENCE BOOKS:

1. Cadick, John, Mary Capelli-Schellpfeffer, and Dennis K. Neitzel. *Electrical safety handbook.* McGraw-Hill Education, 2012.

ADDITIONAL LEARNING RESOURCES:

Indian Electricity acts:

1. https://cercind.gov.in/Act-with-amendment.pdf
2. https://www.indiacode.nic.in/handle/123456789/2058?view_type=browse&sam_handle=123456789/1362

III B. Tech. – I Semester
(19BT50214) SUSTAINABLE ENERGY RESOURCES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Basic Electrical and Electronics Engineering.

COURSE DESCRIPTION: Concepts of non-conventional and hybrid energy systems; Operational modes of Co-generation and their economic benefits.

COURSEOUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Understand the impacts of conventional energy resources on environment and realize various measures to minimize the greenhouse gas effects.
CO2. Understand the generating principles and operational aspects of energy from solar.
CO3. Understand the generating principles and operational aspects ofwindenergyconversion technologies.
CO4. Understand the generating principles and operational aspects ofOcean energy, Biomass and geothermal energy conversion technologies.
CO5. Asses the energy harnessing methods and develop a hybrid energy and energy storage systems.

DETAILED SYLLABUS:

UNIT-I: ENVIRONMENTAL ASPECTS OF POWER GENERATION FROM CONVENTIONAL SOURCES (07 Periods)
Impact of conventional sources on Environment; Limitation of fossil fuels – effects of hydro-electric projects - Atmospheric pollution – Green House Gases (GHG) emission from various energy sources and its effects – disposal of nuclear waste— need for renewable energy sources.

UNIT-II: ENERGY FROM SOLAR (11 Periods)
Introduction, solar radiation, measurement of solar radiation—pyranometer; solar energy collectors; flat plate collectors— liquid and air (non-porous) types; Focusing type— parabolic & point types; solar photovoltaic system— PV cell and its types, configuration of solar panel, PV system; Applications:solar pump, solar water heater.

UNIT-III: ENERGY FROM WIND (08 Periods)
Introduction, power extraction from the wind, Wind turbines— horizontal axis wind turbine—propeller type and vertical axis wind turbine— darrieus rotor type; basic components of wind energy conversion systems, Applications: energy storage, water pumping; environmental impacts.

UNIT-IV: ENERGY FROM OCEAN, BIOMASS AND GEOTHERMAL RESOURCES (11 Periods)
Energy from ocean: Introduction, ocean thermal energy conversion (OTEC): open and closed cycle power plants; tidal energy: schematic diagram of tidal power plant; advantages and disadvantages.
Energy from Biomass: Introduction, biomass conversion technologies-direct, thermochemical and biochemical conversions; biogas generation—anaerobic digestion process.
Geothermal energy: Introduction, Geothermal resources, geothermal power plants—vapor dominated and liquid dominated; environmental issues.

UNIT-V: COGENERATION AND HYBRID ENERGY SYSTEMS (08 Periods)
Cogeneration- Electricity generating systems, Economic and Environmental benefits.Operational modes of co-generation.

Hybrid energy systems: Need for hybrid systems, configuration and coordination, Block diagram approach of Stand-alone PV-wind system, PV-Diesel and Wind-diesel; energy storage systems — ultra capacitors, SMES.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. Rai, G.D., *Non-conventional Energy Sources*, Khanna Publishers, New Delhi, 2017.
2. *S.Rao, Dr.B.B.Parulekar, Energy Technology,* third edition, Khanna publications, 2013.

REFERENCE BOOKS:

1. J K Kaldellis, *Stand-alone and Hybrid Wind Energy Systems*, Wood head, publishing, 1st Edition 2010.
2. David Flin, *Cogeneration: A User's Guide. Renewable energy series*, Vol. 11. IET, 2010.
3. D P Kothari, K C Singal and Rakesh Ranjan, *Renewable Energy Sources and Emerging Technologies*, 2nd Edition, 2012.
4. S N Bhadra, D Kastha and S Banerjee, *Wind Electric Systems*, Oxford Publications, 2nd Edition, 2007
5. C S Solanki, *Solar Photo-voltaics – Fundamentals, Technologies and Applications*, PHI Pvt.,Ltd., 2nd Edition, 2011.
6. R. K. Rajput, *A textbook of power system engineering*, Laxmi publications (P) Ltd, 2016.

III B.Tech. – I Semester
(19BT50232) ELECTRICAL WORKSHOP PRACTICE

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Basic Electrical and Electronic Engineering

COURSE DESCRIPTION: Exercises on assessing of electrical parameters and functionality of electrical apparatus; Design and estimation of electrical systems, and protection system for electrical devices and systems; Troubleshooting of electrical appliances and calibration of measuring instruments.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. demonstrate the usage of power tools for installation applications and cable laying with relevant accessories.
CO2. install panel boards for domestic/industrial applications, design and estimate wiring requirements following the code of conduct.
CO3. practice the measurement of electrical quantities using modern day tools and also calibrate the precession of the measuring instruments.
CO4. Realize the protection equipment used in domestic/industry and practice protection schemes for a particular application.
CO5. demonstrate the practice of using various ancillary equipment for electrical appliances and also troubleshoot in the case of malfunctioning of electrical appliances.
CO6. work independently or in teams to solve problems with effective communication.

List of Exercises/List of Experiments:
*(Minimum **Ten** experiments are to be conducted)*

1. Identification and usage of hand and power tools, PPE for electrical installation applications.
2. Practice of cable laying and termination using conduits, casings, cable joints and its necessary items.
3. Installation and testing of single/three phase distribution boards for domestic/industrial applications.
4. Design and estimation of wiring for a typical house.
5. Measurement of electrical quantities using analog and digital meters.
6. Practice energy meter for measurement of energy and tariff estimation.
7. Calibration of measuring instruments.
8. Operation and testing of Fuse, MCB and Relays.
9. Measurement of equipment to earth resistance and determine the internal leakage currents.
10. Practicing and testing of DOL starter for Induction Motors.
11. Design of Timers for operation of electrical appliances.
12. Troubleshooting of electrical appliances — Fan, Mixer/grinder, Water heater/Iron box.

REFERENCE BOOKS/LABORATORY MANUALS:

1. http://www.srisaiuniversity.org/downloads/files/n59b79d6117211.pdf
2. https://www.gtu.ac.in/syllabus/NEW_Diploma/sem-1/Pdf%20Content%20detailing/3312401Electrical%20&%20Electronic%20Workshop.pdf

ADDITIONAL LEARNING RESOURCES:

1. https://www.youtube.com/watch?v=ax-KUL17YJ4
2. https://www.youtube.com/watch?v=TJpQ3fZIt20
3. https://www.youtube.com/watch?v=6RJnsa83xTA
4. https://www.youtube.com/watch?v=w2M4tS2OMsU
5. https://www.youtube.com/watch?v=DzVJiSQNbew

III B. Tech. – II Semester

(19BT60213) PRINCIPLES OF ENERGY AUDITING AND CONSERVATION

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Basic Electrical and Electronics Engineering.

COURSE DESCRIPTION: Principles of energy audit, management and conservation; Energy efficient motors, lighting schemes; Energy measuring instruments and significance of energy economics.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Apply the relevant rules, regulations and procedure of energy audit in industries and realize the energy management principles and protocols for effective conservation of energy.
CO2. Analyze performance of energy efficient motors and illumination system by applying the relevant protocols of energy auditing.
CO3. Apply appropriate energy auditing instruments for energy auditing in industries and assess their economic benefits.
CO4. Apply the demand side management techniques and relevant standards for organization of energy conservation awareness programs.

DETAILED SYLLABUS:

UNIT-I: ENERGY AUDIT AND MANAGEMENT PRINCIPLES (10 periods)
Energy audit — definitions, concept, types of audit, energy index-cost index, pie charts, Sankey diagrams, load profiles,energy saving potential, energy audit of process industry, building energy audit. IE rules and regulations for energy audit.
Energy management — Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting.

UNIT-II: ENERGY CONSERVATION PRINCIPLES (08 Periods)
Energy scenario in India and world; Rules for efficient energy conservation; Technologies for energy conservation; Principles of energy conservation, roles and responsibilities of energy managers and auditors in industries.

UNIT-III: ENERGY EFFICIENT MOTORS AND LIGHTING (09 Periods)
Energy efficient motors - factors affecting efficiency, loss distribution, constructional details, characteristics, variable speed, variable duty cycle systems.
Lighting -Good lighting system, lighting control, lighting energy audit.

UNIT-IV: ENERGY INSTRUMENTS AND ECONOMIC ANALYSIS (10 periods)
Principles of energy instruments— Infrared thermometer, data loggers, thermo-couples, pyrometers, Lux meters, tongue testers, power quality analyzer, and PLC and pic applications.
Principles of Energy Economic Analysis— The time value of money concept. Cash flow models, payback analysis, depreciation—numerical problems.

UNIT-V: PRINCIPLES OF DEMAND SIDE MANAGEMENT (08 periods)
Introduction to DSM, Principles of DSM, benefits of DSM, different techniques of DSM – time of day pricing; Management and organization of energy conservation awareness programs.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

REFERENCE BOOKS:

1. W.R. Murphy & G. Mckay Butter worth, *Energy management*, Butter worth-Heinemann publications, 2nd Edition, 2016.
2. Albert Thumann, William J. Younger, *Handbook of energy audits*, Taylor & Francis Ltd, 7th edition, 2008.
3. UmeshRathore, *Energy management*, S.K. Kataria& Sons, 2nd Edition, 2014.
4. W.C.Turner, Stevedoty, *Energy management hand boo*k, CRC press, 6th edition, 2006.
5. D.P. Sen, K.R. Padiyar, IndraneSen, M.A. Pai, *Recent Advances in Control and Management of Energy Systems*, Interline Publisher, Bangalore, 1993.
6. Ashok V. Desai, Wiley Eastern, *Energy Demand - Analysis, Management and Conservation Hand book on energy auditing - TERI (Tata Energy Research Institute)*, 2005.
7. Craig B. Smith, Kelly E. Parmenter, *Energy management principles Applications*, benefits, Savings, Elsevier Inc(Pergamon Press), 1st edition, 2016.

ADDITIONAL LEARNING RESOURCES:

1. https://beeindia.gov.in/sites/default/files/1Ch3.pdf
2. https://www.youtube.com/watch?v=M1zijCmeXJg
3. https://www.youtube.com/watch?v=FTpMWXMBSyM
4. https://www.youtube.com/watch?v=_T1Au_P5bnQ
5. https://www.youtube.com/watch?v=ENLzwTVjxms
6. https://www.youtube.com/watch?v=7hDyLuFJ0c8
7. https://www.youtube.com/watch?v=lkNIuFkzxBk

USEFUL WEBSITES:

1. https://beeindia.gov.in/news-events/energy-conservation-building-code-rules-2018
2. https://beeindia.gov.in/content/energy-auditors
3. https://nayaenergy.com/difference-between-energy-audit-and-energy-management/
4. https://www.sgsgroup.in/en-gb/sustainability/environment/energy-services/energy-audits-and-management/energy-audit
5. https://www.consultivo.in/environment-energy/energy-audit-and-management/
6. https://www.teriin.org/energy
7. http://jnujprdistance.com/assets/lms/LMS%20JNU/Dual%20Degree%20Courses/PGD+MBA%20-%20Energy%20Management/Sem%20III/General%20Aspects%20of%20Energy%20Management%20and%20Energy%20Audit.pdf

III B. Tech. – II Semester
(19BT60214) SPECIAL MACHINES AND THEIR CONTROLLERS

Int.	Ext.	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Construction, Working, Types, control operation, characteristics and applications of Stepper Motors, Switched Reluctance Motors, Synchronous Reluctance Motors, Permanent Magnet Brushless DC Motors and Linear Induction Motors.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze the open and closed loop operational characteristics of stepper motor and assess its performance under various scenarios.
CO2. Analyse the operational aspects of switched reluctance motor to assess the performance and design the constructional features for sustainability.
CO3. Analyse the operational aspects of synchronous reluctance motor to assess its performance, sustainability and applications.
CO4. Analyse the sensorless and sensor based operation and control aspects of permanent magnet brushless DC motor and assess the performance under diverse scenarios.
CO5. Analyze the operational and control aspects of linear induction motor and assess their performance for special applications.

DETAILED SYLLABUS:

UNIT-I: STEPPER MOTORS (9 Periods)
Constructional features, types, working principle, torque equation, characteristics, open loop and closed loop control of stepper motor, applications.

UNIT-II: SWITCHED RELUCTANCE MOTORS (9 Periods)
Construction details, principle of operation, design of stator and rotor pole arcs, torque equation, characteristics, power converters, torque equations, control of switched reluctance motor and applications.

UNIT-III: SYNCHRONOUS RELUCTANCE MOTORS (9 Periods)
Constructional features, Types – Axial and Radial flux motors. Principle of operation, characteristics, phasor diagram, control of SyRM, advantages and applications.

UNIT-IV: PERMANENT MAGNET BRUSHLESS DC MOTOR (9 Periods)
Constructional details, principle of operation, types of BLDC motor, sensorless and sensor based control of BLDC motors, torque/speed characteristics and applications.

UNIT-V: LINEAR INDUCTION MOTOR (9 Periods)
Construction, principle of operation– single sided and double-sided LIM, thrust equations, performance equations based on current sheet concept, equivalent circuit, goodness factor, characteristics and applications.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. K. VenkataRatnam, *Special Electrical Machines*, University press, New Delhi, 2009.
2. E.G. Janardhanan, *Special Electrical Machines*, PHI learning private limited, 2014.

REFERENCE BOOKS:

1. Takashi Kenjo, *Stepping Motors and their Microprocessor controls*, clarenden press, Oxford, 1984.
2. T.J.E. Miller, *Brushless Permanent Magnet and Reluctance Motor Drives*, clarenden press, Oxford 1989.
3. R. Krishnan, *Switched Reluctance Motor Drives – Modeling, Simulation, analysis, Design and Applications*, CRC press, Special Indian Edition, 2015.

III B. Tech. –I Semester
(19BT60215)UTILIZATION OF ELECTRICAL ENERGY

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Basic Electrical and Electronics Engineering.

COURSE DESCRIPTION: Types and characteristics of electric drives; types of electric heating and welding; Fundamentals and various methods of Illumination; electric traction; electrolysis, Extraction and refining of metals.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Understand the operational aspects of various drives and apply an appropriate electric drives for various industrial applications.
CO2. Understand the different types of heating and welding techniques.
CO3. Design illumination system for proper lighting system under given circumstances.
CO4. Understand the basic principle of traction systems and different braking techniques used in electric traction.
CO5. Understand the basic principle and applications of electrolytic process.

DETAILED SYLLABUS:

UNIT–I: ELECTRIC DRIVES (8 periods)

Type of electric drives – rating and choice of motor - starting and running characteristics - particular applications of electric drives - types of industrial loads - Continuous - intermittent and variable loads.

UNIT–II: ELECTRIC HEATING & WELDING (10 periods)

Introduction - Advantages and methods of electric heating - resistance heating - induction heating and dielectric heating.

Electric welding: Classification- resistance and arc welding - electric welding equipment - comparison between AC and DC Welding.

UNIT–III: ILLUMINATION (10 periods)

Introduction - terms used in illumination - laws of illumination - sources of light. Discharge lamps – mercury vapor and sodium vapor lamps – comparison between tungsten filament lamps and fluorescent tubes – compact fluorescent lamp – LED -Basic principles of light control - Types and design of good lighting system and practice - flood lighting.

UNIT–IV: ELECTRIC TRACTION (10 periods)

Traction systems:System of electric traction and track electrification - Review of existing electric traction systems in India - Special features of traction motor - Speed-time curves for different services - methods of electric braking - plugging - rheostatic braking, regenerative braking.

UNIT–V: ELECTROLYTIC PROCESS (7 periods)

Introduction - Basic principles - Faradays laws of electrolysis - Energy efficiency - Electrodeposition-Factors governing deposition Processes - Deposition of Alloys - Extraction and refining of metals.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. C.L Wadhwa, *Generation Distribution and Utilization of Electrical Energy*, New age International Publishers,
2. J. B. Gupta, *Utilization of Electrical Power and Electric Traction*, S. K. Kataria and ons, 2002.

REFERENCE BOOKS:

1. N. V. Suryanarayana, *Utilization of Electrical Power including Electric drives and Electric traction*, New Age International (P) Limited, Publishers, 1996.
2. Alan.V. Oppenheim, Ronald.W. Schafer, John R Buck, *Discrete Time Signal Processing*, Prentice Hall, 2nd edition, 2006. E.Openshaw Taylor, Utilization of Electric Energy,Orient Longman,1971.

ADDITIONAL LEARNING RESOURCES:

1. https://www.NPTEL video lectures.
2. https://www.opto-e.com/basics/led-pulsing-and-strobing

III B. Tech. – II Semester
(19BT60234) AUDITING AND CONSERVATION PRACTICE LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES:-

COURSE DESCRIPTION: Experimental investigations on behavior of insulators, performance of synchronous and asynchronous machines, relay testing and fault analysis.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate skill in identifying an appropriate auditing tool for measuring appropriate electrical and non-electrical preliminary quantities for auditing.
CO2. Demonstrate skills to apply the auditing principles for illumination, house hold utilities and suggest a suitable conservation methods for economic benefits.
CO3. Demonstrate skills to audit various industrial drives and suggest suitable methods for energy conservation adhering the protocols of auditing.
CO4. Perform auditing by following the auditing protocols in various commercial, agricultural and domestic class of customers and suggest an appropriate energy conservation practices for economical benefits.
CO5. Work independently or in teams to solve problems with effective communication.

Practical Exercises/List of Experiments:

(Minimum Ten experiments are to be conducted.)

1. Demonstration of auditing instruments for measuring electrical and non-electrical quantities for auditing purpose.
2. Measurement of active, reactive power and energy for auditing purpose.
3. Assess power quality problems using power quality analyzer and suggest a suitable conservative measures to mitigate.
4. Testing of Electric motor drive for energy conservation.
5. Analyze star labeled electrical apparatus and compare the data sheet of various star ratings.
6. Determine energy consumption by fluorescent/incandescent lamp and evaluate net energy savings and payback period by replacing with energy efficient lamp.
7. Evaluate energy conservation in a ceiling fan with and without an electronic regulator.
8. Conserve the energy consumption in a three phase induction motor by applying an appropriate energy conservation method.
9. Determine the energy conservation in an induction motor operating in star and delta mode of operation.
10. Estimate energy and economic savings by improving power factor for a given class of consumer.
11. Estimate the economic benefits of improving load factor for a domestic consumer.
12. Audit the energy of a commercial consumer and suggest an appropriate energy conservation practice to reduce energy bill.

ADDITIONAL LEARNING RESOURCES:

1. https://sites.google.com/a/venusict.org/energy-conservation-and-management/ntpl-video-links
2. https://nptel.ac.in/courses/108/105/108105058/
3. https://www.youtube.com/watch?v=Nd_EL_B3JBQ
4. https://www.youtube.com/watch?v=lkNIuFkzxBk
5. https://www.youtube.com/watch?v=730netBSZKY
6. https://www.youtube.com/watch?v=R_FdTPbgzTs

IV B. Tech. – I Semester
(19BT70213) **POWER ELECTRONIC CONVERTERS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	--	--	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Switched mode power supplies; Silicon Controlled Rectifier — with and without isolation, single and multiple outputs; Single phase and three phase topologies; DC-DC converter; AC-AC converter and AC-DC converter; DC-AC converter.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate the knowledge on energy conversion of Switched mode power supplies, Matrix converter and soft switch converters.
CO2. Analyze closed loop control and regulation of Switched mode dc power supplies based converter.
CO3. Analyze AC-DC, AC-AC and DC-AC circuit operation and evaluate their output parameters by using different firing pulses.
CO4. Analyze the Soft switching techniques of AC-DC, DC-DC and DC-AC converter circuits by using ZVS, ZCS and quasi resonance operation.

DETAILED SYLLABUS:

UNIT-I: SWITCHED MODE POWER SUPPLIES (11 Periods)
DC Power supplies and Classification; Switched mode dc power supplies - with and without isolation, single and multiple outputs; Closed loop control and regulation; Design examples on converter and closed loop performance.

UNIT-II: AC-DC CONVERTERS (11 Periods)
Switched mode AC-DC converters. Synchronous rectification - single and three phase topologies - switching techniques - high input power factor .Reduced input current harmonic distortion.improved efficiency with and without input-output isolation; Performance indices design examples.

UNIT-III: DC-AC CONVERTERS (07 Periods)
Multi-level Inversion - concept, classification of multilevel inverters, Principle of operation, main features and analysis of Diode clamped, Flying capacitor and cascaded multilevel inverters; Modulation schemes.

UNIT-IV: AC-AC CONVERTERS WITH AND WITHOUT DC LINK (07 Periods)
Matrix converters. Basic topology of matrix converter; Commutation – current path; Modulation techniques - scalar modulation, indirect modulation; Matrix converter as only AC-DC converter; AC-AC converter with DC link - topologies and operation - with and without resonance link - converter with dc link converter; Performance comparison with matrix converter with DC link converters.

UNIT-V: SOFT-SWITCHING POWER CONVERTERS (09 Periods)
Elementary principles of Soft switching techniques: ZVS and ZCS; Performance comparison hard switched and soft switched converters— AC-DC converter, DC-DC converter, DC-AC converter; Resonant DC power supplies.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. M.H.Rashid, *Power Electronics Handbook*, Academic press, New york, 2000.
2. Fang Lin Luo and Fang Lin Luo,*Advanced DC/DC Converters, CRC Press*, NewYork, 2004.
3. Marian P.Kazmierkowski, R.Krishnan and FredeBlaabjerg, *Control in Power Electronics- Selected Problem*, Academic Press (Elsevier Science), 2002.

REFERENCE BOOKS:

1. Issa Batarseh, *Power Electronic Circuits*, John Wiley and Sons, Inc.2004
2. FredeBlaabjerg and ZheChen,*Power Electronics for Modern Wind Turbines*, Morgan and Claypool Publishers series, United States of America, 2006.
3. Krein Philip T, *Elements of Power Electronics*, Oxford University press, 2008
4. Agarwal ,*Power Electronics: Converters, Applications, and Design*, 3rd edition, Jai P, Prentice Hall,2000
5. L. Umanand, *Power Electronics: Essentials & Applications*, John Wiley and Sons,2009

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/102/108102145/
2. https://nptel.ac.in/courses/108/101/108101126/
3. https://nptel.ac.in/courses/108/101/108101038/
4. https://nptel.ac.in/courses/108/107/108107128/

IV B. Tech. – I Semester
(19BT70214) FUNDAMENTALS OF ELECTRIC VEHICLES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	--	--	3

PRE-REQUISITES: A course on Basic Electrical and Electronics Engineering.

COURSE DESCRIPTION: Transportation vehicles and their impact in society; Concept, configurations, principle, types and operation of Electric Vehicles (EV); Power Electronic converters in EVs; Different motor drives & energy storage and management technologies in EVs.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Understand the principle of operation of electric, hybrid-electric vehicles and various emerging technological challenges while confronting the issues during transportation.

CO2. Analyze the performance characteristics of various power converters operating in different modes to assess a suitable convertor and its control strategies for sustainability of electric vehicle.

CO3. Analyze various propulsion motor drives operating in different modes for sustainability and to determine their performance/operational parameters of electric vehicle.

CO4. Analyze various battery energy storage & management systems and assess their adaptability for sustainable performance of electric vehicle.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO EVS AND HEVS (10 Periods)

Environmental impact and history of modern transportation, Electric Vehicles (EVs) — configurations, traction motor characteristics; Hybrid Electric Vehicles (HEVs) — concept and architectures; series and parallel HEVs — configuration, operation, advantages and disadvantages; HEVs — interdisciplinary nature, challenges and key technologies; Plug-in EV — concept and architectures.

UNIT-II: POWER ELECTRONICS IN EVs AND HEVs (08 Periods)

Power electronics — semiconductor devices and circuits used for control and distribution of electric power, AC-DC, DC-DC, DC-AC conversion, four quadrant operation of converters, Thermal Management of HEV power electronics.

UNIT-III: ELECTRIC PROPULSION SYSTEM (09 Periods)

Introduction, configuration and control — DC motor drives, Induction Motor drives, Permanent Magnet Motor drives and Switched Reluctance Motor drives and drive efficiency.

UNIT-IV: ENERGY STORAGE SYSTEMS (09 Periods)

Electrochemical Batteries — terminology, specific energy, specific power, energy efficiency in lead-acid batteries, nickel based batteries, lithium based batteries; Ultra-capacitors — features, principle of operation and performance; High speed fly-wheels — operating principle, power capacity, fly-wheel technologies and hybrid energy storage systems; Fuel cell — principle of operation and performance.

UNIT-V: ENERGY MANAGEMENT SYSTEM (09 Periods)

Energy Management Strategies, Concept of State of Charge (SoC) and State of Health (SoH), EV charging standards, concept of V2G, V2V, V2H — principle of operation (Block diagram approach only). Wireless Power Transfer — principle of operation (Block diagram approach only).

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. K. T. Chau, *Electric Vehicle Machines and Drives, Design, Analysis and Application*, Wiley, 2015.
2. John G. Hayes, *Electric Powertrain*, Wiley, 2018.

REFERENCE BOOKS:

1. Iqbal Husain, *Electric and Hybrid Vehicles Design Fundamentals*, 2nd edition, CRC Press, 2011.
2. Jack Erjavec, *Hybrid, Electric & Fuel-Cell Vehicles*, 2nd edition, Delmar Cengage learning, 2013.
3. MehrdadEhsani, Yimin Gao and Ali Emadi, *Modern Electric, Hybrid Electric and Fuel Cell Vehicles*, 2nd edition, CRC Press, 2015.
4. Chris Mi, M. AbulMasrur, David WenzhongGao, *Hybrid Electric Vehicles Principles and Applications with Practical Perspectives*, Wiley, 2011.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/102/108102121/
2. https://swayam.gov.in/nd1_noc20_ee18/preview
3. https://www.coursera.org/learn/electric-vehicles-mobility?#syllabus

IV B. Tech. – I Semester
(19BT70215) PROTECTION OF ELECTRICAL SYSTEMS

Int.	Ext.	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Basic Electrical and Electronics Engineering

COURSE DESCRIPTION: Overview of protective schemes; fuses; circuit breakers; electromagnetic relays; protective schemes applied for various components under various operating conditions; different grounding schemes.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Apply the conceptual knowledge of various fuses for secured operation of domestic and industrial appliances.
CO2. Apply the conceptual knowledge of various circuit breakers for secured operation of power system network.
CO3. Apply the conceptual knowledge of various relays for secured operation of power system network.
CO4. Analyze variousprotection schemes for the protection of alternators, transformers and motors.
CO5. Apply various neutral grounding methods and determine the system parameters for protection in power system.

DETAILED SYLLABUS:

UNIT-I: FUSES (6 periods)
Necessity of power system protection; Types of fuses — low voltage fuse and high voltage fuse; Advantages and disadvantages; Important terms — Current rating of fuse element, fusing current, fusing factor, cut-off current, pre-arcing time, arcing time, breaking capacity; Application of fuse in residential and commercial loads.

UNIT-II: ELECTRICAL SWITCHGEAR (9 periods)
Essential features of switchgear, switchgear components; Phenomenon of arc, arc voltage, recovery voltage, restriking voltage; Types of circuit breakers; Construction and principle of operation — minimum oil circuit breaker, air blast circuit breaker, vacuum circuit breaker and SF_6 circuit breaker, and their comparisons, advantages and disadvantages; Applications of circuit breakers, importance of rating of circuit breakers.

UNIT-III: PROTECTIVE RELAYS (8 periods)
Fundamental requirements of protective relaying, classification of relays — electromagnetic attraction and induction type relays; Construction and working principle of induction type over current relays, differential relays and biased differential relays; Universal torque equation; Characteristics of overcurrent, differential relays; Importance of primary and backup protection, elementary principles of static relays and microprocessor based relays.

UNIT-IV: PROTECTION OF ALTERNATORS, TRANSFORMERS AND MOTORS (11 periods)
Protection of alternators: Various faults in alternators — failure of prime-mover, failure of field, overcurrent, overvoltage, unbalanced loading, stator winding faults, rotor winding faults; Rotor protection; Stator protection — restricted earth fault protection and internal fault protection.
Transformer protection: Internal and external faults; Percentage differential protection, Protection against internal faults – Buchholtz relay.
Motor protection: Various faults & abnormal operating conditions, protection in motors, thermal relays and protection of small and large induction motors.

UNIT-V: SUBSTATION PROTECTION (11 periods)

Protection of feeders: Protection of radial and ring main feeders using over current relays.

Protection against over-voltages: Causes of over voltages in power systems, protection against lightning over voltages — surge diverters and absorbers; Working and applications of sphere gap, horn gap and valve type of lighting arrestors.

Neutral grounding: Necessity of neutral grounding, effects of ungrounded neutral on system performance; Methods of neutral grounding — solid, resistance and reactance grounding—merits and demerits.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. Sunil S. Rao, *Switchgear Protection and Power Systems (Theory, practice and Solved Problems)*, 13th edition, Khanna Publishers, New Delhi, 2013.
2. Rohit Mehta and V.K. Mehta*Principles of Power System, 24th edition,* S. Chand Publishiing, 2010.

REFERENCE BOOKS:

1. Badri Ram, D. N. Viswakarma, *Power system Protection and Switchgear*, 2nd edition, McGraw Hill education (India) Private Limited, New Delhi, 2011.
2. C. L. Wadhwa, *Electrical Power systems*, 7th edition, New Age International (P) Limited, Publishers, New Delhi, 2017.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/101/108101039/
2. https://lsin.panasonic.com/blog/understand-importance-switchgear-protection-devices/
3. https://www.eit.edu.au/courses/professional-certificate-of-competency-electrical-power-system-fundamentals/
4. https://electrical-engineering-portal.com/download-center/books-and-guides/relays/protection-fundamentals
5. https://www.youtube.com/watch?v=LAiBuu_nICI

IV B. Tech. – I Semester
(19BT70234) SIMULATION OF ELECTRICAL SYSTEMS LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A course on Basic Electric and Electronics Engineering.

COURSE DESCRIPTION: Investigation of behavior/operational aspects of various electrical systems using simulation tools.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate generation of signals and perform basic operations on the signals
CO2. Analyze various electric circuits operating under different scenarios.
CO3. Investigate the time domain specifications of a electrical system and develop a controller to control the dynamics.
CO4. Determine the operational aspects of various electrical machines
CO5. Analyze the operation of power electronic circuits for different operating conditions
CO6. Estimate the tariff for domestic load and also forecast the load from the time series data.
CO7. Work independently or in teams to solve problems with effective communication.

Practical Exercises/List of Experiments:

(Minimum Ten experiments are to be conducted.)

1. Generation of continuous and discrete time signals.
2. Basic operations on continuous and discrete time signals — Time scaling and amplitude scaling.
3. Simulate Locus diagram for RL and RC circuits.
4. Determine maximum power transfer using Maximum power transfer theorem.
5. Determine time domain specifications of a transfer function.
6. PID controller for controlling time domain response.
7. Load characteristics of asynchronous machine.
8. Determination of transformer efficiency.
9. Simulation of Single-phase half and full controlled bridge converter with R and RL loads.
10. Simulation of step-down and step-up choppers.
11. Load forecasting using statistical methods.
12. Estimating load consumption and tariff for the domestic load profile.

MINOR DEGREE IN
INSTRUMENTATION AND CONTROL ENGINEERING

Offering Department: ELECTRONICS AND INSTUMENTATION ENGINEERING
Students of Eligible Branches: CSE, CSSE, IT, ECE, EEE, ME and CE

COURSE STRUCTURE

Year &Semester	Course code	Course title	Contact Periods per week			C	Scheme of Examination Max. Marks		
			L	T	P		Int. Marks	Ext. Marks	Total Marks
III B.Tech. I-Sem (2 Theory+ 1 Lab)	19BT31001	Electrical and Electronic Measurements	3	-	-	3	40	60	100
	19BT41001	Industrial Instrumentation	3	-	-	3	40	60	100
	19BT71004	Computer Control of Process	3	-	-	3	40	60	100
	19BT41031	Industrial Instrumentation lab	-	-	2	1	50	50	100
III B.Tech. II-Sem (2 Theory+ 1 Lab)	19BT71003	Aircraft Instrumentation	3	-	-	3	40	60	100
	19BT61001	Process Control Instrumentation	3	-	-	3	40	60	100
	19BT61005	Smart Sensors	3	-	-	3	40	60	100
	19BT61031	Process Control Lab	-	-	2	1	50	50	100
IV B.Tech. I-Sem (1 Theory+ 1 Lab)	19BT71001	Biomedical Instrumentation	3	-	-	3	40	60	100
	19BT71002	Programmable Logic Controllers	3	-	-	3	40	60	100
	19BT71031	Biomedical Instrumentation Lab	-	-	2	1	50	50	100

Note: If any student has chosen a course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s for the Minor degree. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course.

III B. Tech. – I Semester

(19BT31001)**ELECTRICAL AND ELECTRONIC MEASUREMENTS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Science of measurement; construction and principle of operation of ammeters, voltmeters, ohmmeters; potentiometers; power meter; power factor meter; energy meter; design of AC and DC bridges; frequency and time measurements.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Select suitable measuring instrument for measurement of voltage, current, resistance, power and energy by applying the fundamental concepts of measuring instruments.

CO2. Calibrate the DC and AC potentiometers and apply the concepts for calibration of ammeter& voltmeter and measurement of resistance & inductance.

CO3. Design AC and DC bridges for measurement of resistance, capacitance and Inductance.

CO4. Demonstrate the digital measuring instrument used for measurement of frequency and time period.

DETAILED SYLLABUS:

UNIT-I: AMMETERS AND VOLTMETERS (11 Periods)

Classification of analog instruments, Principle of operation of analog instruments, operating forces of electromechanical indicating instruments: deflecting, control and damping; Permanent Magnet Moving Coil (PMMC): Construction, working principle, Expression of torque equation, Errors in PMMC Instruments, Advantage and Disadvantages of PMMC Instruments; Moving Iron Instruments: Classification of Moving Iron Instruments, Construction, working principle and Expression of torque equation; Ammeter: Ammeter shunt, Effect of Temperature Change in Ammeter, Multi-range Ammeters; Voltmeter: Voltmeter Multipliers, Effect of Temperature Change in Voltmeters, Multi-range Voltmeter Analog voltmeter, AC voltmeter using rectifiers, true RMS Voltmeter

UNIT-II: OHMMETERS AND POTENTIOMETERS (9 Periods)

Ohmmeters: Series type ohmmeter, shunt type ohmmeter, Multimeter.

DC Potentiometers: Basic potentiometer circuit, standardization, Compton's Potentiometers, Multiple-range potentiometer, applications: Calibration of Voltmeter, Calibration of Ammeter, Measurement of Resistance.

AC Potentiometers: Standardization, Types of A.C Potentiometers: Polar types, Coordinate types, applications: Voltmeter Calibration, Ammeter Calibration, Measurement of Self reactance of a coil.

UNIT-III: POWER & ENERGY METERS (8 Periods)

Power in D.C Circuits, Power in A.C Circuits, Electrodynamometer wattmeter: Construction, working principle, Torque equation, Errors in Electrodynamometer wattmeter, Three Phase Wattmeter. Electrodynamometer Power Factor Meter: Single Phase, Three Phase. Energy Meter: Single Phase Induction Type Energy Meter: Construction, Working Principle, Errors in Single Phase energy meter; Polyphase energy meters: Two element energy meter

UNIT-IV: BRIDGES (8 Periods)

Measurement of Resistance: Medium Resistance Measurement: Wheatstone bridge, Kelvin Bridge; Low Resistance Measurement: Kelvin double bridge; High Resistance Measurement: Direct deflection methods.

Measurement of Inductance: Maxwell Bridge, Hay's Bridge and Anderson Bridge.

Measurement of capacitance: De Sauty's Bridge and Schering bridge, Q-meter.

UNIT-V: FREQUENCY AND TIME MEASUREMENTS (9 Periods)

Digital Frequency Meter - Basic Circuit, Time Base Selector, Start and Stop gate; Circuit for Measurement of Frequency; Simplified Composite Circuit for a Digital Frequency Meter; High Frequency Measurement, Frequency synthesizer; Period Measurement; Ratio and Multiple Ratio Measurements; Time Interval Measurements; Universal Counter Timer.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. A.K.Sawhney, *A Course in Electrical and Electronics Measurements and Instrumentation*, Dhanpat Rai and Sons, New Delhi, 19th Revised edition, 2013.
2. H S Kalsi, *Electronic Instrumentation and Measurements*, McGraw-Hill, 4th edition, 2019.

REFERENCE BOOKS:

1. E.W. Golding & F.C. Widdis, *Electrical Measurements and Measuring Instruments*, 5th edition, Wheeler Publishing.
2. Doeblin, E.O., Measurement Systems: Applications and Design, McGraw-Hill, 4th edition 2003.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/105/108105153/
2. https://swayam.gov.in/nd1_noc19_ee44/preview

III B. Tech. – I Semester

(19BT41001)INDUSTRIAL INSTRUMENTATION

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Measurement of humidity, Viscosity, Density, Pressure, Level and Flow parameters; Signal Conditioning & Safety Instruments.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze and identify the appropriate transducer to measure density, viscosity, humidity and pressure based on applications.

CO2. Analyze and identify the appropriate transducer to measure level and flow based on applications.

CO3. Design signal conditioning circuit for amplifiers, range extension and conversion of V to I & I to V.

CO4. Demonstrate the safety instruments, requirements for safety and standards.

DETAILED SYLLABUS:

UNIT - I: DENSITY, VISCOSITY & HUMIDITY MEASUREMENT (11 Periods)

Density: Introduction, Pressure head type, Displace type, Float type, Buoyancy effect densitometer method, Hot-wire gas bridge type, Vibration type, Radioactive method. Viscosity: Introduction, Friction tube viscometer, Saybolt's viscometer, Rotameter viscometer, Searle's rotating cylinder, Cone and Plate viscometer. Consistency meter – Rotating vane type and oscillating type. Humidity: Psychrometer, hygrometer & Types, Dew point device. Analysis and selection of Density, Viscosity and Humidity sensors.

UNIT - II: PRESSURE MEASUREMENT (8 Periods)

Dead weight gauges, Manometer and its Types, Elastic transducers – Bourdon tube, Diaphragm, Bellows, Electrical Types, Resistive, Inductive and Capacitive, Force balance & Vibrating Cylinder, High pressure measurement – Very high pressure transducer (Bulk modulus Gage), Low Pressure (Vacuum) measurement – McLeod Gage, Knudsen Gage, Momentum transfer gage, Thermal conductivity gage, Ionization gage, Sound level meter, Microphone. Analysis and selection of pressure sensors.

UNIT – III: LEVEL MEASUREMENT (7 Periods)

Introduction, Gauge Glass technique, Float Types – Float–and– tape method, Float–and–shaft method, Magnetic float types. Displacer types, Hydrostatic types – Air-Purge type, Bubbler type. Thermal effect types, Electrical types – Resistance switch type, Inductive and Capacitance type. Ultrasonic Methods, bellow element type level transmitters, Fibre - optic type, Analysis and selection of level sensors.

UNIT – IV: FLOW MEASUREMENT (10 Periods)

Introduction, Head types – Orifice, Venturi, Flow Nozzle, Dahl Tube, Pitot tube, Area Flow meter - Rotameter & types, Mass flow meters – Turbine Mass flow meter, Coriolis flow meter, Gyroscopic flow meter, Liquid bridge mass flow meter, Calorimetric flow meter. Positive Displacement type flow meters - Nutating Disc, Rotary Vane, Lobed Impeller, Reciprocating Piston type, Fluted Rotor.Electrical type flow meter – Turbo magnetic flow meter, Electromagnetic flow meter, Ultrasonic flow meter, Hotwire anemometer type, Vertex Shedding type.Analysis and selection of Flow sensors.

UNIT-V: SIGNAL CONDITIONING & SAFETY INSTRUMENTS (9 Periods)

Wheatstone bridge: Compensation & Sensitivity. Design of I to V, V to I converters, Range conversion of current, voltage, Design application of Instrumentation amplifier,

Signal conditioning for Self-generating sensors: Chopper and low drift amplifiers Composite amplifier, charge amplifier and electrometer amplifier.
Proximity Sensors, Limit switches, Electrical & Intrinsic Safety: NEMA types, Fuses & Circuit breakers. Explosion hazards & intrinsic safety – Protection methods, Purging, pressurization, ventilation.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. D. Patranabis, *Principles of Industrial Instrumentation*, TMH, 3rd Edition, 2010.
2. A. K. Sawhney, *A Course in Electrical and Electronics Measurements and Instrumentation*, Dhanpat Rai and Sons, 19th edition, 2011.

REFERENCE BOOKS:

1. Bela G Liptak, *Instrument Engineers' Handbook: Process Measurement and Analysis*, CRC Press - Butterworth Heinemann, 4th Edition, 2003.
2. Ramon PallásAreny, John G. Webster, *Sensors and Signal Conditioning*, John Wiley and Sons, 2nd Edition, 2000.
3. Ernest Doebelin, Dhanesh Manik, *Measurement Systems*, McGraw-Hill International, 6th Edition, 2011.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108105064/
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/108105064/lec1.pdf
3. https://www.ibiblio.org/kuphaldt/socratic/sinst/book/liii.pdf

III B. Tech. – I Semester

(19BT71004)COMPUTER CONTROL OF PROCESS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Analysis of discrete state variable system identification techniques, direct discrete design techniques, advanced control strategies used in industries, Adaptive Control.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on discrete data systems, Z –Transform and modified Z - Transform of Sampled Data system.
CO2. Design of controllers based on discrete time models are used in Industries.
CO3. Analyze various control strategies and identify mathematical model for various systems.
CO4. Asses the information to provide effective solution for real time problems using adaptive control methods.

DETAILED SYLLABUS:

UNIT-I: DISCRETE STATE-VARIABLE TECHNIQUE (11 Periods)
State equation of discrete data system with sample and hold, State transition equation, Methods Of computing the state transition matrix, Decomposition of discrete data transfer functions, State Diagrams of discrete data systems, System with zero-order hold, Controllability and observability of linear time invariant discrete data system, Stability tests of discrete-data system.

UNIT-II: SYSTEMIDENTIFICATION (8 Periods)
SystemTheory, Mathematical models,Modelproperties,Structural model representation, System identification procedure. Modified Z – Transform, First order system with timedelay.

UNIT-III: DESIGNOF CONTROLLERS (9 Periods)
Computer control loop, Convertingcontinuoustimecontrollertodiscretetimedomain, Designofcontrollersbased on discrete time model beat and Dahlin's algorithms. Design of Feed Forward Controller: Block Diagram.

UNIT-IV: ADVANCED PROCESS CONTROLSTRATEGIES (9 Periods)
Cascade Control- Dynamic response, Types, Implementation, Predictive Control– Model based and Multivariable System, Statistical Process Control, Algorithms for Processes with Dead Time–Smith Predictor, Analytical Predictor.

UNIT-V: ADAPTIVECONTROL (8 Periods)
Self-Tuning Regulators, Adaptive Control Adjustment, Indirect Adaptive Control, Direct Adaptive Control, Model Reference Adaptive Control, Relationship between MRAC and STR, Inertial Control with examples.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:
1. S.K.Singh, *Computer Aided Process Control*, PHI,2009.
2. Gopal, M., *Digital Control and State Variable Methods*, Tata McGraw Hill, 2003.

REFERENCE BOOKS:

1. M. Chidambaram, *Computer Control of Processes*, Narosa Publications, 2nd Edition, 2003.
2. Karel J. Keesman, *System Identification: An Introduction*, Springer, 2011.
3. Pradeep B.Deshpande and Raymond H Ash, *Elements of Computer Process Control with Advanced Applications*, 2nd Edition, Instrument Society ofAmerica,1981.
4. Krishna Kant, *Computer-based Industrial Control*, 2nd Edition, PHI, Delhi, 2010.

ADDITIONAL LEARNING RESOURCES:

1. http://nptel.ac.in/courses/112103174/4
2. http://nptel.ac.in/courses/112103174/3
3. www.freevideolectures.com /Course/3126/Process-Control-and-Instrumentation
4. www.nptel.ac.in/courses/103105064/

III B. Tech. – I Semester

(19BT41031)**INDUSTRIAL INSTRUMENTATION LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Industrial Instrmentation

COURSE DESCRIPTION: LabVIEW basics; Circuit design and simulation in Multisim; Measurement of Torque, Temperature, Viscosity, Humidity, Pressure, Level and Flow.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Apply the LabVIEW functions in programming.
CO2. Simulate electrical circuits using Multisim.
CO3. Analyze the characteristics of measuring instruments by applying the fundamental concepts.
CO4. Develop PC based data logger systems by interfacing hardware devices like myRIO, ELVIS and required sensors for measurement.
CO5. Design and solve problems in the measurement of parameters for required specifications.
CO6. Work independently and in teams to solve problems with effective communication.

LIST OF EXPERIMENTS:

(Minimum ELEVEN experiments are to be conducted)

1. LabVIEW Basics : Practice of Virtual Instrumentation Course content

Numeric, Boolean, Strings, For, While, Case Structures, Arrays, Clusters, Sequence: Flat, Stacked, Formula Node, SubVI's, Local/Global Variables.

2. Data Acquisition and analysis using Graphs, Charts, myRio/ELVIS and LabVIEW.
3. Data Logging and analysis of simulated or acquired signals using File I/O.
4. Design and verification of converters using op-amps in Multisim.

a) I to V
b) V to I

5. Design and verification of resistance measurement, conversion in Multsim using

a) Op-Amp
b) Wheatstone bridge for improving sensitivity, compensation and linearity.

6. Measurement of Pressure.
7. Measurement of Humidity.
8. Measurement of Flow.
9. Measurement of Torque.
10. Measurement of Viscosity.
11. Design and verification of level measurement.
12. Design and verification of Speed measurement.
13. Design and verification of temperature measurement using LabVIEW & ELVIS.

REFERENCE BOOKS/LABORATORY MANUALS:

1. Travis Jeffrey, Jim Kring, *LabVIEW for Everyone*, Pearson Education, 2009.
2. Johnson Jennings, *LabVIEW Graphical Programming*, McGraw Hill, 4th Edition, 2014.
3. D. Roy Chowdhury, *Linear Integrated Circuits*, New Age International Pvt. Ltd., 4th Edition, 2010.
4. D. Patranabis, *Principles of Industrial Instrumentation*, TMH, 3rd Edition, 2010.
5. Ramon PallásAreny, John G. Webster, *Sensors and Signal Conditioning*, John Wileyand Sons, 2nd Edition, 2000.
6. A. K. Sawhney, *A Course in Electrical and Electronics Measurements and Instrumentation*, Dhanpat Rai and Sons, 19th edition, 2011.

SOFTWARE/Tools used:

1. NI Labview 2018
2. NI Circuit Design Suite – Multisim 2019
3. NI myRIO
4. NI ELVIS

ADDITIONAL LEARNING RESOURCES:

1. https://www.ni.com/pdf/manuals/320999e.pdf
2. https://ieeexplore.ieee.org/document/8960023/
   A Different way of Level measurement for PBL in Education of Students using NI-LabVIEW, Multisim and MyRIO
3. http://www.ni.com/pdf/manuals/376047c.pdf
4. https://www.clemson.edu/cecas/departments/ece/document_resource/undergrad/lab_manuals/NI_ELIVS_II_Orientation_Manual.pdf
5. http://www.ni.com/pdf/manuals/374629c.pdf
6. http://www.ni.com/pdf/manuals/373363f.pdf

III B. Tech. – II Semester

(19BT71003)**AIRCRAFT INSTRUMENTATION**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Aircraft Instruments; Air Data Instruments; Gyroscopic Instruments; Engine Instruments and Flight Control and Navigational Aids, EFIS, Electronic warfare and Aircraft safety.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1: Demonstrate knowledge on aircraft system.
CO2: Select suitable instrument for specific parameter measurement in an aircraft.
CO3: Design control schemes for Auto pilot and Auto-throttle system in an aircraft.
CO4: Select navigation aids for appropriate communication in an aircraft.
CO5: Demonstrate knowledge on aircraft safety systems and electronic warfare.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO AIRCRAFT (10 Periods)

Control Surfaces, Forces, Moments and Angle of Attack, Modern Aircraft System, Aircraft Instruments and their Layout, Aircraft Display Types: Quantitative Displays, Display Color and Markings, Glass Cockpits of Modern Aircraft: Attitude Director Indicator, Electronic Attitude Director Indicator, Horizontal Situation Indicator, EFIS, Command bars, HSI, ADP.

UNIT-II: COCKPIT INSTRUMENTS (10 Periods)

Introduction to Air Data Instruments, Air Data Computer, Combined Pitot and Static Probe, Position Error, ASI, ALTI, VSI, Introduction to Gyro, Vibrating Gyros, Ring Laser Gyroscope, Fibre Optic Gyros, Directional Gyro, Gyro Horizon.

UNIT-III: ENGINE INSTRUMENTS (10 Periods)

Introduction, Engine Speed Measurement: Electrical TachoGenerator/Indicator, Non-Contact type TachoProbe, Torque Measurement, Electronic Torque Meter, Pressure Measurement, Engine vibration Measurement and Monitoring, Fuel Flow Rate Indicator, Engine Fuel Quantity Indicator

UNIT-IV: FLIGHT CONTROL AND NAVIGATIONAL AIDS (8 Periods)

Introduction to AFCS, Auto pilot, Auto-throttle, IFCS, Fundamentals of Radio Navigation Aids, VOR, DME, Instrument Landing system, GPS.

UNIT-V: ELECTRONIC WARFARE AND AIRCRAFT SAFETY (7 Periods)

Introduction to Electronic warfare, Electronic support, EP, EA, Jamming and Spoofing, DEW, Air data warning systems, Stall warning systems, GPWS, TCAS

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. S.Nagabhushana, L.K.Sudha, *Aircraft Instrumentation andSystems*, I K International Publishing House Pvt. Ltd,2010

REFERENCE BOOK:

1. Pallett, E.H.J, *AircraftInstruments and Integrated Systems*,Pearson higher Education, 1992.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/101/104/101104069/
2. https://nptel.ac.in/courses/112/103/112103281/
3. http://www.nptelvideos.in/2012/11/space-flight-mechanics.html

III B. Tech. – II Semester

(19BT61001)**PROCESS CONTROL INSTRUMENTATION**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Mathematical modeling of processes, Different types of controllers, characteristics of controllers, design of controllers, Tuning of controllers, characteristics of control valves, multi loop controllers.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Develop mathematical model of various process by applying fundamental laws.
CO2. Design controller by applying fundamental concepts of control schemes and tuning methods.
CO3. Demonstrate knowledge on various final control elements used in process Industries.
CO4. Apply the Multi loop control concepts of real time industrial and domestic applications.

DETAILED SYLLABUS:

UNIT - I: PROCESS CHARACTERISTICS (10 Periods)

Elements of process control, Process variables, Degree of freedom, Characteristics of electric system, liquid system, gas system and thermal system, Elements of process dynamics, Mathematical model of liquid process, gas process and thermal processes, Servo operation, Regulatory operation, Self-regulation.

UNIT - II: CONTROL SCHEMES AND CONTROLLERS (10 Periods)

Discontinuous controller modes: Two position, Multi-position, Floating control modes; Continuous controller modes: Proportional, Integral, Derivative; Composite controller modes: PI, PD, PID; Electronic controllers: Design of discontinuous, continuous and composite controller modes. Pneumatic controllers (displacement type).

UNIT – III: CONTROLLER TUNING (8 Periods)

One-Quarter decay ratio criteria, Time integral performance criteria, Process loop tuning: open-loop transient response method, Ziegler-Nichol's method, Cohen- Coon method, Direct synthesis method, Frequency responsemethod.

UNIT - IV: FINAL CONTROL ELEMENTS (9 Periods)

Pneumatic actuators: Spring actuator, Hydraulic actuators: Piston actuator, Electrical actuators: Solenoid, Electro-pneumatic actuators, Control valves: Types of control valves and its characteristics, Sliding-stem control valves, Rotating-shaft control valves, Selection of control valves, Control-valve sizing, Pneumatic valve positioner.

UNIT - V: MULTI LOOP CONTROL SCHEMES (8 Periods)

Cascade control, Ratio control, Feed forward control, Over-ride, Split range, Case study on distillation column: Principle control scheme- constant top product, constant bottom product and reflex rate, constant reflex rate and steam rate.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Donald P. Eckman, Automatic Process Control, Wiley Eastern Ltd., 1993.
2. Curtis D. Johnson, *Process Control Instrumentation Technology*, Pearson Education, New Delhi, 7th Edition, 2002.
3. G. Stephanopoulis, *Chemical Process Control,* PrenticeHall, 1990.

REFERENCE BOOKS:

1. Patranabis, *Principles of Process Control*, TMH.,1981.
2. Peter Harriot, *Process Control*,TMH.
3. K. Krishnaswamy, *Process Control*, New Age International, 2nd Edition, 2009.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in
2. https://www.amtekcompany.com › Amatrol
3. https://wiki.metakgp.org › H31011:Instrumentation and Process Control

III B. Tech. – II Semester

(19BT61005)**SMART SENSORS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Smart sensors for physical variables, Different smart materials and technologies, getting sensor information to MCU, Communication protocols and different standards for smart sensors.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***
CO1. Apply suitable smart sensor for measurement of physical parameters.
CO2. Demonstrate knowledge on smart materials and its fabrication techniques.
CO3. Design signal conditioning circuits for various smart sensors.
CO4. Select appropriate protocol for real time applications.
CO5. Demonstrate knowledge on IEEE standards for smart sensors.

DETAILED SYLLABUS:

UNIT-I: SMART SENSORS FOR ELECTRICAL AND NON-ELECTRICAL, PHYSICAL AND CHEMICAL VARIABLES: TENDENCIES AND PERSPECTIVES (8 Periods)
Introduction, Temperature IC and Smart Sensors, Pressure IC and Smart Sensors and Accelerometers, Rotation Speed Sensors, Intelligent Opto Sensors, Humidity Frequency Output Sensors, Chemical and Gas Smart Sensors.

UNIT-II: MATERIALS AND TECHNOLOGIES (9 Periods)
Materials: Silicon as a Sensing Material, Plastics, Metals, Ceramics, Structural Glasses, Optical Glasses, Nano-materials, Surface Processing: Spin-Casting, Vacuum Deposition, Sputtering, Chemical Vapor Deposition, Electroplating, MEMS Technologies: Photolithography, Silicon Micromachining, Micromachining of Bridges and Cantilevers, Wafer Bonding.

UNIT-III: GETTING SENSOR INFORMATION INTO THE MCU (10 Periods)
Introduction, Amplification and Signal Conditioning: Instrumentation Amplifiers, SLEEP MODE Operational Amplifier, Rail-to-Rail Operational Simplifiers, Switched-Capacitor Amplifier, 4- to 20-mA Signal Transmitter, Inherent Power-Supply Rejection, Separate Versus Integrated Signal Conditioning: Integrated Passive Elements, Integrated Active Elements, Digital Conversion: A/D Converters, Performance of A/D Converters, Implications of A/D Accuracy and Errors.

UNIT-IV: COMMUNICATIONS FOR SMART SENSORS (9 Periods)
Introduction, Sources (Organizations) and Standards, Automotive Protocols: CAN Protocol, LIN Protocol, Media Oriented Systems Transport, FlexRay, Industrial Networks, Protocols in Silicon: MCU with Integrated CAN, LIN Implementation, Ethernet Controller, Transitioning Between Protocols, Application Example.

UNIT-V: STANDARDS FOR SMART SENSING (9 Periods)
Introduction, Setting the Standards for Smart Sensors and Systems, IEEE 1451.1, IEEE 1451.2, IEEE 1451.3, IEEE 1451.4, IEEE 1451.5, IEEE 1451.6, IEEE 1451.7, Application Example.

TotalPeriods: 45

Topics for Self Study are provided in the Lesson Plan

TEXT BOOKS:

1. Nikolay Kirianaki, Sergey Yurish, Nestor Shpak, Vadim Deynega , *Data Acquisition and Signal Processing for Smart Sensors*, John Wiley & Sons Ltd, 1st edition, 2002.
2. Jacob Fraden , *Handbook of Modern Sensors: Physics, Designs, And Applications*, Springer, 5thedition, 2016.
3. Randy Frank, *Understanding Smart Sensors*, Artech House, 3rd Edition, 2013.

REFERENCE BOOKS:

1. Sergio Franco*, Design with Operational Amplifiers and Analog Integrated Circuits,* McGraw-Hill Education, 4th edition, 2015.
2. G.K. Ananthasuresh K.J. Vinoy S. Gopala krishnan K.N. Bhat V.K. Aatre, *Micro and Smart Systems: Technology and Modeling*, John Wiley & Sons, Inc., 1st edition, 2012.

ADDITIONAL LEARNING RESOURCES:

1. **Smart sensors:**
   https://www.electrochem.org/dl/interface/wtr/wtr10/wtr10_p029-034.pdf
   https://www.ee.iitb.ac.in/~esgroup/es_mtech02_sem/es02_sem_rep_dubey.pdf
2. **MEMS Technologies: Photolithography**
   https://nanoscale.unl.edu/pdf/Photolithography_Participant_Guide.pdf
3. **Standards for smart sensors- ieee-1451:**
   https://www.electronicdesign.com/technologies/components/article/21787128/smart-sensors-ieee-1451.

III B. Tech. – II Semester

(19BT61031)**PROCESS CONTROL LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Process Control Instrumentation**.**

COURSE DESCRIPTION: Tuning methods, Characteristics of control valve, Response of controllers for different processes like flow, level, pressure etc., Design of controllers.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on process equipments.
CO2. Develop the transfer function of the process and analyze the performance of the process in terms of time domain specifications.
CO3. Design electronic PID controller and tune its controller parameters using various tuning methods.
CO4. Analyze the response of flow, level and pressure process.
CO5. Work independently and in teams to solve problems with effective communication.

LIST OF EXPERIMENTS:

(Minimum 10 experiments to be conducted)

1. Analyze the behavior of Flow process with and without controller.
2. Obtain the performance for liquid level process with and without controller.
3. Response of Pressure Process using controller.
4. Obtain the transfer function model for Interacting Systems.
5. Obtain the transfer function model for Non-Interacting Systems.
6. Analyze the servo and regulatory response for pressure control process.
7. Obtain the characteristics of electro-pneumatic converter.
8. Obtain the controller parameters using Process reaction curve method.
9. Obtain the controller parameters using continuous oscillation method.
10. Study the response of ratio controller.
11. Study the closed loop performance of cascade controller.
12. Obtain the valve flow-lift characteristics of Linear, On-OFF and equal percentage control valve.
13. Realization of control actions- Electronic PID controller.

REFERENCE BOOKS/LABORATORY MANUALS:

1. Donald P. Eckman, *Automatic Process Control*, Wiley Eastern Ltd., 1993.
2. Curtis D. Johnson, *Process Control Instrumentation Technology*, Pearson Education, New Delhi, 7th Edition, 2002.

ADDITIONAL LEARNING RESOURCES:

1. http://www.vlab.co.in/lab_ready_for_use.php
2. https://www.pidlab.com/en/
3. http://www.eiecouncil.com/process-control-lab.html

IV B. Tech. – I Semester

(19BT71001)**BIOMEDICAL INSTRUMENTATION**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Human Anatomy & Physiology; Bio-signals; Cardiovascular and Neuro-muscular Instrumentation; Therapeutic Equipment; Advanced Imaging techniques.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on Bioelectric Potentials and various electrodes for measuring Potentials.
CO2. Analyze ECG signals and measure various cardiovascular parameters.
CO3. Analyze EEG and EMG signals and measure various parameters in neuro muscular and respiratory systems.
CO4. Demonstrate the working of various theraptic instruments.
CO5. Demonstrate the working of imaging instruments used for diagnosis by following ethical values.

UNIT–I: BIO ELECTRIC POTENTIALS AND ELECTRODES (9 Periods)

Block diagram of biomedical instrumentation, Problems encountered in measuring a living system, system, Structure of cell, Resting and Action Potentials, Propagation of Action Potentials, sources of Bioelectric Potentials, Electrode theory, Bio potential electrodes, Bio chemical transducers.

UNIT–II: CARDIOVASCULAR INSTRUMENTATION (9 Periods)

Physiology of cardiovascular system, electrical conduction system of the heart, interpretation of ECG waveform, standard 12-lead configurations, Einthoven triangle, specifications of ECG Machine; Blood pressure, blood flow and heart sound measurements; Relation between electrical and mechanical activities of the heart.

UNIT–III: NEURO-MUSCULAR AND RESPIRATORY INSTRUMENTATION (9 Periods)

Physiology of nervous system, electrode placement for EEG and EMG recording, Specification of EEG and EMG machines, Interpretation of EEG and EMG.
Respiratory Instrumentation: Mechanism of respiration, Spirometry, Pnemuotachograph Ventilators.

UNIT – IV: THERAPEUTIC EQUIPMENT (9 Periods)

Pacemakers: Need for Cardiac pacemakers, pacing modes, Ventricular asynchronous Pacemaker (Fixed rate Pacemaker), Ventricular inhibited Pacemaker (demand Pacemaker), Atrial Synchronous pacemaker, Comparision between internal & external Pacemakers; Defibrillators: AC Defibrillator, DC Defibrillator, Synchronised DC Defibrillator; Diathermy: Shortwave and microwave, Dialysis: Hemo Dialysis, Peritonal Dialysis.

UNIT – V: MEDICAL IMAGING SYSTEM (9 Periods)

Ultrasonic Imaging: Doppler principle, Modes of Display: A-Mode, B-Mode and Echocardiography. Computed Tomography: Block diagram of CT scanner, Applications of Computed Tomography.MRI Imaging System, Cine angiogram, Endoscope.

TotalPeriods: 45

Topics for self-study are provided in the lesson plan

TEXTBOOKS:

1. Leslie Cromwell, Fred. J. Weibell and Erich. A. Pfeiffer, *Biomedical Instrumentation and Measurements*, 2nd Edition, PHI, 2003.
2. R.S. Khandpur, *Hand Book of Biomedical Instrumentation*, Tata McGraw Hill, 2nd Edition, 2002.

REFERENCE BOOKS:

1. John G.Webster, *Medical Instrumentation Application and Design*, 3rd Edition, Wiley India Pvt. Ltd., 2004
2. M. Arumugam, *Biomedical Instrumentation*, Anuradha Publications, 1992.

ADDITIONAL LEARNING RESOURCES:

- https://www.nibib.nih.gov›science-education›students-resource
- https://www.who.int›medical_devices›support
- https://nptel.ac.in

IV B. Tech. – I Semester

(19BT71002) PROGRAMMABLE LOGIC CONTROLLERS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION Introduction to PLC, PLC ladder diagrams, programming PLC, timers, counters and sequences used in PLC, data handling functions, bit Patterns, advanced PLC functions.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge on programmable logic controllers, various functions of PLCs.
CO2. Analyse the process of automation using PLC functions.
CO3. Develop programs for industrial applications to automate the process using PLC functions.
CO4. Solve real time problems in industries using PLCs.

DETAILED SYLLABUS:

UNIT-I: PLC BASICS AND PROGRAMMING (9 Periods)
Introduction, PLC advantages, disadvantages, PLC system, CPU,I/O modules and interfacing, power supplies, Programming equipment, Programming formats, Construction of PLC ladder diagrams, Devices connected to I/O modules. Input instructions, outputs, Operational procedures, Programming examples usingcontacts and coils, Fail-Safe Circuits, Drill press operation.

UNIT-II: LADDER DIAGRAMS, REGISTERS AND TIMER FUNCTIONS (9 Periods)
Digital logic gates, Boolean algebra PLC programming, Conversion examples. Ladder Diagrams for process control: Ladder diagrams & sequence listings, ladder diagram construction and flowchart for spray process system. Characteristics of Registers, module addressing, holding registers, Input Registers, OutputRegisters.Timer function & Industrial applications, Counter functions& industrial applications.

UNIT-III: INTERMEDIATE AND DATA HANDLING FUNCTIONS (9 Periods)
Intermediate functions: Arithmetic functions, Number comparison functions, Number conversion functions. Skip, Master control relay, Jump functions. PLC data move systems: Move function, FIFO, FAL, & Sweep functions and their applications.

UNIT-IV: PLC FUNCTIONS WORKING WITH BITS (8 Periods)
Bit Pattern, Changing a register bit status, Shift register functions and applications, Sequencer functions and applications,Controlling of two-axis & three axis Robots with PLC, Matrixfunctions.

UNIT-V: ADVANCED PLC FUNCTIONS (10 Periods)
Analog modules & systems, Analog signal processing, Multi-bit Data Processing, Analog output application examples, PID principle, position indicator with PID control, PID Modules, PID tuning, PID functions, Networking of PLCs, Alternative Programming languages.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK:

1. John W. Webb & Ronald A. Reiss, *Programmable Logic Controllers Principles and Applications*, 5th edition, PHI 2009.

REFERENCE BOOKS:

1. Frank D. Petruzella, *Programmable Logic Controller*, 3rd edition, Tata Mc-Graw Hill, 2010.
2. M.Chidambaram, *Computer Control of Process*, Narosa 2003.

ADDITIONAL LEARNING RESOURCES

1. https//openautomationsoftware.com/use cases /allenbradleywpfscada/
2. https//new.siemens.com/global/en/products/automation/industrysoftware/automation software/scada.html
3. https//ab.rockwellautomation.com/Programmable Controllers

IV B. Tech. – I Semester

(19BT71031)BIOMEDICAL INSTRUMENTATION LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A Course on Biomedical Instrumentation.

COURSE DESCRIPTION: Measurements of parameters: pH, Dissolved Oxygen, Conductivity blood pressure, respiration rate and heart sounds; Analysis of Bio-Signals; Compression of Bio-Signals.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Select suitable biomedical instrument for specific measurement of physiological parameters.
CO2. Design signal conditioning circuit for various biosensors.
CO3. Analyze the response of various biosignals to detect abnormalities.
CO5. Work independently and in teams to solve problems with effective communication.

LIST OF EXPERIMENTS:

Minimum of TEN experiments to be conducted

1. Calibration and measurement of pH value, Dissolved Oxygen and Thermal Conductivity of a given sample.
2. Blood pressure measurement.
3. Analysis of ECG for different lead configurations.
4. Analysis of EEG Signals.
5. Analysis of EMG Signals.
6. Design of Instrumentation Amplifier for bioelectrical Signals.
7. Measurement of Heart Sounds.
8. Real time EPR System.
9. Electrical Safety analyzer for biomedical equipments.
10. Analysis of Bio-Signals using Lab View.
11. Compression of Bio-Signals using Lab View.
12. Flame photometer for biomedical applications.
13. Study and analyze the performance of UV-VIS Spectrophotometer.

REFERENCE BOOKS/LABORATORY MANUALS:

1. Leslie Cromwell, Fred. J. Weibell and Erich. A. Pfeiffer, *Biomedical Instrumentation and Measurements*, 2nd Edition, PHI, 2003.
2. R.S. Khandpur, *Hand Book of Biomedical Instrumentation*, Tata McGraw Hill, 2nd Edition, 2002.
3. John G.Webster, *Medical Instrumentation Application and Design*, 3rd Edition, Wiley India Pvt. Ltd.,2004

ADDITIONAL LEARNING RESOURCES:

1. Lab view 2013 biomedical toolkit.
2. http://www.vlab.co.in/ba-nptel-labs-biotechnology-and-biomedical-engineering
3. https://physionet.org/

MINOR DEGREE IN
ROBOTICS

Offering Department: MECHANICAL ENGINEERING
Students of Eligible Branches: CSE, CSSE, IT,ECE, EEE, EIE and CE

COURSE STRUCTURE

Semester	Course Code	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
III B.Tech. I-Sem (2 Theory)	19BT50316	Computer Integrated Manufacturing	3	-	-	3	3	40	60	100
	19BT50317	CNC Programming	3	-	-	3	3	40	60	100
	19BT50318	Introduction to Mechanical systems *	3	-	-	3	3	40	60	100
III B.Tech. II-Sem (2 Theory)	19BT60321	Principles of Industrial Automation	3	-	-	3	3	40	60	100
	19BT60322	Principles of Robotics*	3	-	-	3	3	40	60	100
	19BT60323	Robot Kinematics and Dynamics	3	-	-	3	3	40	60	100
IV B.Tech. I-Sem (2 Theory)	19BT70315	Applied and Industrial Robotics	3	-	-	3	3	40	60	100
	19BT70316	Robotic Programming	3	-	-	3	3	40	60	100
	19BT70317	Sensors and Machine Vision Systems	3	-	-	3	3	40	60	100

* Compulsory Course

Note: If any student has chosen a course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s for the Minor degree.It is the responsibility of the student to acquire/complete prerequisite before taking therespective course.

III B. Tech. – I Semester
(19BT50316) COMPUTER INTEGRATED MANUFACTURING

Int. Marks	Ext.Marks	TotalMarks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSEDESCRIPTION: Introduction to CIM, CAD/CAM, product life cycle, Fundamentals of NC and CNC, Group Technology and FMS, Computer Aided Planning Systems, Adaptive control systems

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Apply the principles of Computer integrated manufacturing to control and foster the production process.
CO2. Analyze the architecture of numerical control and apply the Numerical control programming techniques for machining process.
CO3. Analyze different part families through grouping and construe different machine cell designs and flexible manufacturing systems.
CO4. Demonstrate different approaches and techniques for computer aided process planning in automation.
CO5. Demonstrate the knowledge on Adaptive control systems for different applications.

DETAILED SYLLABUS:

UNIT - I: FUNDAMENTALS OF CIM (9Periods)

Introduction to Manufacturing;CIM -Types, Manufacturing Systems, CIM Definition, CIM wheel, CIM components, Evolution of CIM - Development of computers, needs of CIM, Benefits of CIM, CIM Hardware & Software, Fundamentals of CAD / CAM, Product cycle.

UNIT-II: FUNDAMENTALS OF NC AND CNC (9Periods)

Numerical control machines: Introduction, basic components of an NC system, the NC procedure, NC coordinate system, NC motion control system, application of numerical control and Economics of Numerical control.

Computer controls in NC: Principle of CNC, types of CNC machine tools, programming and applications of CNC machine tools, Direct Numerical control (DNC), Database and DBMS- requirement, features and architecture of DBMS.

UNIT - III: GROUP TECHNOLOGY AND FMS (9 Periods)

Group Technology: Group Technology - Part families, Parts classification and coding, Production flow analysis, Composite part concept, Machine cell design and Benefits of GT.

Flexible Manufacturing Systems: FMS - Components of FMS, FMS Work stations, Material Handling Systems, Computer Control system, FMS layout configurations and Benefits of FMS.

UNIT-IV: COMPUTER AIDED PLANNING SYSTEMS (9Periods)

Computer aided planning systems - Approaches to Computer aided Process Planning (CAPP), Generative and Retrieval CAPP systems, Benefits of CAPP, Material Requirement Planning (MRP), Mechanism of MRP, Benefits of Capacity Planning.

UNIT - V: ADAPTIVE CONTROL SYSTEMS: (9 Periods)

Adaptive control machining system - Adaptive control optimization system, Adaptive control constraint system, Applications to machining processes, Computer process monitoring, Hierarchical structure of computers in manufacturing, and computer process control.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Mikel.P.Groover, *Automation, Production systems and Computer Integrated Manufacturing Systems*, Pearson Education; 4th Edition,2016.
2. P.N.Rao, *CAD/CAM: Principles and Applications,* McGraw Hill Education*, 3rd edition, 2017.*

REFERENCE BOOKS:

1. Radhakrishnan and Subramanian, *CAD/CAM/CIM*, New Age International Pvt Ltd, 4th Edition, 2018.
2. M. Groover, *CAD/CAM*, Pearson Education; 1st Edition, 2003.

III B. Tech. – I Semester
(19BT50317) **CNC PROGRAMMING**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION:
Fundamentals of NC And CNC Machines, CNC Machine Elements, CNC Machine Structure and Machining Centers ,Machining Centers, Adaptive Control Systems and Drives, DNC Systems and Adaptive Control, Feedback Devices, Fundamentals of CNC Programming, CNC Part Programming, CNC Turning and Milling Programming, CNC Turning, CNC Milling.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***
CO1. Demonstrate the knowledge of numerical controls & computerized numerical control of a manufacturing system.
CO2. Demonstrate the knowledge of constructional and functional features of machines and its support systems.
CO3. Analyze CNC machines with the knowledge of Adaptive control systems and drive systems considering societal needs.
CO4. Apply CNC coding used in CNC programming for a given operation.
CO5. Apply CNC programming for basic Turning and Milling Operations.

DETAILED SYLLABUS:

UNIT- I: FUNDAMENTALS OF NC and CNC MACHINES (9 Periods)
NC machines: Fundamentals of numerical control, advantage of NC systems, classification of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, features of NC Machine tools, interpolations.
CNC Machines: CNC machine elements, principle of operation of CNC, features of CNC, classification of CNC systems, Advantages of CNC system,Application of CNC systems.

UNIT- II: CNC MACHINE STRUCTURE AND MACHINING CENTERS (9 Periods)
CNC Machine Structure: Guide ways, feed drives, spindles, spindle bearings, slide ways - Friction, Antifriction and types of guide ways; Recirculating ball screw; Torque transmission elements - gears, timing belts, flexible couplings and bearings.
Machining centers: Features, Auto Tool Changer (ATC) & Automatic Pallet Changer (APC).

UNIT- III: ADAPTIVE CONTROL SYSTEMS AND DRIVES (9 Periods)
DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages and disadvantages of DNC, adaptive control with optimization, adaptive control with constraints. **Feedback devices** – Open loop and closed loop control systems, positional feedback, velocity feedback devices.
Drives: spindle drives-DC shunt motor, 3 phase induction motor, Feed drives-stepper motors, servo principle, DC and AC servomotors.

UNIT- IV: CNC PROGRAMMING (9 Periods)
CNC PART PROGRAMMING: Coordinate systems- structure of part program, Types of interpolation, Methods of CNC part programming, Part Program Terminology-G and M Codes, Machine and work piece datum, absolute and incremental programming, tool offset and tool nose radius compensation, fixed cycles, subroutines in part programming, computer-aided part programming, CNC controllers (FANUC and SINUMERIC),

UNIT- V: CNC TURNING AND MILLING PROGRAMMING (9 Periods)
CNC Turning: Basic programs on Turning, Facing, Drilling, Threading, Taper Turning, Boring, reaming, and tapping

CNC Milling: Basic programs on Face Milling, End Milling, Drilling, Chamfering, Boring, Reaming, Tapping, Sinking.
Features of typical CAM packages: Master CAM, Edge CAM, Siemens NX CAM.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Mike Mattson, *CNC Programming: Principles & Applications: Principles and Applications*, Delmar; 1st edition, 2013.
2. YoremKoren, *Computer Control of Manufacturing Systems*, Mc Graw Hill Book Co, 2017.
3. P. Radhakrishnan, *Computer Numerical Control (CNC) Machines*, New Central Book Agency; 1st edition,2013

REFERENCE BOOKS:

1. M. Adithan and B.S. Pable, *CNC Machines*, New Age, Third edition, 2018.
2. Mikell P. Groover, *Automation, Production Systems and Computer-Integrated Manufacturing*, Pearson Education; Fourth edition, 2016.
3. J.S. Narang, *CNC Machines And Automation*, Dhanpat Rai & Co. (P) Limited, 2016.

III B.Tech. – I Semester
(19BT50318) INTRODUCTION TO MECHANICAL SYSTEMS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION:
Statics of rigid bodies; Laws of mechanics; Force couple system; Equilibrium of rigid bodies; Supports and reactions forces; Moment and couple and their representation; Dynamics of rigid bodies; Motion of a rigid bodies; Energy equations; Frictional forces; Robotics and automation; Configuration and anatomy of robots; End effectors; Robotic drive and control systems; Actuators.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze the mechanical behavior of a rigid body and components of forces involved in it.
CO2. Analyze conditions of equilibrium applied over a rigid body in different dimensions and compute its moments and couples.
CO3. Analyze the dynamic behavior of a rigid body and its condition of motion.
CO4. Demonstrate knowledge of robots and its components.
CO5. Analyze the functional characteristics of robot drives, actuators and controlsfor a configurations.

DETAILED SYLLABUS:

UNIT- I: STATICS (9 Periods)
Introduction, Units and Dimensions, Laws of Mechanics, Force Characteristics, System of forces, Lami's theorem, Parallelogram and triangular Law of forces, Statics of rigid bodies in two dimensions, force couple system.

UNIT- II: EQUILIBRIUM OF RIGID BODIES (9 Periods)
Free body diagram, Types of supports, Action and reaction forces, Moments and Couples, Moment of a force about a point and about an axis, Vectorial representation of moments and couples, Varignon's theorem, Equilibrium of Rigid bodies in two dimensions.

UNIT- III: RIGID BODY DYNAMICS (9 Periods)
Displacements, Velocity and acceleration, their relationship, Relative motion, Curvilinear motion, Newton's laws of motion, Work Energy Equation; Friction force – Laws of sliding friction, Equilibrium analysis of simple systems with sliding friction.

UNIT- IV: ROBOTICS (9 Periods)
Robotics and programmable automation, Law of robotics, Anatomy, Configuration of robots, Robot end effectors-classification, force analysis, active and passive grippers.

UNIT-V: ROBOTIC DRIVES, ACTUATORS & CONTROLS (9 Periods)
Functions of Drive Systems, General Types of Fluids, Classification of fluid power systems, Components of hydraulic fluid power systems, components of pneumatic systems, Pump Classification, Introduction to Pneumatic Systems, Electrical Drives, D.C. Motors and Transfer Functions, A.C. Motors, Piezoelectric Actuators, Stepper Motor, Drive Mechanisms.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Beer F.P, Johnston Jr.E.R, *Vector Mechanics for Engineers Statics and Dynamics,* McGraw Hill Education, 11th Edition, 2017.
2. Mikell P Groover, Mitchell Weiss, Roger N Nagel, Nicholas Odrey, Ashish Dutta *"Industrial Robotics (SIE): Technology, Programming and Applications*, McGraw Hill Education India, 2012
3. S.R. Deb and S.Deb"*Robotic Technology and Flexible Automation*" McGraw Hill Education India. Second Edition, 2012.
4. Khushdeep goyal, Deepak Bhandari*, Industrial automation and robotics*, Katson books, 2013.

REFERENCES:

1. Hibbeller R.C, Ashok Gupta "*Engineering Mechanics Statics and Dynamics*", Pearson Education, 11th Edition, 2009.
2. Bhavikatti S.S "*Engineering Mechanics*", 7th Edition, New Age International (P) Limited Publishers, 2019.
3. Young D H, Timashenko S "*Engineering Mechanics*", Tata McGraw-Hill., 2006
4. S K Saha*"Introduction to Robotics",* 2nd Edition, McGraw Hill Education India, 2014.

III B. Tech. – II Semester
(19BT60321) PRINCIPLES OF INDUSTRIAL AUTOMATION

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSEDESCRIPTION: Introduction to automation, Types of automation systems, Fluid power and fluid power systems, Assembly automation equipment, Material handling, transfer and assembly equipment, Types of automated assembly machines, Programmable Logic Controllers, PLC hardware components, Microprocessors and Microcontrollers, Feedback devices.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1: Demonstrate the knowledge on automation and its different applications.
CO2: Analyze functional characteristics of power systems for industrial applications.
CO3: Demonstrate the knowledge on assembly automation equipment and its related components.
CO4: Demonstrate the knowledge of programming logic controller unit for industrial applications.
CO5: Demonstrate the knowledge of microprocessors and microcontrollers in integrating mechanical systems with computer and electronic systems.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO AUTOMATION (9 Periods)
History, Elements of Automation, Types of Automation systems, Applications of Automation, Goals of Automation, Low cost automation, Hierarchical levels in industrial Automation systems.

UNIT-II: FLUID POWER AND FLUID POWER SYSTEMS (9 Periods)
Introduction to fluid power- Classification of fluid power systems, comparison of electrical, hydraulic and Pneumatic systems; Basic circuit diagram of Hydraulic fluid power and pneumatic power systems, Components of Hydraulic fluid power systems, Components of Pneumatic power system, Logic Gates, Truth tables and Boolean algebra.

UNIT-III: ASSEMBLY AUTOMATION EQUIPMENT (9 Periods)
Material Handling : Principles of Material handling, Material handling equipment- Wheel conveyor, Gravity Roller conveyor, Chain conveyor, Flat belt conveyor, Magnetic belt conveyor, bucket conveyor, Vibrating conveyor, screw conveyor, vertical lift conveyor, trolley conveyor, sortation conveyor, cranes and Hoists, storage equipment, AS/RS, AGV.
Transfer and assembly equipment: Introduction to feeder units, Cycled transfer equipment and non-cycled transfer equipment.
Automated assembly machines: Dial indexing machine, In-line machine, and floating work platform machines.

UNIT-IV: PROGRAMMABLE LOGIC CONTROLLERS (9 Periods)
Programmable Logic Controllers (PLC): Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Applications.
PLC hardware Components: The I/O Section, Discrete I/O Modules,Analog I/O Modules, Special I/O Modules, I/O Specifications, Typical Discrete I/O Module Specifications, Typical Analog I/O Module Specifications, The Central Processing Unit (CPU),Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).

UNIT-V: MICROPROCESSORS AND MICROCONTROLLERS (9 Periods)
Evolution of microprocessors and microcontrollers; Architectures of microprocessors and

microcontrollers; Integration of mechanical systems with computer and electronic systems (Mechatronic systems).
Feedback devices: LVDT, Linear/Rotary encoders, absolute encoders, resolvers and potentiometers, Fundamentals of SCADA and Data Acquisition Systems.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Khushdeep Goyal, *Industrial Automation and Robotics*, S.K.Kataria& Sons, 4th Edition, 2013.
2. Frank. D.Petruzella*, Programmable Logic Controllers,* Tata McGraw-Hill Education, 4thEdition, 2011.

REFERENCE BOOKS:

1. M.P. Groover, Automation, *Production systems and Computer Integrated Manufacturing*, Fourth edition, PHI Learning, 2016.
2. Geoffrey Boothroyd, *Assembly Automation and Product design*, Taylor and Francis Publishers, Second edition 2005.

III B.Tech. II-Semester

(19BT60322)**PRINCIPLES OF ROBOTICS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Brief history - Robot – Definition, Various robot manipulators – Linear and angular velocities, tactile, proximity and range sensors, End Effectors and robot economics

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate knowledge of robotics, its specifications, functions and different applications.
CO2. Demonstrate knowledge on various robot manipulators
CO3. Demonstrate knowledge on sensors, work cells and programming languages.
CO4. Analyze functional characteristics of robot end effectors through design considerations.
CO5 Analyze economic aspects of robots by considering different safety parameters.

DETAILED SYLLABUS:

UNIT-I: BASIC CONCEPTS (9 Periods)

Brief history, Robot - Definition, Anatomy; Co-ordinate Systems, Work Envelope types and Classification, Robotic Specifications, Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load, Robot Parts and their Function; Need for Robots, Applications.

UNIT-II: ROBOT MANIPULATORS (9 Periods)

Various robot manipulators, Linear and angular velocities, Manipulator Jacobian, Prismatic and rotary joints, Robotic Inverse, Wrist and arm singularity.

UNIT-III: ROBOT SENSORS (9 periods)

Desirable features of Sensors; Tactile, proximity and range sensors; Uses of sensors in robotics; work cell; Introduction to Programming languages.

UNIT-IV: ROBOT END EFFECTORS (9 periods)

End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT-V: IMPLEMENTATION AND ROBOT ECONOMICS (9 p*eriods*)

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. R.K.Mittal and I.J.Nagrath, *Robotics and Control*, Tata McGraw Hill, New Delhi,4th Reprint, 2005.
2. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, *Industrial Robotics*, McGraw-Hill Singapore, 1996.

REFERENCE BOOKS:

1. JohnJ. Craig, *Introduction to Robotics Mechanics and Control*, Pearson Education, Third edition, 2009.
2. Ashitava Ghoshal, *Robotics-Fundamental Concepts and Analysis*, Oxford University Press, Sixth impression, 2010.

III B. Tech. – II Semester

(19BT60323) ROBOT KINEMATICS AND DYNAMICS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Robot Manipulation, Robot Classification, Robot Specifications, Direct Kinematics, Inverse Kinematics, Manipulator Differential Motion and Statics, Manipulator Jacobian, Dynamic Modeling,

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate the knowledge on robot manipulation and control for industrial applications
CO2. Analyze forward and Inverse kinematics for different robot schemes.
CO3. Analyze manipulator differential motion and statics for different robot schemes
CO4. Develop dynamic models for robots using Langrangian mechanics, Lagrange–Euler formulation, Newton–Euler formulation and other techniques.

DETAILED SYLLABUS:

UNIT-I: ROBOT MANIPULATION (9 Periods)

Automation and robots; Robot anatomy; Robot Classification; Manipulation and control; Applications; Robot Specifications**-**Number of axes, Capacity and speed, Reach and stroke, Tool orientation, Repeatability, precision and accuracy, Operating environment.

UNIT-II: DIRECT KINEMATICS (9 Periods)

Dot and cross products; coordinate frames; Rotations; Homogeneous coordinates; link coordinates; D-H Representation; The ARM equation; Schematic diagram of four, five and six axis articulated robot.

UNIT-III: INVERSE KINEMATICS (9 Periods)

Manipulator workspace; Solvability of inverse kinematic model; Existence of solutions; Multiple solutions, Solution techniques; Closed form solution;The inverse kinematics problem; General properties of solutions; Tool configuration; Inverse kinematics of four axis SCARA robot and six axis articulated robot.

UNIT-IV: MANIPULATOR DIFFERENTIAL MOTION AND STATICS (9Periods)

Linear and angular velocity of a rigid body; Relationships between transformation; Mapping, Velocity vector; Velocity propagation along links; Manipulator Jacobian; Jacobian inverse; Jacobian singularities; Static analysis.

UNIT V: DYNAMIC MODELING: (9Periods)

Langrangian mechanics; Two degree of freedom manipulator–Dynamic model, Lagrange –Euler formulation, Newton–Euler formulation; Comparison of Lagrange–Euler formulation and Newton–Euler formulation; Inverse dynamics.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Robert J. Schilling, *Fundamentals of Robotics Analysis and Control,*PHI Learning, 2011.
2. R.K.Mittal and Nagrath*, Robotics and Control, TMH, 2017.*

REFERENCE BOOKS:

1. Niku S B*, Introduction to Robotics, Analysis, Systems, Applications,* Prentice Hall, Second edition 2006.
2. Geoffrey Boothroyd, *Assembly Automation and Product design*, Taylor and Francis Publishers, Second edition 2005.

IV B.Tech I Semester

(19BT70315) APPLIED AND INDUSTRIAL ROBOTICS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: General considerations in Robot material handling, material transfer application, machine loading and unloading, CNC machine tool loading; repeatability, maximum working envelop, kinematic and state values. Robot safety Considerations, Factors affecting robot safety measures; Cooperative manipulation; field robots and robots in health care

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate the knowledge on robotic material handling and assembly systems.
CO2. Demonstrate the knowledge of expert systems in robotic performance testing and safety
CO3. Demonstrate the knowledge on various cooperative and SWARM robots and its applications.
CO4. Analyze robotic configurations and specifications for field and service applications.
CO5. Demonstrate the core concepts of robots in medical applications.

DETAILED SYLLABUS:

UNIT- I: ROBOT MATERIAL HANDLING (10 periods)

General considerations in Robot material handling, material transfer application, machine loading and unloading, CNC machine tool loading, Robot centered cell Assembly and parts presentation methods, Assembly operation, Compliance and the Remote center compliance (RCC) Device, Assembly system configurations, Adaptable programmable assembly system, Designing for robotic assembly, Inspection automations - vision inspection system, robot - manipulated inspection.

UNIT- II: EXPERT SYSTEMS (9 periods)

Factors influencing the choice of a robot, Robot performance testing - Path/point accuracy and repeatability, Maximum working envelop, Kinematic and State values. Robot safety Considerations, Factors affecting robot safety measures, Safety features built into industrial robot, Safety barriers and other devices.

UNIT-III: COOPERATIVE AND SWARM ROBOTS (7 periods)

Cooperative manipulation, Challenges in cooperative manipulation- Case studies for Cooperative manipulation for Industrial and Service applications; Introduction to swarm Robots, Comparison with other multi-agent systems, challenges and benefits of swarm systems- Algorithms for swarm Robots, application, case study of swarm Robots.

UNIT-IV: FIELD ROBOTS (10 periods)

Forestry, Robot locomotion, Forestry automation, Broad acre Applications- Automatic guidance, sowing, weeding, spraying and broad-acre harvesting; Horticulture, Picking of fruits, Robot milking, Sheep shearing, Slaughtering, livestock inspection, Robots in construction, Future directions; Robots for hazardous applications, Enabling technologies- Search and Rescue robotics: Disaster characteristics-Impact on Robots, Robots actually used at disaster, Promising robots, open issues – Case studies; Cleaning Robots, lawn moving Robots- Smart appliances and smart homes.

UNIT-V: ROBOTS IN HEALTH CARE (9 periods)

Medical robotics, Core concepts, Technology- Medical robotic systems, Research areas and applications; Rehabilitation and Health care robotics- Overview, physical therapy and training Robots; Robotic aid for people with disabilities- Smart prostheses and orthoses, diagnosis and monitoring.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS

1. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel and Nicholas G. Odrey, *Industrial Robotics Technology, Programming and Applications*, Mc Graw Hill Book company, 4th edition, 2016.
2. Bernard Hodges, *Industrial Robotics*, Second Edition, Jaico Publishing House, 1993.

REFERENCE BOOKS

1. Yangsheng Xu Huihuan Qian Xinyu Wu, *Household and Service Robots*, ElsevierLtd,2015.
2. Aleksandar Lazinica, -*MobileRobotsTowardsNewApplications*, Advanced Robotic SystemsInternational, 2006.
3. LMarques,AdeAlmeida,MoTokhi,GSVirk, -*AdvancesinMobileRobotics*, World Scientific PublishingCo. Pte.Ltd. 2008.
4. Bruno Siciliano, OussamaKhatib, -*Springer Handbook of Robotics*, Springer-Verlag BerlinHeidelberg,2008.

IV B.Tech. – I Semester

(19BT70316) **ROBOTIC PROGRAMMING**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Robotic programming; Robotic software functions; Program planning; Modes of programming; Commands for motion control; Lead through robotic programming; Textual robotic programming; End effectors and sensors commands; Program control and subroutines; VAL II Programming; AML Programming.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate the knowledge of basic planning schemes involved in development of robotic programming.
CO2. Develop Programmes for robots based on the techniques of pendent and command control.
CO3. Demonstrate the knowledge of robotic languages for operations and control.
CO4. Develop Programs for robots on VAL II platform with a complete command-based control.
CO5: Develop Programs for robots on AML platform with a complete command-based control.

DETAILED SYLLABUS:

UNIT- I: FUNDAMEMNTALS OF ROBOT PROGRAMMING (9 Periods)

Robot software functions - coordinate systems, Position control, Oher control functions, sub-routines, Planning of robotic programming using flow charting - examples.

UNIT-II: METHODS OF ROBOT PROGRAMMING (9 Periods)

Online programming, off-line programming advantages of off-line programming; lead through methods - powered lead through, manual lead through, Teach pendant; Robot program as a path in space, defining position in space, motion interpolation, WAIT, SIGNAL and DELAY commands, Branching capabilities and Limitations of lead through methods.

UNIT-III: ROBOT LANGUAGES (9 Periods)

Textual robot Languages, first generation and Second-generation languages, Structure of a robot language - Operating Systems, Elements and Functions, Constants, Variables and Other data objects, Motion commands, Points in workspace, End effectors and sensor commands, Computations and operations, Program control and subroutines, Communications and Data processing.

UNIT-IV: VARIABLE ASSEMBLY LANGUAGE (9 Periods)

Variable Assembly Language II - Introduction, Monitor commands, motion command, Hand Control, Configuration control, interlock commands, INPUT/OUTPUT Controls, Program Control, Examples

UNIT- V: A MANUFACTURING LANGUAGE (9 Periods)

A Manufacturing Language (AML) - Introduction, AML statements, Constant and variables, Program control statements, motion commands, Sensor commands; Grip sensing capabilities, Data processing, Examples.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel and Nicholas G. Odrey, *Industrial Robotics Technology, Programming and Applications*, McGraw Hill Book company, 1986
2. Bernard Hodges, *Industrial Robotic*, Jaico Publishing House, 2nd Edition, 1993.
3. S.R. Deb and S.Deb*Robotic Technology and Flexible Automation,* Second Edition McGraw Hill Education India., 2012

REFERENCES:

1. JJ Craig, *Introduction to Robotic Mechanics and Control*, Pearson, 3rd edition, 2004.
2. Fu, Lee and Gonzalez, *Robotics, control vision and intelligence*, McGraw Hill International, 2nd edition, 1987.

IV B.Tech. – I Semester
(19BT70317) SENSORS AND MACHINE VISION SYSTEMS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES:-

COURSE DESCRIPTION: Vison systems; Components of vision systems; Elements of visual perception; Low level vison; Filters; Higher level visions; Boundary and regional description; Sensors in robots; Different sensing variables; Robotic control; Robotic operating System; Open CV.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate the knowledge of vision system components and image interfaces.
CO2. Demonstrate the knowledge of image representations and filters for low level vision system.
CO3. Demonstrate the knowledge of higher level vision for industrial applications.
CO4. Analyze functional characteristics of sensors incorporated in a robot system.
CO5. Demonstrate the knowledge on robotic operating system and vision system for robotic simulation.

DETAILED SYLLABUS:

UNIT-I: VISION SYSTEM (9 Periods)

Basic Components, Elements of visual perception: structure of human eye, Image formation in the eye – pinhole cameras - color cameras – Image formation model – Imaging components and illumination techniques-Picture coding–Basic relationship between pixels -Camera-Computer interfaces.

UNIT-II: LOW-LEVEL VISION (9 Periods)

Image representation–Gray level transformations, Histogram, Image subtraction, Image averaging – Filters: Smoothing spatial filters, sharpening spatial filters, smoothing frequency domain filters, sharpening frequency domain filters-Edge detection.

UNIT-III: HIGHER LEVEL VISION: (9 Periods)

Segmentation-Edge linking and Boundary Detection, Thresholding, Region-oriented segmentation, the use of motion Description: Boundary Descriptors, Regional Descriptors, Recognition: Decision-Theoretic methods, structural methods.

UNIT-IV: SENSORS IN ROBOTICS (9 Periods)

Position sensors - optical, non-optical, Velocity sensors, Accelerometers, Proximity Sensors - Contact, non-contact, Range Sensing, touch and Slip Sensors, Force and Torque Sensors. Different sensing variables - smell, Heat or Temperature, Humidity, Light, Speech or Voice recognition Systems, Telepresence and related technologies, robot control through vision

UNIT-V: ROBOT VISION (9 Periods)

Robotic operating System (ROS) -Introduction, Real and Simulated Robots; Introduction to OpenCV, Open NI and PCL, installing and testing ROS camera Drivers, ROS to OpenCV – The CV_bridge Package.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. K.S.Fu, R.C.Gonzalez, CSG.Lee, -*Robotics control, sensing, vision and Intelligence*‖, McGraw Hill EducationPvt.Ltd.,2017.
2. Richard D. Klafter, Thomas A. Chmielewski, Michael Negin,*RoboticsEngineering: An Integrated Approach*, PHI Learning, New Delhi, 2009.

REFERENCE BOOKS:

1. Damian M.Lyons, *Cluster Computing for Robotics and Computer Vision,*World Scientific, Singapore, 2011.
2. Rafael C.Gonzalez, Richard E.Woods, StevenL. Eddins, *Digital Image Processing using MATLAB*, 2nd edition, Tata McGrawHill, 2010.
3. Carsten Steger, Markus Ulrich, Christian Wiedemann, -*Machine Vision algorithms and Applications*, WILEY-VCH, Weinheim, 2008.
4. Kenneth Dawson-Howe, *A Practical Introduction to Computer Vision with OpenCV*, Wiley, Singapore, 2nd edition, 2013.

MINOR DEGREE IN
SUSTAINABLE ENGINEERING

Offering Department: CIVIL ENGINEERING
Students of Eligible Branches: CSE, CSSE, IT,ECE, EEE, EIE and ME

COURSE STRUCTURE

Year &Semester	Course Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
III B.Tech. I-Sem (2 Theory)	19BT40107	Sustainable Engineering*	3	-	-	3	3	40	60	100
	19BT50110	Ecology and Environmental Impact	3	-	-	3	3	40	60	100
	19BT50111	Waste to Energy	3	-	-	3	3	40	60	100
III B.Tech. II-Sem (2 Theory)	19BT60126	Environmental Sustainability	3	-	-	3	3	40	60	100
	19BT60127	Sustainable Energy Systems	3	-	-	3	3	40	60	100
	19BT60128	Sustainability in The Built Environment	3	-	-	3	3	40	60	100
IV B.Tech. I-Sem (2 Theory)	19BT70117	Environmental Economics	3	-	-	3	3	40	60	100
	19BT70118	Sustainable Cities	3	-	-	3	3	40	60	100
	19BT70119	Sustainable Design of Technology Systems	3	-	-	3	3	40	60	100

***** CompulsaryCourse if not studied in Major Degree.

Note: If any student has chosen a course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s for the Minor degree.It is the responsibility of the student to acquire/complete prerequisite before taking therespective course.

III B.Tech. - I Semester
(19BT40107) SUSTAINABLE ENGINEERING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Principles of sustainability; Sustainability metrics and assessment tools; Sustainable engineering practices; Sustainable engineering applications; Sustainable urbanization and industrialization.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Analyze the principles of sustainability to solve complex environmental problems following relevant standards/protocols considering society, health, safety and environment.

CO2. Analyze sustainability metrics and assessment tools to solve complex environmental problems following relevant standards and emerging trends considering society, health, safety, environment and economics besides communicating effectively in graphical form.

CO3. Analyze sustainable engineering practices to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

CO4. Design sustainable engineering applications to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

CO5. Analyze sustainable urbanization and industrialization principles to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT - I: PRINCIPLES OF SUSTAINABILITY (09 Periods)

Emerging challenges, Sustainability and sustainable engineering; Environmental concerns; Social, economic and legal issues; Availability and depletion of natural resources, Disaster resiliency; Multilateral environmental agreements – Basel convention, Clean development mechanism (CDM), Montreal and Kyoto protocols.

UNIT – II: SUSTAINABILITY METRICS AND ASSESSMENT TOOLS (09 Periods)

Sustainability indicators, metrics and assessment tools, Material flow analysis and material budget, Carbon footprint analysis, Life cycle assessment, Streamlined life-cycle assessment (SLCA), Economic input output-life cycle analysis, Environmental health risk assessment, Other emerging assessment tools.

UNIT - III: SUSTAINABLE ENGINEERING PRACTICES (09 Periods)

Sustainable energy engineering, Sustainable waste management, Green and sustainable buildings and infrastructure, Sustainable civil infrastructure, Sustainable remediation of contaminated sites, Climate geoengineering.

UNIT - IV: SUSTAINABLE ENGINEERING APPLICATIONS (09 Periods)

Environmental and chemical engineering projects, Materials engineering projects, Infrastructure engineering projects – Background, Methodology, Goal and Scope, Study area, Technical design, Environmental sustainability, Life cycle assessment, Economic sustainability, Social sustainability, Rating systems – ENVISION, LEED, GRIHA, IGBC; Conclusions.

UNIT – V: SUSTAINABLE URBANIZATION AND INDUSTRIALIZATION(09 Periods)
Sustainable urbanization and industrialization, United Nations sustainable development goals – Right to education, Poverty eradication, Social and technological changes; Industrial Processes - Material selection, Energy efficiency, Pollution prevention and control techniques, Industrial Ecology, Industrial symbiosis.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Reddy, K. R., Cameselle, C., and Adams, J. A., *Sustainable Engineering: Drivers, Metrics, Tools, and Applications*, John Wiley & Sons, Inc., Hoboken, New Jersey, 2019,
2. Allen, D. T. and Shonnard, D. R., *Sustainability Engineering: Concepts, Design and Case Studies*, Pearson Education, 1st Edition, 2012.

REFERENCE BOOKS:

1. Bradley. A. S; Adebayo, A. O., Maria, P., *Engineering Applications in Sustainable Design and Developmen*t, Cengage Learning, 1st Edition, 2016.
2. Purohit, S. S., *Green Technology: An Approach for Sustainable Environment*, Agrobios Publication, 1st Edition, 2016.
3. *Energy Conservation Building Code (ECBC) 2007*, Bureau of Energy Efficiency, Govt. of India, New Delhi.
4. Twidell, J. W. and Weir, A. D., *Renewable Energy Resources*, Routledge, Taylor & Francis Group, 3rd Edition, 2015.

ADDITIONAL LEARNING RESOURCES:

1. Daniel A. Vallero and Chris Brasier, *Sustainable Design: The Science of Sustainability and Green Engineering*, Wiley-Blackwell, 1st Edition, 2008.
2. Jorge A. Vanegas, *Sustainable Engineering Practice: An Introduction*, Committee on Sustainability, American Society of Civil Engineers, https://doi.org/10.1061/9780784407509, 2004.
3. Mackenthun, K. M., *Basic Concepts in Environmental Management*, CRC Press, Taylor & Francis Group, 1st Edition, 1999.
4. *Environment Impact Assessment Guidelines*, Notification of Government of India, 2006.

III B.Tech. - I Semester
(19BT50110) ECOLOGY AND ENVIRONMENTAL IMPACT

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PREREQUISITES: A Course on Environmental Science

COURSE DESCRIPTION: Ecology; Ecosystem; Ecological impact assessment, Ecotoxicology and bio-monitoring, Restoration ecology.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1. Demonstrate the basic knowledge on ecology to provide solutions to environmentalproblems using appropriate tools and techniques considering society, health, environment and sustainability besides communicatingeffectivelyingraphicalform.
CO2. Analyze the ecosystems to solve environmentalproblems using appropriate tools and techniques considering society, health, safety, environment and sustainability besides communicatingeffectivelyingraphicalform.
CO3. Analyze the ecological impact assessment to solvecomplex environmental problems using appropriate tools and techniques following relevant standards and norms considering society, health, safety, environment, sustainability and economics besides communicatingeffectivelyingraphicalform.
CO4. Analyze the eco-toxicology effects and bio-monitoring of ecosystems to solvecomplex environmental problems using appropriate tools and techniques following relevant standards and norms considering society, health, safety, environment, sustainability and project management besides communicatingeffectivelyingraphicalform.
CO5. Analyzeecology of disturbed ecosystems, reconstructions and restoration of natural ecosystems to solvecomplexenvironmentalproblems following relevant standards and latest developments considering society, health, safety, environment, sustainability and project management besides communicatingeffectivelyingraphicalform.

DETAILED SYLLABUS:

UNIT - I: ECOLOGY (10 Periods)
Scope, concept and multidisciplinary nature of ecology; Organizational level of ecological systems, Abiotic and biotic environment, Limiting factors, Adaptation, Habitat and niche, Holocoenotic nature of environment, Concept of biosphere; Landscape, population and community ecology; Synecological principles, Species area relations, Methods of sampling and describing plant community, Ecological succession, Succession models, Concept of climax.

UNIT - II: ECOSYSTEM (8 Periods)
Structure and function of ecosystems, Productivity, Decomposition, Energy flow, Ecological efficiencies, Ecological pyramids, Global pattern of productivity, Nutrient cycling (Carbon, Nitrogen and Phosphorus), Ecosystem stability – Inertia, Resilience; Fragile ecosystem, Hot spots, Ecosystem services, Net Present Value (NPV) of ecosystems, Major biomes of India and the world.

UNIT - III: ECOLOGICAL IMPACT ASSESSMENT (09 Periods)
Principles and practices of ecological assessment, Carrying capacity of environment and earth, Environmental quality, Ecological and social impact of man, Resource depletion, Loss of biological diversity, Land degradation and deforestation, Impact assessment methods through case studies at organism, Community and ecosystem levels, Detailed criteria, Survey methods and evaluation, Cost benefit analysis, Prediction of impacts on

physical environment and biotic communities through modelling, Developing impact statement.

UNIT - IV: ECOTOXICOLOGY AND BIO-MONITORING (08 Periods)

Ecotoxicology: Ecotoxicology - Background, importance and measurement; LC50, EC50, NOEC, LOEC, Toxic units, Ecosystem response to de-oxygenation; Eutrophication - Kinetics, Lake phosphorous model, Pesticides.

Bio-monitoring: Bio-monitoring, Active and passive monitoring, Concept of bioaccumulation, Bio-indicator parameters, Bio-air conditioning and bio-purifiers, Pollution tolerance index of plants, Green belt development, Plant protection and protective substances to pollution stress, Data-gathering techniques, Organization of the survey and data analysis.

UNIT - V: RESTORATION ECOLOGY (10 Periods)

Ecological theories and principles that guide restoration practices in a variety of ecosystems, Causes of ecosystem degradation, Motivations for restoration, Factors that influence success in restoration; Ecology of disturbed ecosystems - Disturbance and its impact on the structure and functioning of terrestrial and aquatic ecosystems; Aims and strategies of restoration - Concepts of restoration, Single vs. multiple end-points, Ecosystem reconstructions, Physical, chemical, biological and biotechnological tools of restoration; Restoration of biological diversity - Acceleration of ecological succession, Reintroduction of biota; Degradation and restoration of natural ecosystems – Rivers, Wetlands, Forests, Grassland, Savanna, Aquatic; Restoration of degraded soils - Restoration of contaminated soils and soil fertility, Mine spoil restoration.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Saha, T. K., *Ecology and Environmental Biology*, Books and Allied (P) Ltd., Kolkata, 1st Edition, 2010.
2. Walker, C. H., Hopkin, S. P., Sibly R. M. and Peakall, D. B., *Principles of Ecotoxicology*, Taylor and Francis Group, London, 2nd Edition, 2004.
3. Palmer, M. A., Zedler, J. B. and Falk, D. A., *Foundations of Restoration Ecology*, Island Press, USA, 2016.

REFERENCE BOOKS:

1. Dash, M. C. and Dash, S. P., *Fundamentals of Ecology*, Tata - McGraw Hill, New Delhi, 3rd Edition, 2001.
2. Smith, T. M. and Smith, R. L., *Elements of Ecology*, Pearson Education Ltd., England, 9th Edition, 2015.
3. Hughes, W., *Essentials of Environmental Toxicology*, Taylor & Francis Press, USA, 2005.
4. Wathern, P., and Hynman, U., *Impact Assessment and Sustainable Resource Management-Theory and Practice*, Routledge Press, 2014.
5. Westman, W. E., Ecology, *Impact Assessment and Environmental Planning*, John Wiley, New York, 1985.

ADDITIONAL LEARNING RESOURCES:

1. Rajgopalan, R., *Environment and Ecology - A Complete Guide*, OakBridge Publishing, 2nd Edition, 2019.
2. Charles J. Krebs, *Ecology: The Experimental Analysis of Distribution and Abundance*, Pearson Education India, 6th Edition, 2008.
3. Mani, M., Ganesh, L.S. and Varghese, K., *Sustainability and Human Settlements*, Sage Publications, New Delhi, 1st Edition, 2005.

III B.Tech. - I Semester
(19BT50111)**WASTE TO ENERGY**

Int. Marks	Ext. Marks	Total Marks	L
40	60	100	3

PRE-REQUISITES: A Course on Environmental Science.

COURSE DESCRIPTION: Waste to energy concept; Municipal solid waste; Thermochemical waste to energy technologies; Biological waste to energy technologies; Waste to energy plants and the environment.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1 Analyze waste to energy process to solve waste management challenges using appropriate tools and techniques, following relevant codes, regulations and latest developments considering society, environment, sustainability and economics besides communicating effectively in graphical form.

CO2 Analyze municipal solid waste characteristics and sampling techniques to solve solid waste management challenges using appropriate tools and techniques, following relevant codes, regulations and latest developments considering society, environment, sustainability and economics besides communicating effectively in graphical form.

CO3 Analyze thermochemical waste to energy technologies to solve solid waste management challenges using appropriate tools and techniques, following relevant codes, regulations and latest developments considering society, environment, sustainability and economics besides communicating effectively in graphical form.

CO4 Analyze traditional and advanced biological technologies for converting waste to energy using appropriate tools and techniques, following relevant codes, regulations and latest developments considering society, environment, sustainability and economics besides communicating effectively in graphical form.

CO5 Analyze energy plants and the environment to solve waste to energy challenges using appropriate tools and techniques, following relevant codes, regulations and latest developments considering society, environment, sustainability and economics besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT - I: WASTE TO ENERGY CONCEPT (09 Periods)

Waste to energy- A historical prospective, Waste as a renewable resource, Global production of power from waste; The politics of waste - Waste management hierarchy, Circular economy/zero Waste, Energy from waste with the circular economy concept.

UNIT - II: MUNICIPAL SOLID WASTE (08 Periods)

Sources and types of solid waste, Quantity, Factors affecting generation of solid waste, Characteristics, Waste classification, Methods of sampling and characterization, Energy content of the waste.

UNIT - III: THERMOCHEMICAL WASTE TO ENERGY TECHNOLOGIES (10 Periods)

Traditional waste combustion technologies - Waste processing and treatment facility, Rotary combustors, Fluidized bed combustors; Energy production from waste through advanced thermochemical techniques - Incineration, Gasification and Pyrolysis.

UNIT - IV: BIOLOGICAL WASTE TO ENERGY TECHNOLOGIES (10 Periods)

Energy production from waste through biological techniques - Anaerobic digestion, Fermentation, Transesterification, Advanced microbial fuel cells; Cultivation of algal biomass from wastewater and energy production from algae.

UNIT - V: WASTE TO ENERGY PLANTS AND THE ENVIRONMENT (08 periods)

Emission limits for waste combustion, Environmental politics and science, Waste to energy plant cost, Latest developments in waste to energy, Case Studies.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Breeze, Paul, *Energy from Waste*, Academic Press, 1st Edition, 2017.
2. Singh, R. P., Prasad, V. and Vaish, B., *Advances in Waste-to-Energy Technologies*, CRC Press, 1st Edition, 2019.

REFERENCE BOOKS:

1. Maczulak, A. E., *Environmental Engineering: Designing a Sustainable Future,* Infobase Publishing, 4th Edition, 2010.
2. Kalogirou, E. N., *Waste-to-Energy Technologies and Global Applications*, CRC Press, 1st Edition, 2017.
3. Klinghoffer, N. B., &Castaldi, M. J., *Waste to Energy Conversion Technology*, Elsevier, 3rd Edition, 2013.

ADDITIONAL LEARNING RESOURCES:

1. Rogoff. M. J., & Screve. F., *Waste-to-energy: Technologies and Project Implementation*, Academic Press, 1st Edition, 2019.
2. Trabold, T., and Babbitt, C. W., *Sustainable Food Waste-to-Energy Systems*, Academic Press, 1st Edition, 2018.

III B.Tech. - II Semester
(19BT60126) ENVIRONMENTAL SUSTAINABILITY

Int. Marks	Ext. Marks	Total	L	T	P	C
40	60	100	3	-	–	3

PREREQUISITES: Courses on Environmental Science, and Sustainable Engineering .

COURSE DESCRIPTION: Environmental measurements from different disciplines and sustainability concepts; Environmental chemistry and physical process in environment; Environmental risk assessments with concepts of EIA and LCA; Sustainability assessment of water and wastewater treatment; Sustainability assessment of solid waste management and air pollution issues.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1 Analyze environmental measurements and sustainability concepts to solve environmental sustainability challenges using appropriate tools and techniques, following relevant codes, regulations and latest developments considering society, environment, sustainability and economics besides communicating effectively in graphical form.

CO2 Analyze environmental chemistry and physical processes to solve environmental sustainability challenges using appropriate tools and techniques, following relevant codes, regulations and latest developments considering society, environment, sustainability and economics besides communicating effectively in graphical form.

CO3 Analyze environmental risk assessment with concepts of EIA and LCA to solve environmental sustainability problems using appropriate tools and techniques following relevant codes and latest developments considering society, environment, sustainability and economics besides communicating effectively in graphical form.

CO4 Analyze water and wastewater treatment to solve environmental sustainability problems using appropriate tools and techniques, following relevant codes, regulations and latest developments considering health, society, environment, sustainability and economics besides communicating effectively in graphical form.

CO5 Analyze sustainable assessment of solid waste management and air pollution issue to solve complex problems using appropriate tools and techniques, following relevant codes, regulations and latest developments considering health, society, environment, sustainability and economics besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT – I: ENVIRONMENTAL MEASUREMENTS FROM DIFFERENT DISCIPLINES AND SUSTAINABILITY CONCEPTS (09 Periods)

Environmental measurements - Mass concentration units, Partial pressure units, Other types of units, Qualitative and quantitative measurements; Sustainability concepts and evolution, Engineering for sustainability.

UNIT – II: ENVIRONMENTAL CHEMISTRY AND PHYSICAL PROCESS IN ENVIRONMENT (09 Periods)

Environmental chemistry, Mass balance and reactor systems; Mass balance in continuous reactor, continuous stirred tank reactor (CSTR) and Plug flow reactor; Plug flow reactor and energy flow, Energy balance and earth overshot day, Mass transport processes.

UNIT – III: ENVIRONMENTAL RISK ASSESSMENT WITH CONCEPTS OF EIA AND LCA (09 Periods)

Life Cycle Assessment (LCA); Environmental Impact Assessment (EIA) - Fundamentals, Evolution of EIA (Global and Indian Scenario), Elements of EIA– Screening, Scoping, Public consultation, Environmental clearance process in India - Key elements in 2006 EIA

(Govt. of India) notification; Environmental risk, Environmental impact calculation by using LCA technique, Risk assessments with concepts of EIA and LCA, Case studies.

UNIT – IV: SUSTAINABILITY ASSESSMENT OF WATER AND WASTEWATER TREATMENT (08 Periods)

Sustainability assessment in Water purification – Processes, Engineered systems – Aeration, Solids separation, Settling operations, Coagulation, Softening, Filtration, Disinfection; Sustainability assessment in wastewater treatment process and disposal – Primary, Secondary and Tertiary.

UNIT – V: SUSTAINABILITY ASSESSMENT OF SOLID WASTE MANAGEMENT AND AIR POLLUTION ISSUES (10 Periods)

Sustainability assessment of solid waste management –Need and scope; Municipal solid waste – Types, Composition and characteristics; Methods of collection and transportation; Methods of disposal – Open dumping, Sanitary landfill, Composting and Incineration; Utilization - 6R Concept; Sustainability assessment of air pollution issues – Need and scope, Classification, Sources – Line, Area, Stationary, Mobile; Effects of air pollutants on man, Material and vegetation; Global effects of air pollution.

Total Periods: 45

Topics for self-study are included in the lesson plan.

TEXT BOOKS:

1. Davis, M. L. and Cornwell, D. A., *Introduction to Environmental Engineering,* McGraw-Hill, 5th Edition, 2008.
2. Keong, Choy Yee, *Global Environmental Sustainability: Case Studies and Analysis of the United Nations' Journey toward Sustainable Development*, Elsevier, 2020.

REFERENCE BOOKS:

1. Singh, Ritu, and Sanjeev Kumar, *Green Technologies and Environmental Sustainability*, Springer, 2nd Edition, 2017.
2. Joumard, Robert, and Henrik Gudmundsson, *Indicators of Environmental Sustainability in Transport: An Interdisciplinary Approach to Methods,* European Commission, 2nd Edition, *2010.*
3. Smith, Fraser, *Environmental Sustainability: Practical Global Applications*, CRC Press, 1st Edition, 2020.

ADDITIONAL LEARNING RESOURCES:

1. Burke. G., Singh. B. R. and Theodore, L., *Handbook of Environmental Management and Technology*, John Wiley & Sons, 2nd Edition, 2000.
2. Peavy, Howard S., Donald R. Rowe, and George Tchobanoglous, *Environmental Engineering*, McGraw-Hill, Indian Edition, 1st Edition, 2017.

III B.Tech. - II Semester
(19BT60127) SUSTAINABLE ENERGY SYSTEMS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PREREQUISITES: Courses on Environmental Science and Sustainable Engineering.
COURSE DESCRIPTION: The energy landscape and sustainability; Solar and wind energy; Biomass, geothermal, tidal and wave energies; Electricity storage technologies; Grid integration of renewable energy.
COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

- CO1 Analyze the energy landscape and sustainability to provide solutions to energy problems using appropriate tools and techniques following relevant standards considering society, health and environment besides communicating effectively in graphical form.
- CO2 Analyze solar and wind energy systems to solve the complex energy problems using appropriate tools and techniques following relevant standards considering society, health, environment, sustainability and economics besides communicating effectively in graphical form.
- CO3 Analyzebiomass, geothermal, tidal and wave energy systems to solve the complex energy problems using appropriate tools and techniques following relevant standards considering society, health, environment, sustainability and economics besides communicating effectively in graphical form.
- CO4 Analyze electric storage technology systems to solve the complex energy problems using appropriate tools and techniques following relevant standards and latest developments considering society, health, environment, sustainability and economics besides communicating effectively in graphical form.
- CO5 Analyze grid integration of renewable energy to solve the complex energy problems using appropriate tools and techniques following relevant standards considering society, health, environment, sustainability and economics besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT - I: THE ENERGY LANDSCAPE AND SUSTAINABILITY (09 Periods)
Current global energy use, National and international energy consumption and related greenhouse gas emissions, Lifetime of fossil fuels, Sustainability and energy use, Energy conversion technologies, Energy forms and conversion, First and second laws of thermodynamics and efficiencies; Devices - Heat engines, Refrigerators, Heat pumps; Instantaneous and average power.

UNIT - II: SOLAR AND WIND ENERGY (09 Periods)
Principles of solar radiation, Resource foundations, Technology challenges, Sustainability, Solar energy industry and economics, Net Metering; Origin of the wind, Power in the wind, Wind resource basics, Wind energy technologies, Challenges, Sustainability, Wind energy Industry.

UNIT - III: BIOMASS, GEOTHERMAL, TIDAL AND WAVE ENERGIES (09 Periods)
Sources of feedstocks; Biofuels - Bioethanol, Biodiesel, Algal, Jatropha and Biogas; Conversion technology, Diesel and ethanol, Biogas, Electricity production, Transportation, Challenges, Sustainability, Economics; Geothermal energy - Principles, Geothermal potential and technology, Electricity production, Conversion technology, Challenges, Economics; Tidal and wave energies, Conversion technologies, Sustainability.

UNIT - IV: ELECTRICITY STORAGE TECHNOLOGIES (09 Periods)
Introduction, Battery energy storage technologies - Lithium-ion batteries, Full cells, Nickel-based batteries, Lead-acid batteries, Sodium-sulfur batteries; Hydro energy

storage - Applications of pump hydro energy storage plant, Site selection for pump hydro energy storage plant; Thermal energy storage, Capacitors and applications, Latest developments.

UNIT - V: GRID INTEGRATION OF RENEWABLE ENERGY (09 Periods)

Variability, Intermittency and dispatchability, Electric grid infrastructure, Integrating renewable energy into the grid, Growing a more efficient grid, The smart grid, Secure communication in the smart grid; Cogeneration plant and power distribution in industry, Micro grids.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Boyle, Godfrey, *Renewable Energy: Power for a Sustainable Future*, Oxford University Press, 3rd Edition, 2012.
2. Jefferson W. Tester, Elisabeth M. Drake, Michael J. Driscoll, Michael W. Golay, William A. Peters, *Sustainable Energy (Choosing Among Options)*, MIT Press, 2nd Edition, 2012.

REFERENCE BOOKS:

1. Gilbert M. Masters, *Renewable and Efficient Electric Power Systems*, John Wiley &Sons, Inc., Hoboken, New Jersey, 2nd Edition, 2013.
2. Vanek, F.M., Albright, L.D., *Energy Systems Engineering - Evaluation and Implementation*, McGraw-Hill, 2nd Edition, 2008.
3. David MacKay, *Sustainable Energy: Without the Hot Air*, UIT Cambridge Ltd., Cambridge, England, 2009.
4. Frank Kreith, *Principles of Sustainable Energy Systems*, CRC Press, Taylor and Francis group, 2nd Edition, 2014.

ADDITIONAL LEARNING RESOURCES:

1. Richter Burton, *Beyond Smoke and Mirrors: Climate Change and Energy in the 21st Century*, Cambridge University Press, New York, 2010.

III B.Tech. - II Semester

(19BT60128) **SUSTAINABILITY IN THE BUILT ENVIRONMENT**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Environmental Science, and Sustainable Engineering.

COURSE DESCRIPTION: Sustainable urban development; Sustainable site planning and analysis; Sustainable buildings; Building envelope and services; Management of sustainable built environment.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

- CO1 Analyze sustainable urban development to solve problems associated with the built environment using appropriate tools and techniques following relevant standards considering society, health and environment besides communicating effectively in graphical form.
- CO2 Analyze sustainable site planning to solve complex problems associated with the built environment using appropriate tools and techniques following relevant standards considering society, health and environment besides communicating effectively in graphical form.
- CO3 Analyze sustainable buildings to solve complex problems associated with the built environment using appropriate tools and techniques following relevant standards considering society, health and environment besides communicating effectively in graphical form.
- CO4 Analyzebuilding envelope and services to solve complex problems associated with the built environment using appropriate tools and techniques following relevant standards considering society, health and environment besides communicating effectively in graphical form.
- CO5 Analyze management of sustainable built environment to solve complex problems using appropriate tools and techniques following relevant standards considering society, health and environment besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT-I: SUSTAINABLE URBAN DEVELOPMENT (09 Periods)

Urban development - Human activities and their effects; Carbon cycle; Role of construction material such as concrete and steel; CO2 contribution from cement and other construction materials; GHG emissions - Global climate change; Efforts in sustainable development and construction - Universal efforts, International organizations involved.

UNIT - II: SUSTAINABLE SITE PLANNING AND ANALYSIS (09 Periods)

Sustainable site planning, Principles of site analysis, Improving sustainability of a site – Stormwater, Reducing site disturbance, Vegetation; Site analysis - Examples of site analysis; Introduction to alternative energy - Solar, Wind, Hydro, Biofuel etc.

UNIT - III: SUSTAINABLE BUILDINGS (09 Periods)

Introduction to sustainable buildings and standards, Green buildings, Energy efficiency and sustainability; Passive House; Net Zero Energy Buildings (NZEB), Examples of different types of NZEB.

UNIT - IV: BUILDING ENVELOPE AND SERVICES (09 Periods)

Building envelope effect and energy efficiency measures, Renewable energy integration, Sustainable building services, Sustainable construction and materials, Integrated design, Energy use and CO2, Built environment - Aging and susceptibility to natural disasters.

UNIT – V: MANAGEMENT OF SUSTAINABLE BUILT ENVIRONMENT (09 Periods)

Life cycle planning, Measuring sustainability; Facilities management - Waste management, Improved amenities,Improved transport infrastructure, Social mix, Accessibility issues, Cultural and historical issues.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Alison Cotgrave and Mike Riley, *Total Sustainability in the Built Environment*, Macmillan Education, 1st Edition, 2012.
2. Kevin Lynch and Gary Hack, *Site Planning*, MIT Press, 3rd Edition, 1984.

REFERENCE BOOKS:

1. William McLean and Pete Silver, *Environmental Design Source Book: Innovative Ideas for a Sustainable Built Environment*, RIBA Publishing, 1st Edition, 2021.
2. Tim Dixon, John Connaughton, Stuart Green, *Sustainable Futures in the Built Environment to 2050: A Foresight Approach to Construction and Development*, John Wiley & Sons Ltd., 2018.
3. Rob Fleming, Saglinda H Roberts, *Sustainable Design for the Built Environment*, Routledge Press, London, 1st Edition, 2019.
4. Charles J. Kibert, *Sustainable Construction: Green Building Design and Delivery,* Wiley,4th Edition, 2021.

ADDITIONAL LEARNING RESOURCES:

1. Mani, M., Ganesh, L.S. and Varghese, K., *Sustainability and Human Settlements,* Sage Publications, 1st Edition, 2005.
2. Barton, H., Grant, M., Guise, R., *Shaping Neighbourhoods: For Local Health and Global Sustainability*, Routledge Press, 2nd Edition, 2020.
3. https://nptel.ac.in/courses/105/102/105102195/
4. https://nptel.ac.in/courses/124/107/124107011/

IV B.Tech. - I Semester
(19BT70117) **ENVIRONMENTAL ECONOMICS**

Int. Marks	Ext. Marks	Total	L	T	P	C
40	60	100	3	-	–	3

PREREQUISITES: Courses on Environmental Science, and Sustainable Engineering.

COURSE DESCRIPTION: Fundamentals of environmental economics; Economy and the natural environment interaction; Economic development and environment; Valuation of environmental goods and services; Sustainable economic development.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1 Analyze fundamentals of environmental economics to solve environmental economics challenges associated with sustainable design of technology systems considering latest developments, society, environment, economic, and sustainability besides communicating effectively in graphical form.

CO2 Analyze economy and the natural environment interaction to solve ecological limits and scarcity of eco-services approaches using different tools and techniques considering latest developments, relevant guidelines, environment and sustainability besides communicating effectively in graphical form.

CO3 Analyze economic development and environment to solve environmental cost-benefit challenges using different tools and techniques considering latest developments, relevant guidelines, environment and sustainability besides communicating effectively in graphical form.

CO4 Analyze valuation of environmental goods and services to solve methodical challenges using different tools and techniques considering latest developments, relevant guidelines, environment and sustainability besides communicating effectively in graphical form.

CO5 Analyze sustainable economic development to solve environmental economics challenges using different tools and techniques considering latest developments, relevant guidelines, environment and sustainability besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT – I: FUNDAMENTALS OF ENVIRONMENTAL ECONOMICS (10 Periods)

Fundamentals of environmental economics, Review of microeconomics and welfare economics, Ecology-economy interaction, Perspective of economic modeling- the concept and conditions of sustainability of the human economy, Classification and characterization of resources and pollution as a public good or bad, Role of Externalities as the fundamental determinants, Property Rights, Market, Spatial-temporal dimensions of externality- command and control, Market approaches, Green tax, Taxes in controlling externalities

UNIT - II: ECONOMY AND THE NATURAL ENVIRONMENT INTERACTION (08 Periods)

An overview of the economy and the natural environment; Interaction using an input-output based general equilibrium approach to show how ecological limits and scarcity of eco-services would affect the resource allocation and prices; Regimes of natural resources, Types of goods, Provision of public goods.

UNIT – III: ECONOMIC DEVELOPMENT AND ENVIRONMENT (09 Periods)

The relation between development environmental Quality - Environmental Kuznets curve; Development vs conservation of environmental resources - Ecosystem flips and irreversibility - Krutilla-Fisher equation; Environmental cost-benefit analysis under strong

and weak conditions of sustainability; Choice of time discount rate for evaluation - Sustainability premium.

UNIT – IV: VALUATION OF ENVIRONMENTAL GOODS AND SERVICES (10 Periods)

Theory of environmental valuation and conceptual basis of its methods - Compensating variations and surplus, Equivalent variations and surplus, Willingness to pay or accept for improvement or loss of environmental goods and services; Empirical approaches in environmental valuation; Indirect methods of environmental valuation, Non-demand function methods of valuation, Revealed preference methods - (a) Hedonic Pricing, (b) Household production function approach, Defensive cost, Health cost and travel cost methods; The direct method of environmental valuation - Stated preference - Contingent valuation method.

UNIT – V: SUSTAINABLE ECONOMIC DEVELOPMENT (08 Periods)

Capital theoretic basis of the notion of sustainable development - Sustainable Development as non-declining intertemporal utility or that of the value of the wealth. Concepts of Genuine investment or savings, Green National Income, Natural capital stock and sustainable resource accounting, Strong and weak sustainability, Environmental adjustment of national income.

Total Periods: 45

Topics for self-study are included in the lesson plan.

TEXT BOOKS:

1. Siebert, H. and Siebert, H., *Economics of the Environment*. Massachusetts: Lexington Books, 9th Edition, 1981.
2. Pearce, David W., and Kerry Turner R., *Economics of Natural Resources and The Environment,* JHU Press, Revised and Enlarged Edition, 1990.

REFERENCE BOOKS:

1. Nick Hanley, Jason F Shorgen and Ben White, *Environmental Economics Theory and Practice*, MacMillan, 2nd Edition, 2006.
2. Tietenberg, Tom and Lynne Lewis, *Environmental and Natural Resource Economics*, Routledge, 11th Edition, 2018.
3. Kumar, P., *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations*, Routledge, 2012.

ADDITIONAL LEARNING RESOURCES:

1. Field, C., *Environmental Economics: An Introduction*, McGraw-Hill Book Company (UK) Ltd, 8th Edition, 2021.
2. Sengupta, R., *Ecological Limits and Economic Development,* OUP Catalogue, 2013.

IV B.Tech. - I Semester
(19BT70118) **SUSTAINABLE CITIES**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Environmental Science, and Sustainable Engineering.

COURSE DESCRIPTION: Sustainability and urban development; Functions of cities; Inclusive, Safe and productive cities; Sustainable urban services and infrastructure; Governing sustainable cities.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1 Analyze sustainability and urban development to solve problems associated with cities using appropriate tools and techniques following relevant codes, regulations and latest developments considering society, environment, sustainability and economics besides communicating effectively in graphical form.

CO2 Analyze city functioning for sustainability to solve problems associated with cities using appropriate tools and techniques, following relevant codes, regulations and latest developments considering society, environment, sustainability and economics besides communicating effectively in graphical form.

CO3 Analyze inclusiveness, safety and productivity in cities to solve problems associated with cities using appropriate tools and techniques, following relevant codes, regulations and latest developments considering society, environment, sustainability and economics besides communicating effectively in graphical form.

CO4 Analyze sustainable urban services and infrastructure to solve problems associated with cities using appropriate tools and techniques, following relevant codes, regulations and latest developments considering society, environment, sustainability and economics besides communicating effectively in graphical form.

CO5 Analyze governance for sustainable cities to solve problems associated with cities using different tools and techniques considering latest developments, relevant guidelines, environment and sustainability besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT - I: SUSTAINABILITY AND URBAN DEVELOPMENT (08 Periods)

The urban opportunity; Cities - Cultural and social transformation; Challenge of urban politics, Planning and governance, Urban research methods, Urban theory and history, Urban development and the environment, Urban growth and the environment - Why cities grow?, Externalities and the environment, Urban economic restructuring, City size and settlement planning.

UNIT - II: FUNCTIONS OF CITIES (09 Periods)

Understanding urban systems, Municipal, Regional and national governance, Urban utilities, Urban public finance and taxation; Law, order and conflict; Land management and planning, Lessons from London and Mumbai.

UNIT - III: INCLUSIVE, SAFE AND PRODUCTIVE CITIES (10 Periods)

What is urban poverty?, Measuring urban poverty, Poverty reduction in cities, Affordable and adequate housing, Who can deliver the housing we need?, Safety and violence, Urban vulnerabilities; Making cities productive and reduce inequality- City production and consumption, Women in the informal economy, Migration, mobility and the urban-rural continuum Wealth and inequality, Case: SEWA, India, Migration and the refugee crisis; Improving human development in cities – Addressing the challenges of urban public health, Solutions for improving urban health, Education and skills, Higher education in cities, Gender in the city, Human rights and justice, Law and equality, Apartheid in South African cities.

UNIT - IV: SUSTAINABLE URBAN SERVICES AND INFRASTRUCTURE (08 Periods)
Sustainable environmental services and infrastructure, Sustainable transport planning, ICT, Sustainable urban energy systems, Sustainable transport: Bangkok; How can cities be resilient -Air, water, food and natural resources; City risk exposure; Climate impacts, adaptation and mitigation; Building urban resilience, Environmental planning and the politics of change.

UNIT - V: GOVERNING SUSTAINABLE CITIES (10 periods)
Sustainable environmental practices, Urban disaster risk management, Post-disaster recovery, SDGs and other global processes, New institutions and governance, Public participation and democracy, Financing sustainable development, Measuring and monitoring the SDGs, Opportunities of secondary cities.

Total Periods: 45

Topics for self-study are included in the lesson plan.

TEXT BOOKS:

1. Al-Zu'bi, Maha, and VeselaRadovic, *SDG11-Sustainable Cities and Communities: Towards Inclusive, Safe, and Resilient Settlements*, Emerald Group Publishing, 1st Edition, 2019.
2. Rydin, Yvonne, *Governing for Sustainable Urban Development*, Earthscan, 2012.
3. Evans, Bob, Marko Joas, Susan Sundback, and Kate Theobald, *Governing Sustainable Cities*, Routledge, 2013.

REFERENCE BOOKS:

1. Register, R., EcoCities: *Rebuilding Cities in Balance with Nature*, New Society Publishers, Revised Edition, 2006.
2. Yigitcanlar, T, *Sustainable Urban and Regional Infrastructure Development: Technologies, Applications and Management: Technologies, Applications and Management*, IGI Global, 2007.

ADDITIONAL LEARNING RESOURCES:

1. Flint J. and Raco M., *The Future of Sustainable Cities: Critical Reflections,* Policy Press, 2nd Edition, 2012.
2. Corburn, J., *Toward the Healthy City: People, Places and the Politics of Urban Planning,* MIT Press, 3rd Edition, 2009.

IV B.Tech. - I Semester

(19BT70119)**SUSTAINABLE DESIGN OF TECHNOLOGY SYSTEMS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Environmental Science.

COURSE DESCRIPTION: Sustainability and sustainable development;Product life cycle design – Methods and strategies; Product life cycle design – Software tools; Designing for sustainable product-service system – Methods and tools; Design for sustainability – Engineering design criteria and guidelines.

COURSE OUTCOMES: ***After successful completion of this course, the students will be able to:***

CO1 Analyze sustainability and sustainable development to solve complex problems associated with sustainable design of technology systems using appropriate tools and techniques, following relevant codes, regulations and latest developments considering society, environment and economics besides communicating effectively in graphical form.

CO2 Analyzeproduct life cycle design methods and strategies to solve complex problems associated with sustainable design of technology systems using appropriate tools and techniques, following relevant codes, regulations and latest developments considering society, environment and economics besides communicating effectively in graphical form.

CO3 Analyzeproduct life cycle design software tools to solve complex problems associated with sustainable design of technology systems using appropriate tools and techniques, following relevant codes, regulations and latest developments considering society, environment and economics besides communicating effectively in graphical form.

CO4 Design sustainable product-service systems to solve complex problems associated with sustainable design of technology systems using appropriate tools and techniques, following relevant codes, regulations and latest developments considering society, environment and economics besides communicating effectively in graphical form.

CO5 Design engineering criteria and guidelinesto solve complex problems associated with sustainable design of technology systems using appropriate tools and techniques, following relevant codes, regulations and latest developments considering society, environment and economics besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT - I: SUSTAINABILITY AND SUSTAINABLE DEVELOPMENT (09 Periods)

Sustainability and sustainable development - Understanding un-sustainability and need for Sustainability, Definitions, Pathway, Systems approach to design; Evolution of sustainability within design - Diverse approaches to design for sustainability, Relationship between approaches to design for sustainability and the application context.

UNIT - II: PRODUCT LIFE CYCLE DESIGN – METHODS AND STRATEGIES (08 Periods)

Life Cycle Assessment (LCA) - Product Life Cycle Assessment, LCA introduction, LCA methodology, LCA goal, LCA scope, Inventory analysis, Impact assessment, Interpretation; Environmental risk, Environmental impacts calculation by using LCA technique, Risk assessment with concepts of LCA.

UNIT - III: PRODUCT LIFE CYCLE DESIGN – SOFTWARE TOOLS (08 Periods)
History of product design by LCA with examples; ISO 14000, Life cycle analysis, SIMA PRO, LCA software and other software for LCA, LCA methodical challenges - Allocation and uncertainty, Sensitivity analysis.

UNIT - IV: DESIGNING FOR SUSTAINABLE PRODUCT-SERVICE SYSTEM – METHODS AND TOOLS (10 Periods)
Sustainable product service system design – Definition, Types and examples; Sustainable product service system – Transition path and challenges, Sufficiency economy philosophy applied to sustainable product-service system (PSS) thinking, Khadi movement as a precursor to PSS thinking.

UNIT - V: DESIGN FOR SUSTAINABILITY – ENGINEERING DESIGN CRITERIA AND GUIDELINES (09 periods)
Sustainable product-service system design applied to distributed economy, Other design for sustainability tools and approaches – Agriculture, Cities and communities, Carbon footprint, Green buildings, Green materials, Green energy, Sustainable development, Zero waste, Circular economy.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Horne, Ralph, Tim Grant, and Karli Verghese, *Life Cycle Assessment: Principles, Practice and Prospects*, Csiro Publishing, 2009.
2. Bhamra, Tracy, and Vicky Lofthouse, *Design For Sustainability: A Practical Approach*. Routledge, 1st Edition, 2016.

REFERENCE BOOKS:

1. Vezzoli, C., Kohtala, C., Srinivasan, A., Diehl, J. C, Fusakul, S. M., Xin, L. and Sateesh, D., Product-service System Design for Sustainability, Routledge, 1st Edition, 2017.
2. Curran, Mary Ann, *Life Cycle Assessment Student Handbook*, John Wiley & Sons, 1st Edition, 2015.
3. Hauschild, Michael Z., Ralph K. Rosenbaum and Stig Irvin Olsen, *Life Cycle Assessment*, Springer International Publishing, 2018.
4. Hendrickson, Chris T., Lester B. Lave, and H. Scott Matthews, *Environmental Life Cycle Assessment of Goods and Services: An Input-Output Approach*. Routledge, 2010.

ADDITIONAL LEARNING RESOURCES:

1. Sharmistha Banerjee, System Design for Sustainability, IIT Guwahati, https://nptel.ac.in/ courses/107/103/107103081/.
2. Curran, Mary Ann, *Life Cycle Assessment Handbook: A Guide for Environmentally Sustainable Products*, John Wiley & Sons, 3rd Edition, 2012.