ACADEMIC REGULATIONS

COURSE STRUCTURE

AND

DETAILED SYLLABI

OF

ELECTRONICS AND COMMUNICATION ENGINEERING

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

Sree Vidyanikethan 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 ELECTRONICS AND COMMUNICATION ENGINEERING

Vision

To be a center of excellence in Electronics and Communication Engineering through teaching and research producing high quality engineering professionals with values and ethics to meet local and global demands.

Mission

- The Department of Electronics and Communication Engineering is established with the cause of creating competent professionals to work in multicultural and multidisciplinary environments.
- Imparting knowledge through contemporary curriculum and striving for development of students with diverse background.
- Inspiring students and faculty members for innovative research through constant interaction with research organizations and industry to meet societal needs.
- Developing skills for enhancing employability of students through comprehensive training process.
- Imbibing ethics and values in students for effective engineering practice.

PROGRAM EDUCATIONAL OBJECTIVES

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

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

PROGRAM OUTCOMES

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

PS01: Design and develop customized electronic circuits for domestic and industrial applications.

PS02: Use specific tools and techniques to design, analyze and synthesize wired and wireless communication systems for desired specifications and applications.

PS03: Apply suitable methods and algorithms to process and extract information from signals and images in Radar, Satellite, Fiber optic and Mobile communication systems.

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 SreeVidyanikethanEngineeringCollege 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, Sree Vidyanikethan 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="3">1.</td><td rowspan="3">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="2">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 rowspan="2">2.</td><td rowspan="2">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>50</td><td>30</td><td>Day-to-Day evaluation for Performance in laboratory experiments and Record.
(Internal evaluation).</td><td>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</td></tr>
</table>

Sl. No.	Course	Marks	Examination and Evaluation		Scheme of examination
			20	Practical test (Internal evaluation).	conducted just before FIRST mid-term examinations. **Laboratory examination-II:** Shall be conducted just before SECOND mid-term examinations.
3.	Internship	100	Semester-end Examination		The evaluation shall be done by the Department Evaluation Committee (**DEC**) at the end of the semester as given in 12.2.1.
4.	Open Elective (MOOC)	100	-		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.
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. Academic Regulations for Minor degree:

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. 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 a Minor degree by paying the requisite fee.
b. In the subsequent semesters, the student has to pass all the courses registered for Major and Minor Degrees in the first attempt i.e., regular examinations without any backlog to keep the Minor Degree registration active or else it shall be canceled.
c. If a student becomes ineligible for continuing the Minor Degree, the earned credits under Minor Degree cannot be transferred to Major Degree; they will remain extra. These additional courses will be mentioned in the transcript. However, they are eligible to receive B.Tech. Degree after satisfying its requirements.
d. The evaluation pattern of the courses shall be similar to the evaluation of regular program courses.
e. Minimum strength required for offering **Minor Degree in a** discipline is 40 students.
f. **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.
g. 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 mentioned in the transcripts, along with the list of courses taken for **Minor degree** program. However the performance of the student in the Minor courses will not be considered for the calculation of SGPA and CGPA for the award of Major Degree.
h. 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.
i. Students aspiring for 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.

j. A Student shall register for Minor with the 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).

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

15. Academic Regulations for Honors degree:

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. In the subsequent semesters, the student has to pass all the courses registered for Major and Honors Degrees in the first attempt i.e., regular examinations without any backlog to keep the Honors Degree registration active or else it shall be canceled.

c. If a student becomes ineligible for continuing the Honors Degree, the earned credits under Honors Degree cannot be transferred to Major Degree; they will remain extra. These additional courses will be mentioned in the transcript. However, they are eligible to receive B.Tech. Degree after satisfying its requirements.

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

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

f. 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.

g. 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. However the performance of the student in the Honor courses will not be considered for the calculation of SGPA and CGPA for the award of Major Degree.

h. 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.

i. Students aspiring for Honors degree must register from III B.Tech I-Semester onwards.

j. A Student shall register for 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).

NOTE: Interested meritorious students shall be permitted to register either for Minordegree 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: <u>The Degree shall be conferred and awarded by Jawaharlal Nehru Technological University Anantapur, Ananthapuramu on the recommendations of the Chairman, Academic Council, SVEC (Autonomous).</u>

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, Sree Vidyaniketan 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	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared

	or answer book or additional sheet, during or after the examination.	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)

ELECTRONICS AND COMMUNICATION ENGINEERING

<table>
<tr><th>Mandatory Induction Program</th><th>03 weeks duration</th></tr>
<tr><td rowspan="8">Induction program offered before commencement of the I-Semester course work</td><td>Physical activity</td></tr>
<tr><td>Creative Arts</td></tr>
<tr><td>Universal Human Values</td></tr>
<tr><td>Literary</td></tr>
<tr><td>Proficiency Modules</td></tr>
<tr><td>Lectures by Eminent People</td></tr>
<tr><td>Visits to local Areas</td></tr>
<tr><td>Familiarization to Department/Branch and Innovations</td></tr>
</table>

Course Structure
Electronics and Communication Engineering
I B.Tech. – I Semester

Sl. No.	Subject 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.	19BT1BS02	Biology for Engineers	2	-	-	2	2	40	60	100
3.	19BT1BS03	Engineering Physics	3	-	-	3	3	40	60	100
4.	19BT10341	Basic Civil and Mechanical Engineering	3	-	-	3	3	40	60	100
5.	19BT10201	Basic Electrical and Electronics Engineering	3	-	-	3	3	40	60	100
6.	19BT1BS31	Engineering Physics Lab	-	-	2	2	1	50	50	100
7.	19BT10231	Basic Electrical and Electronics Engineering Lab	-	-	2	2	1	50	50	100
8.	19BT20331	Engineering Workshop	-	-	2	2	1	50	50	100
		Total:	**14**	**1**	**6**	**21**	**18**	**350**	**450**	**800**
9.	19BT1AC01	Spoken English	2	-	-	2	-	-	-	-

I B.Tech. – II Semester

Sl. No.	Subject 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.	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.	19BT20241	Network Analysis	3	1	-	4	4	40	60	100
6.	19BT1BS32	Engineering Chemistry Lab	-	-	2	2	1	50	50	100
7.	19BT1HS31	Communicative English Lab	-	-	2	2	1	50	50	100
8.	19BT10331	Computer Aided Engineering Drawing	-	1	2	3	2	50	50	100
9.	19BT10531	Programming for Problem Solving Lab	-	-	2	2	1	50	50	100
10.	19BT20251	Network Analysis Lab	-	-	2	2	1	50	50	100
		Total:	**15**	**4**	**10**	**29**	**24**	**450**	**550**	**1000**

II B.Tech.– I Semester

Sl. No.	Subject Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	19BT3BS02	Special Functions and Complex Analysis	3	1	-	4	4	40	60	100
2.	19BT30401	Electromagnetic Fields and Transmission Lines	3	1	-	4	4	40	60	100
3.	19BT30402	Electronic Devices and Circuits	3	-	-	3	3	40	60	100
4.	19BT30403	Signals and Systems	3	-	-	3	3	40	60	100
5.	19BT30404	Switching Theory and Logic Design	3	-	-	3	3	40	60	100
6.	19BT3HS31	Soft Skills Lab	-	-	2	2	1	50	50	100
7.	19BT30431	Electromagnetic Fields and Transmission Lines Lab	-	-	2	2	1	50	50	100
8.	19BT30432	Electronic Devices and Circuits Lab	-	-	2	2	1	50	50	100
9.	19BT30433	Signals and Systems Lab	-	-	2	2	1	50	50	100
		Total:	**15**	**2**	**8**	**25**	**21**	**400**	**500**	**900**
10.	19BT3MC01	Environmental Science	2	-	-	2	-	40	-	40

II B.Tech. – II Semester

Sl. No.	Subject Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	19BT50201	Control Systems	3	-	-	3	3	40	60	100
2.	19BT40401	Analog Communications	3	-	-	3	3	40	60	100
3.	19BT40402	Electronic Circuit Analysis and Design	3	1	-	4	4	40	60	100
4.	19BT40403	Linear and Digital IC Applications	3	-	-	3	3	40	60	100
5.	19BT40404	Probability and Stochastic Processes	3	-	-	3	3	40	60	100
6.	**Open Elective – 1**		3	-	-	3	3	40	60	100
7.	19BT40431	Digital Design Workshop	-	-	2	2	1	50	50	100
8.	19BT40432	Electronic Circuit Analysis and Design Lab	-	-	2	2	1	50	50	100
9.	19BT40433	Linear and Digital IC Applications Lab	-	-	2	2	1	50	50	100
		Total:	**18**	**1**	**6**	**25**	**22**	**390**	**510**	**900**
10.	19BT315AC	Design Thinking	2	-	-	2	-	-	-	-

III B.Tech. – I Semester

Sl. No.	Subject Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	19BT50401	Digital Communications	3	-	-	3	3	40	60	100
2.	19BT50402	Digital Signal Processing	3	-	-	3	3	40	60	100
3.	19BT50403	VLSI Design	3	-	-	3	3	40	60	100
Professional Elective-1			3	-	-	3	3	40	60	100
4.	19BT50404	Electronic Measurements and Instrumentation								
	19BT50405	Fiber Optic Communications								
	19BT50406	FPGA Architectures and Applications								
	19BT50407	Radar Engineering								
5.	**Open Elective-2**		3	-	-	3	3	40	60	100
Inter Disciplinary Elective-1			3	-	-	3	3	40	60	100
6.	19BT50207	Computer Organization and Architecture								
	19BT40501	Computer Networks								
	19BT21501	Object Oriented Programming Through Java								
	19BT50408	Microelectromechanical Systems								
7.	19BT61531	Internet of Things Lab	-	1	2	3	2	50	50	100
8.	19BT50431	Analog and Digital Communications Lab	-	-	2	2	1	50	50	100
9.	19BT50432	Socially Relevant Project-I	-	-	-	-	1	50	50	100
		Total:	**18**	**1**	**4**	**23**	**22**	**390**	**510**	**900**
10.	19BT503AC	Foundations of Entrepreneurship	2	-	-	2	-	-	-	-

III B.Tech. – II Semester

Sl. No.	Subject 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.	19BT60401	Antennas and Propagation	3	-	-	3	3	40	60	100
3.	19BT60402	Microcontrollers	3	-	-	3	3	40	60	100
		Professional Elective-2								
4.	19BT60403	Advanced Digital Signal Processing	3	-	-	3	3	40	60	100
	19BT60404	ARM and AVR Microcontrollers								
	19BT60405	Digital IC Design								
	19BT60406	Satellite Communications								
		Professional Elective-3								
5.	19BT60407	Image Processing	3	-	-	3	3	40	60	100
	19BT60408	Nanostructures and Nanotechnology								
	19BT60409	Testing and Testability								
	19BT60410	Wireless Sensor Networks								
		Inter Disciplinary Elective-2								
6.	19BT60502	Machine Learning	3	-	-	3	3	40	60	100
	19BT60201	Power Electronics								
	19BT60503	Cryptography and Network Security								
	19BT51041	PLC and SCADA								
7.	19BT60431	Digital Signal Processing Lab	-	-	2	2	1	50	50	100
8.	19BT60432	Microcontrollers Lab	-	-	2	2	1	50	50	100
9.	19BT60433	Socially Relevant Project-II	-	-	-	-	1	50	50	100
		Total:	**18**	**-**	**4**	**22**	**21**	**390**	**510**	**900**
10.	19BT5MC01	Universal Human Values	2	-	-	2	-	40	-	40

IV B.Tech. – I Semester

Sl. No.	Subject 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.	19BT70401	Embedded Systems	3	-	-	3	3	40	60	100
3.	19BT70402	Microwave Engineering	3	-	-	3	3	40	60	100
Professional Elective–4										
4.	19BT71001	Biomedical Instrumentation	3	-	-	3	3	40	60	100
	19BT70403	Analog IC Design								
	19BT70404	Cellular and Mobile communications								
	19BT70405	Speech Processing								
Professional Elective–5										
5.	19BT70406	Adaptive Signal Processing	3	-	-	3	3	40	60	100
	19BT70407	Error Control Coding								
	19BT70408	Low Power CMOS VLSI Design								
	19BT70409	Real Time Systems								
6.	19BT7MOOC	MOOC	-	-	-	-	3	-	100	100
7.	19BT70431	Antennas and Microwave Engineering Lab	-	-	2	2	1	50	50	100
8.	19BT70432	Embedded Systems Lab	-	-	2	2	1	50	50	100
9.	19BT70433	Internship	-	-	-	-	2	-	100	100
		Total:	**15**	**-**	**4**	**19**	**22**	**300**	**600**	**900**
10.	19BT704AC	Principles of Operating Systems	2	-	-	2	-	-	-	-

IV B.Tech. – II Semester

Sl. No.	Subject Code	Course Title	Contact Periods per week				C	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	19BT80431	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 have undergone additional learning for 18 credits in the same discipline.

HONORS DEGREE IN ELECTRONICS AND COMMUNICATION ENGINEERING

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)	19BH50401	ASIC Design	3	-	-	3	40	60	100
	19BH50402	Data communications and networks	3	-	-	3	40	60	100
	19BH50403	Detection and Estimation of Signals	3	-	-	3	40	60	100
	19BH50404	Physical Design Automation	3	-	-	3	40	60	100
III B.Tech II-Sem. (2 Theory)	19BH60401	Advanced Digital Communication Systems	3	-	-	3	40	60	100
	19BH60402	Audio signal processing	3	-	-	3	40	60	100
	19BH60403	Network-on-Chip Design	3	-	-	3	40	60	100
	19BH60404	RF IC Design	3	-	-	3	40	60	100
IV B.Tech I-Sem. (2 Theory)	19BH70401	Advanced Wireless Communications	3	-	-	3	40	60	100
	19BH70402	Optical networks	3	-	-	3	40	60	100
	19BH70403	Pattern Recognition	3	-	-	3	40	60	100
	19BH70404	VLSI Signal Processing	3	-	-	3	40	60	100

Minor Degree: Minor degree is awarded to the students who have 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
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

(19BT1BS02) BIOLOGY FOR ENGINEERS

(Common to EEE, ECE and EIE)

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 this course, the 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)

Biomolecules, 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
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. - I Semester

(19BT1BS03) **ENGINEERING PHYSICS**

(Common to EEE, ECE and EIE)

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 this course, the 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, 11^{th} edition, 2019.
2. P. K. Palaniswamy, *Engineering Physics*, Scitech Publications India Private Limited, 2^{nd} edition, 2009.

REFERENCE BOOKS:

1. K. Thyagarajan, *Engineering Physics*, McGraw-Hill Education (India) Pvt. Ltd, 2016.
2. R.K.Gaur & 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**
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. - I Semester

(19BT10341) **BASIC CIVIL AND MECHANICAL ENGINEERING**

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: -

COURSE DESCRIPTION: Overview of Civil Engineering; Surveying, Civil Engineering Materials, Mechanics of Materials, Building Components, Civil Engineering Infrastructure; Overview of Basic Mechanical Engineering; Internal Combustion Engines and Turbines, Mechanical Power Transmission Systems, Manufacturing Processes, Machining Processes, Non-Conventional Machining.

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

CO1: Apply the basic principles of civil engineering, Techniques and tools for analyzing civil structures and solve related problems.

CO2: Describe the working of principles of basic mechanical engineering and solve problems related to it.

DETAILED SYLLABUS:

Part–A: CIVIL ENGINEERING

UNIT-I: SURVEYING AND CIVIL ENGINEERING MATERIALS (10 Periods)

Overview of Civil Engineering: Civil Engineering contributions to the welfare of society, specialized sub disciplines in Civil Engineering.

Surveying: Objectives, classification and principles; Measurements – distances, angles, levels, areas and volumes; contouring; Illustrative examples.

Civil Engineering Materials: Bricks, stones, concrete, steel, glass, timber, composite materials.

Mechanics of Materials: Forces, system of forces, laws of mechanics ,moment of a force, equilibrium, resultant, Internal and External forces, Stress, Strain, Hooke's law and Elasticity.

UNIT-II: BUILDING COMPONENTS AND CIVIL ENGINEERING INFRASTRUCTURE (08 Periods)

BUILDING COMPONENTS:

Sub structure - Types of foundations, Bearing capacity and settlement, Requirement of good foundations.

Superstructure - Civil engineering construction - Brick masonry, Stone masonry, Beams, Columns, Lintels, Roofs, Floors, Stairs, Building bye-laws - bye-laws floor area, carpet area and floor space index, basics of interior design and landscaping.

Civil Engineering Infrastructure - Types of Bridges and Dams, Water supply and Sanitary systems, Rainwater harvesting, Types of Highways and Railways, Ports and Harbours.

Part–B: MECHANICAL ENGINEERING

UNIT-III: INTERNAL COMBUSTION ENGINES, TURBINES AND PUMPS

(09 Periods)

Overview of Mechanical Engineering: Introduction to Mechanical Engineering**,** specialized sub disciplines in Mechanical Engineering.

Internal Combustion Engines - Classification – Working principle of Petrol and Diesel Engines – Four stroke and two stroke engines – Comparison of four stroke and two stroke engines.

Turbines and Pumps – Classifications of Steam turbines - Impulse turbine, Reaction turbines; Working principle of Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps.

UNIT-IV: MECHANICAL POWER TRANSMISSION SYSTEMS (09 Periods)

Power Transmission Systems: Belt, rope and chain drives, Gears and Transmission screw

Power transmission by belts: Classification of belts, Length of the Belt (Open and Crossed-Belt Drives), Power Transmitted by Belt Drive, Tension due to Centrifugal Forces, Initial Tension, Maximum Power Transmitted.

Power transmission by Gear train: Gear terminology, Classification of gears, Gear train- Simple Gear Train and Compound Gear Train, Power Transmitted by Simple Gear Train.

UNIT-V: MANUFACTURING PROCESSES (09 Periods)

Manufacturing processes: Elementary ideas of Casting, Forging, Rolling, Welding, Soldering and Brazing.

Machining processes- Lathe-Turning, Taper turning, Thread cutting, Shaping, Drilling, Grinding, Milling (simple sketches and short notes).

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXTBOOKS:

1. Shanmugam G. and Palanichamy M.S., *Basic Civil and Mechanical Engineering*, Tata McGraw Hill Publishing Co.,New Delhi, 1st edition 2018.
2. R. Vaishnavi, M. Prabhakaran & V. Vijayan, *Basic Civil and Mechanical Engineering*, S.CHAND Publications, 2nd edition, 2013.
3. B.C Punmia, Ashok Kumar Jain, Arun kumar Jain, *Surveying (vol-I),* Laxmi publications, 16th edition, 2005.
4. B. C Punmia, Ashok Kumar Jain, Arun kumar Jain, *Building Construction,* Laxmi publications, 10th edition, 2008.

REFERENCES:

1. Seetharaman S., *Basic Civil Engineering*, Anuradha Agencies, 2005.
2. Ramamrutham S., *Basic Civil Engineering*, Dhanpat Rai Publishing Co.(P) Ltd.1999.
3. Kalpakjian, Serope, *Manufacturing Engineering and Technology,* Pearson Education, 7th edition, 2014.
4. Prabhu .T.J, Jai Ganesh. V and Jebaraj.S, *Basic Mechanical Engineering*, Scitech Publications, Chennai, 2000.
5. Pravin Kumar, *Basic mechanical engineering* Pearson Education, 1st edition, 2013.

CO-PO and PSO Mapping:

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	--	--	1	1	1	1	--	1	--	--	--	--	--
CO2	3	2	1	--	--	--	--	--	--	--	--	--	--	--	--
Average	**3**	**2.5**	**1**	**--**	**1**	**1**	**1**	**1**	**--**	**1**	--	--	--	--	--
Course Correlation Level	3	3	1	--	1	1	1	1	--	1	--	--	--	--	--
Correlation Level:3-High 2-Medium 1-Low															

I B. Tech. – I Semester

(19BT10201) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: -

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

COURSE OUTCOMES: After successful completion of this course, the 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., *3*rd 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 McGraw-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
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	-	-	-	--	1	1	-	-	-	-	3	-	-
CO3	3	-	-	-	-	1	-	-	-	-	-	-	3	-	-
CO4	3	1	-	-	-	1	-	-	-	-	-	-	3	-	-
Average	3	2	1	-	-	1	1	1	-	-	-	-	3	-	-
Level of correlation of the course	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-

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

I B. Tech. - I Semester

(19BT1BS31) **ENGINEERING PHYSICS LAB**

(Common to EEE, ECE and EIE)

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 this course, the 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.

List of Engineering Physics Experiments:

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

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**
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. - I Semester

(19BT10231) **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB**

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: Physics at intermediate level.

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

COURSE OUTCOMES: After successful completion of this course, the 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. YannisTsividis, *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**
CO1	3	3	2	2	1	-	-	-	-	-	-	-	3	-	-
CO2	1	2	3	2	-	-	-	-	-	-	-		3	-	-
CO3	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-
Average	2	2.5	2.5	2	1	-	-	-	2	2	-	-	3	-	-
Level of correlation of the course	2	3	3	2	1	-	-	-	2	2	-	-	3	-	-

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

I B. Tech. - I Semester

(19BT20331) ENGINEERING WORKSHOP

(Common to EEE, ECE and EIE)

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 this course, the 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, 17^{th} edition, 2012.
2. Kalpakjian, Serope, *Manufacturing Engineering and Technology*, Pearson Education, 7^{th} 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**
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. - I Semester

(19BT1AC01) **SPOKEN ENGLISH**

(Audit Course)

(Common to EEE, ECE and EIE)

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 this course, the 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; Just a Minute; **Listening – Speaking:** Do's and Don'ts; **Expressing:** Ability/ Admiration/ Agreement/ Anger/ Annoyance/ Appreciation/ Pleasure/ Sarcasm/ Satisfaction/ Surprise/ Approval/ Capability/ Certainty/ Condolences/ Doubt/ Fear/ Gratitude/ Possibility/ Worry; **Asking for:** Advice/ Clarification/ Direction/ Information/ Permission/ Predictions/ a recommendation

UNIT-II: VOCABULARY BUILDING: (06 Periods)

Vocabulary for day-to-day conversations; Introduction: 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)

English Grammar and the Indian Student; Introduction: Parts of Speech, Verb forms; Tenses; Voice; Speech

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

Universal Auxiliaries; Sentence making for an effective communication; 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 terms; Useful daily expressions; Courtesy, Good manners and Etiquette; Conversation Techniques; Narrating/ Reading/ Listening to stories; Telling Stories

Total Periods: 30

Topics for Self-Study are provided in the 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**
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	-	-	-	-	2	-	-	-	-	-

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 this course, the 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
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

(19BT1BS04) ENGINEERING CHEMISTRY

(Common to EEE, ECE and EIE)

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, 16^{th} 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, 5^{th} edition 2010.
2. Skoog and West, *Principles of Instrumental Analysis*, Thomson, 6^{th} edition, 2007.
3. Peter Atkins, Julio de Paula and James Keelar, *Atkins' Physical Chemistry*, Oxford University Press, 10^{th} 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
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	1	-	-	-	2	1	-	-	-	-	-	-	-	-

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

I B. Tech. - II Semester

(19BT1HS01) COMMUNICATIVE ENGLISH

(Common to EEE, ECE and EIE)

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 & PushpLata, *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
CO1	2	-	-	-		-	-	-	-	-	-	-	-	-	-
CO2	1	3	-	-	-		-	-	-	-		-	-	-	-
CO3	1	1	-	-	2	-	-	-	-	-	-	-	-	-	-
CO4	1	1	-	-	2	-	-	-	-	3	-	1	-	-	-
Average	1.2	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. – II Semester

(19BT10501) **PROGRAMMING FOR PROBLEM SOLVING**

(Common to EEE, ECE and EIE)

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: Demonstrate knowledge on Python constructs to solve basic 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 i*t 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
CO1	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-	-	-	-
Average	3	2.5	2.5	2.5	3	-	-	-	-	-	-	-	-	-	-
Level of correlation of the course	3	3	3	3	3	-	-	-	-	-	-	-	-	-	-

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

I B. Tech. - II Semester

(19BT20241) **NETWORK ANALYSIS**

(Common to ECE and EIE)

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

PRE-REQUISITES: Physics at Intermediate Level.

COURSE DESCRIPTION: Fundamentals of electrical circuits; Analysis of single phase AC circuits; Network theorems; Transient analysis and Two port networks.

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

CO1: Analyze and solve various DC and single phase AC circuits by applying conceptual knowledge of network reduction, analyzing techniques and theorems

CO2: Design the Components for resonant, transient circuits and Two-port networks meeting the specified needs using circuit concepts.

DETAILED SYLLABUS:

UNIT-I: FUNDAMENTALS OF ELECTRICAL CIRCUITS (09 Periods)

Basic definitions of network, circuit, node, branch and loop; network reduction techniques-series, parallel, series-parallel circuits, current division and voltage division rules; source transformation, wye-to-delta and delta-to-wye transformations; nodal analysis and super node concept, mesh analysis and super mesh concept – numerical problems with dependent and independent AC & DC sources.

UNIT-II: ANALYSIS OF SINGLE PHASE AC CIRCUITS (09 Periods)

Analysis of single phase AC circuits: impedance and admittance, impedance triangle; power triangle; Sinusoidal response of R, L and C elements with different combinations; current locus; Resonance, bandwidth and quality factor for series and parallel networks.

UNIT-III: NETWORK THEOREMS (08 Periods)

Superposition, Thevenin's, Norton's, Maximum power transfer, Millmann's and Reciprocity theorems for DC & AC Excitations (without proof).

UNIT-IV: TRANSIENT ANALYSIS (10 Periods)

Transient response of RL, RC and RLC for DC excitation and Sinusoidal excitation - Solution by using Differential equation and Laplace Transforms method.

UNIT-V: TWO PORT NETWORKS (09 Periods)

Network Functions - Driving point and transfer functions. Impedance parameters, admittance parameters, transmission (ABCD) parameters, hybrid parameters, conversion of one parameter to another, conditions for reciprocity and symmetry, interconnection of two-port networks in series, parallel and cascaded configurations.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Charles K. Alexander, Mathew N O Sadiku, *Fundamentals of Electric Circuits*, 5th edition, McGraw Hill Education (India) Private Limited, New Delhi, 2013.
2. A. Sudhakar, Shyam mohan S Palli, *Circuits and Networks Analysis and Synthesis*, 5th edition, McGraw Hill Education (India) Private Limited, New Delhi, 2015.

REFERENCE BOOKS:

1. J. A. Edminister, M. D. Nahvi, *Theory and Problems of Electric Circuits*, 4th edition, Schaum's outline series, McGraw Hill, New Delhi, 2004.
2. W H Hayt, J E Kemmerly, S M Durbin, *Engineering Circuit Analysis*, 6th edition, McGraw Hill, New Delhi, 2008.

ADDITIONAL LEARNING RESOURCES

1. https://nptel.ac.in/courses/117106108/
2. https://ocw.mit.edu/high-school/physics/exam-prep/electric-circuits/

CO-PO and PSO Mapping:

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	--	--	2	1	--	--	--	--	--	--	3	--	--
CO2	3	3	2	1	2	1	--	--	--	--	--	--	3	--	--
Average	3	3	2	1	2	1	--	--	--	--	--	--	3	--	--
Course Correlation Level	3	3	2	1	2	1	--	--	--	--	--	--	3	--	--
Correlation Level:3-High 2-Medium 1-Low															

I B. Tech. - II Semester

(19BT1BS32) ENGINEERING CHEMISTRY LAB

(Common to EEE, ECE and EIE)

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
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. - II Semester

(19BT1HS31) COMMUNICATIVE ENGLISH LAB

(Common to EEE, ECE and EIE)

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 this course, the 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
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-
CO4	1	1	-	-	2	-	-	-	1	-	-	-	-	-	-
CO5	1	2	-	-	2	-	-	-	-	3	-	1	-	-	-
Average	1.4	1.7	-	-	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. – II Semester

(19BT10331) COMPUTER AIDED ENGINEERING DRAWING

(Common to EEE, ECE and EIE)

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, the 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 & RajashekarPatil, *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
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. – II Semester

(19BT10531) PROGRAMMING FOR PROBLEM SOLVING LAB

(Common to EEE, ECE and EIE)

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 this course, the 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*, 2^{nd} 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**
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	3	3	3	3	-	-	-	3	3	-	-	3	-	-

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

I B. Tech. - II Semester

(19BT20251) **NETWORK ANALYSIS LAB**

(Common to ECE and EIE)

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

PRE-REQUISITES: Physics at Intermediate Level.

COURSE DESCRIPTION: Practical investigations on DC, single phase AC circuits, circuit theorems, transient circuits and Two-Port networks.

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

CO1: Analyze, measure, interpret and validate the practical observations by applying the conceptual knowledge of electrical networks.

CO2: Design resonant, transient and Two-port circuits/networks meeting the specified needs using electrical circuits/networks concepts.

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

List of Experiments:

Minimum Ten experiments are to be conducted.

1. Analysis of Series and Parallel circuits.
2. Mesh and Nodal analysis.
3. Phasor analysis of RL, RC and RLC circuits.
4. Current locus of RL and RC circuits.
5. Series and Parallel resonance.
6. Measurement of active and reactive power in a single phase circuit.
7. Verification of Superposition and Reciprocity theorems.
8. Verification of Thevenin's and Norton's theorem.
9. Verification of Maximum Power transfer theorem for DC and AC excitations.
10. Transient response of RL, RC and RLC circuits.
11. Determination of Open circuit and Short circuit parameters in isolated and interconnected networks.
12. Determination of ABCD and Hybrid parameters in isolated and interconnected networks.

REFERENCE BOOKS / LAB MANUALS:

1. P. S. Dhogal, *Basic Practicals in Electrical Engineering*, Standard Publishers, 2004.
2. YannisTsividis, *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. https://nptel.ac.in/courses/117106108/
3. https://ocw.mit.edu/high-school/physics/exam-prep/electric-circuits/

CO-PO and PSO Mapping:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	2	--	--	--	--	--	--	3	--	--
CO2	3	2	3	1	2	1	--	1	--	--	--	--	3	--	--
CO3	--	--	--	--	--	--	--	--	3	3	--	--	--	--	--
Avg.	3	2	2	1.5	2	1.5	--	1	3	3	--	--	3	--	--
Course Correlation Level	3	2	2	2	2	2	--	1	3	3	--	--	3	--	--
Correlation Level:3-High 2-Medium 1-Low															

II B. Tech. - I Semester

(19BT3BS02) SPECIAL FUNCTIONS AND COMPLEX ANALYSIS

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: A course on Differential equations and Multivariable calculus

COURSE DESCRIPTION: Special Functions (Beta and Gamma functions); Special Functions (Bessel's and Legendre's equations); Analytic Functions; Conformal Mapping; Complex Integration; Residue Theorem.

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

CO1: Apply the knowledge of special functions to evaluate improper integrals.

CO2: Analyze the behavior of functions through the knowledge of complex analysis and evaluate integrals on complex planes.

DETAILED SYLLABUS:

UNIT-I: SPECIAL FUNCTIONS (Beta and Gamma Functions) (07 Periods)

Beta and Gamma functions: Properties, Relationship between beta and gamma functions, Evaluation of integrals using beta and gamma functions.

UNIT-II: SPECIAL FUNCTIONS (Bessel's and Legendre's Equations) (09 Periods)

Bessel's equation: Recurrence formulae for $J_n(x)$, Generating function for $J_n(x)$ (without proof), Orthogonality of Bessel functions; Legendre's equation: Legendre polynomials, Rodrigue's formula, Generating function for $P_n(x)$ (without proof), Recurrence formulae for $P_n(x)$.

UNIT-III: ANALYTIC FUNCTIONS AND CONFORMAL MAPPING (11 Periods)

Differentiation, analytic functions, Cauchy-Riemann equations (both Cartesian and polar), harmonic functions, harmonic conjugate, potential functions; Conformal mapping: Definition and examples, Translation, Rotation, Inversion, Transformations $w=z^2, e^z$; Bilinear transformation and their properties.

UNIT-IV: COMPLEX INTEGRATION (08 Periods)

Line integrals, Cauchy's theorem (without proof), Cauchy's integral formula (without proof), Generalized Cauchy's integral formula (without proof); Taylor's series, Laurent's series; zeros of an analytic functions, Singularities: Types of singularities, pole of order n.

UNIT-V: RESIDUE THEOREM **(10 Periods)**

Residues and evaluation of residues at poles, Cauchy's Residue theorem (without proof), evaluation of integrals using residue theorem, evaluation of improper and real integrals of the type: (i) $\int_0^{2\pi} f(\cos\theta,\sin\theta)d\theta$ ii) $\int_{-\infty}^{\infty} f(x)dx$ iii) $\int_{-\infty}^{\infty} e^{imx} f(x)dx$.

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, *Text book of Engineering Mathematics, Vol-III*, S. Chand & Company, 9th edition, 2012.
2. B. S. Grewal, *Higher Engineering Mathematics*, Khanna publishers, 44th edition, 2017.

REFERENCE BOOKS:

1. J. W. Brown and R. V. Churchill, *Complex Variables and Applications,* Mc-Graw Hill, 7th edition, 2004.
2. N. P. Bali and Manish Goyal, *A text book of Engineering Mathematics*, Laxmi Publications, Reprint, 2010.

CO-PO and PSO Mapping:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	1.5	--	--	--	--	--	--	--	--	--	--	--	--	--
Course Correlation Level	3	2	--	--	--	--	--	--	--	--	--	--	--	--	--
Correlation Level:3-High 2-Medium 1-Low															

II B. Tech. - I Semester

(19BT30401) **ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES**

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

PRE-REQUISITES: Courses on Transformation Techniques and Linear Algebra & Engineering Physics

COURSE DESCRIPTION: Static Fields; Maxwell's Equations; Electromagnetic Wave Propagation; Transmission Lines.

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

CO1: Analyze time invariant electromagnetic field equations in different media.

CO2: Solve problems on time variant electromagnetic fields using Maxwell's Equations

CO3: Understand the Reflection and refraction of Uniform Plane Waves for Electromagnetic Wave Propagation in various media.

CO4: Design impedance transformers by applying impedance matching techniques for maximum power transfer in transmission Lines.

DETAILED SYLLABUS:

Review of calculus and vector algebra

UNIT-I: STATIC FIELDS (10 Periods)

Static Electric Field

Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions. Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations between E and V, Convection and Conduction Currents, Continuity Equation. Capacitance – Parallel Plate, Coaxial Capacitors.

Static Magnetic Field

Biot-Savart's Law, Ampere's Circuital Law, Magnetic Flux Density. Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, illustrative Problems.

UNIT-II: MAXWELL'S EQUATIONS AND BOUNDARY CONDITIONS (09 Periods)

Maxwell's Equations

Faraday's Law and Transformer emf, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements (time variant and invariant).

Boundary Conditions

Conditions at a Boundary Surface: Dielectric-Dielectric and Dielectric-Conductor Interfaces, illustrative Problems.

UNIT-III: ELECTROMAGNETIC WAVE PROPAGATION (10 Periods)

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media. Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics. Polarization

Reflection – Normal Incidences and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics. Refraction of Plane Waves - Brewster Angle, Total Internal Reflection.

Poynting Vector and Poynting Theorem, Illustrative Problems.

UNIT-IV: TRANSMISSION LINES - I (08 Periods)

Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless/Low Loss Characterization, Condition for Distortionless Lines.

UNIT-V: TRANSMISSION LINES - II (08 Periods)

Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. $\lambda/4$, $\lambda/2$, $\lambda/8$ Lines – Impedance Transformations. Smith Chart – Configuration and Applications, Single stub matching, Illustrative Problems.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Mathew O Sadiku, *"Principles of Electromagnetics",* Oxford University press, 6th Edition, New York, 2011.
2. John D. Ryder, *Networks, Lines and Fields*, PHI, 2nd Edition, 1999.

REFERENCE BOOKS:

1. 1.William Hayt and John Buck "*Engineering Electromagnetics",* Tata McGraw Hill, 7th Edition, New Delhi,2012.
2. 2.E.C. Jordan and K.G. Balmain*, Electromagnetic Waves and Radiating Systems*, PHI, 2nd Edition, 2000.

ADDITIONAL LEARNING RESOURCES:

1. https://swayam.gov.in/nd1_noc20_ph08

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	3	2	-	3	-	-	-	-	-	-	-	3	-
Average	3	2.3	2.5	2.3	2	3	-	-	-	-	-	-	3	3	-
Course Correlation Level	3	3	3	3	2	3	-	-	-	-	-	-	3	3	-

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

II B. Tech. – I Semester

(19BT30402) ELECTRONIC DEVICES AND CIRCUITS

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: Courses on Basic Electrical and Electronics Engineering, Differential Equations and Multivariable Calculus & Engineering Physics.

COURSE DESCRIPTION: Linear and Non-Linear Wave shaping, Biasing and small signal analysis of BJT & FET, Operation and characteristics of Special Purpose electronic devices.

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

CO1: Analyze the response of High pass circuits, Low pass RC circuits for various signals and performance of clippers and clampers.

CO2: Design transistor biasing circuits and stabilize the operating point using appropriate techniques.

CO3: Develop mathematical model of BJT for CE, CB and CC configurations using h-parameters.

CO4: Analyze various configurations and biasing techniques for FET.

CO5: Demonstrate the operation and characteristics of special purpose semiconductor devices for real time applications.

DETAILED SYLLABUS:

UNIT-I: LINEAR & NONLINEAR WAVE SHAPING (09 Periods)

High-pass, Low-pass RC circuits, their response for Sinusoidal, Step, Pulse, Square and Ramp inputs. High pass RC network as a Differentiator, Low pass RC network as an Integrator, Diode clippers and Clampers.

UNIT-II: TRANSISTOR BIASING & STABILISATION (10 Periods)

DC Load Line analysis and Selection of Q point, Biasing Circuits-Fixed(Base) Bias, Collector-to-Base Bias, Base Bias and collector-to-Base Bias with Emitter Resistor, Voltage Divider Bias Circuit, Thermal stability of Bias circuits, compensation techniques using Thermistor, Sensistor and Diode.

UNIT-III: SMALL SIGNAL ANALYSIS OF BJT (09 Periods)

Transistor modeling using h-Parameters, CE, CB and CC circuit analysis using h-parameters, Simplified hybrid model, Comparison of CB, CE and CC circuits, Analysis of CE amplifier with emitter resistance.

UNIT-IV: FIELD EFFECT TRANSISTOR **(10 Periods)**

Construction, Operation and characteristics of JFET, Enhancement MOSFET & Depletion MOSFET, FET Biasing-Gate bias, Self bias, voltage divider bias, FET equivalent circuit, CS,CD and CG amplifiers, comparison of BJT & FET.

UNIT-V: SPECIAL PURPOSE ELECTRONIC DEVICES **(07 Periods)**

Tunnel Diode, Varactor Diode, Unijunction Transistor (UJT),UJT as Relaxation Oscillator, DIAC, TRIAC, Silicon Controlled Rectifier

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Jacob Millman, Herbert Taub and Surya prakash Rao Mothiki, *Pulse Digital and Switching Waveforms,* TMH, 3rd edition,2011.
2. J. Millman, Christos C. Halkias and SatyabrataJit, *Electronic Devices and Circuits*, TMH, 3rd Edition, 2010.

REFERENCE BOOKS:

1. David A. Bell, *Electronic Devices and Circuits*, Oxford University press, 5th Edition, 2014
2. S. Salivahanan, N. Suresh Kumar, *Electronic Devices and Circuits*, TMH, 3rd Edition 2013.
3. R.L. Boylestad and Louis Nashelky, *Electronic Devices and Circuits*, PHI, 10thEdition, 2009.

ADDITIONAL LEARNING RESOURCES:

1. http://www.nptelvideos.in/2012/11/basic-electronics-prof-tsnatarajan.html
2. https://kupdf.net/download/n-n-bhargava-basic-electronics-and-linear-circuits_5912b54adc0d60a324959ea5_pdf
3. http://www.talkingelectronics.com/Download%20eBooks/Principles%20of%20electronics/CH-21.pdf

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	3	2	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	-	-
CO5	3	-	-	-	-	3	-	-	-	-	-	-	3	-	-
Average	3	2.5	3	2	-	3	-	-	-	-	-	-	3	-	-
Course Correlation Level	3	3	3	2		3	-	-	-	-	-	-	3	-	-

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

II B. Tech. – I Semester

(19BT30403) SIGNALS AND SYSTEMS

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

PRE-REQUISITES: A course on Differential Equations and Multivariable Calculus & Transformation Techniques and Linear Algebra.

COURSE DESCRIPTION: Analysis of signals and systems; Representation of signals using Fourier series and Fourier transforms; Time-Domain and Frequency-Domain aspects of signals and systems; concept of convolution and correlation; Sampling and types of sampling; Laplace transform of signals.

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

CO1: Understand the basic operations on signals & sequences and determine the response of LTI systems using convolution.

CO2: Apply fourier series and transform to analyse spectral characteristics of continuous-time periodic and aperiodic signals.

CO3: Analyse the properties of correlation and convolution to extract signals from noisy signal in various applications.

CO4: Apply Laplace transformation technique to analyse the characteristics of LTI systems.

CO5: Analyse sampling &it's effects and reconstruct signals using interpolation.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO SIGNALS AND SYSTEMS (12 Periods)

Elementary signals- Unit Impulse and Unit Step Functions, Exponential and Sinusoidal Signals. Classification of Continuous- Time and Discrete-Time Signals, Basic operations on signals, Classification of Continuous-Time and Discrete-Time Systems, Basic System Properties, Linear Time-Invariant Systems -Discrete-Time LTI Systems- The Convolution Sum, Continuous-Time LTI Systems –Convolution Integral, Properties of Linear Time-Invariant Systems.

UNIT-II: FOURIER SERIES AND FOURIER TRANSFORM (12 Periods)

Fourier series: Representation of Fourier series, Continuous time periodic signals, Dirichlet's conditions, Properties of CT Fourier Series, Trigonometric Fourier Series and Exponential Fourier Series with examples. Complex Fourier spectrum. Fourier series representation of a periodic signals. Fourier Transforms: Deriving Fourier Transform from Fourier series, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of CT Fourier Transform, Systems characterized by Linear constant coefficient differential equations. The Magnitude-Phase Representation of the Fourier Transform, The Magnitude-Phase Representation of the Frequency Response of LTI Systems.

UNIT-III: CORRELATION OF SIGNALS **(07 Periods)**

Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and energy/power spectral density function. Relation between convolution and correlation, Detection of periodic signals in the presence of noise by correlation in radar systems, Extraction of signal from noise by filtering.

UNIT-IV: LAPLACE TRANSFORMS **(07 Periods)**

The Laplace Transform, The Region of Convergence for Laplace Transforms, The Inverse Laplace Transform, Relationship between Fourier and Laplace Transforms, Properties of the Laplace Transform, Some Laplace Transform Pairs, Analysis and Characterization of LTI Systems Using the Laplace Transform**.**

UNIT-V: SAMPLING **(07 Periods)**

Representation of a Continuous-Time Signal by its Samples - Sampling Theorem, Reconstruction of a Signal from Its Samples Using Interpolation. Effect of under sampling - Aliasing, Discrete-Time Processing of Continuous-Time Signals.

Total periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOK:

1. Alan V. Oppenheim, Alan S. Willsky, & S. Hamid, *Signals and Systems*, Pearson Higher Education, 2nd Edition,2008.

REFERENCE BOOKS:

1. Simon Haykin and B. Van Veen, *Signals & Systems*, John Wiley, 2nd Edition, 2010.
2. A. Anand Kumar, *Signals & Systems*, PHI, 2011

ADDITIONAL LEARNING RESOURCES

1. Hilbert Transform: https://ieeexplore.ieee.org/document/5609110
2. Impulse Response Application: https://ieeexplore.ieee.org/document/629264
3. SAMPLING:https://www.researchgate.net/publication/325846982_SAMPLE_AND_SAMPLING_DESIGNS

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	-	2	3	-	-	-	-	-	-	-	-	-	3
CO3	3	3	-	2	-	2	-	-	-	-	-	-	-	-	3
CO4	3	2	-	2	3	-	-	-	-	-	-	-	-	-	3
CO5	3	3	-	2	-	-	-	-	-	-	-	-	-	-	3
Average	3	2.4	-	2	3	2	-	-	-	-	-	-	-	-	3
Course Correlation Level	**3**	**3**	**-**	**2**	**3**	**2**	**-**	-	-	-	-	-	-	-	3

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

II B. Tech. – I Semester

(19BT30404) SWITCHING THEORY AND LOGIC DESIGN

(Common to ECE and EIE)

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 (08 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 (09 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 (07 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

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	3	1	-	1	1	-	-	-	-	-	3	-	-
CO3	3	2	3	1	-	1	1	-	-	-	-	-	3	-	-
CO4	3	2	3	1	-	1	1	-	-	-	-	-	3	-	-
Average	3	2	3	1	-	1	1	-	-	-	-	-	3	-	-
Course Correlation Level	**3**	**2**	**3**	**1**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

II B. Tech. – I Semester

(19BT3HS31) **SOFT SKILLS LAB**

(Common to CE, ME, EEE, ECE and EIE))

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.

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

List of Exercises:

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 BOOKS:

1. R. C. Sharma & Krishna Mohan, *Business Correspondence and Report Writing*, Tata McGraw-Hill Publishing Company Limited, 3rd edition, New Delhi, 2012.

SUGGESTED SOFTWARES:

1. KVAN SOLUTIONS
2. Learning to Speak English 8.1, The Learning Company – 4 CDs.
3. English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
4. Language in Use 1, 2 & 3.
5. Cambridge Advanced Learner's Dictionary - 3rd Edition.
6. Let's Talk English, Regional Institute of English South India.

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

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	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	2	2	-	-	2	-	-	-	3	3	-	-	-	-	-

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

II B. Tech. - I Semester

(19BT30431) ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES LAB

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

PREREQUISITES: Courses on Transformation Techniques and Linear Algebra & Engineering Physics

COURSE DESCRIPTION: Design and Simulation of electric and magnetic fields (Time variant an Time-in variant) due to Charged particles, finite lines. Simulation of Maxwell's equation and wave equation, primary and secondary constants of Transmission lines.

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

CO1: Analyze the vector field, vector product, Coulomb law, Electric flux lines, Electric Potential and Bio-Savart's Law.

CO2: Solve Uniform Plane Wave equation for Electromagnetic Wave Propagation.

CO3: Design and verify the conditions for loss less and distortion less transmission Lines

CO4: Analyze the time-variant and time-invariant electromagnetic fields in different media.

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

List of Exercises/List of Experiments:

(Minimum **Ten** experiments are to be conducted)

Simulate the following analytically using MATLAB

1. Plot the following three different graphs in MATLAB
   a) Plot a Circle
   b) Quiver plot or Electric line in 2D
   c) Quiver plot or Electric line in 3D
2. a) Find the Slope of the differential equation given below:

   b) Plot the Vector field and Volume Visualization.
   c) For the given two vectors, find the Dot product, the projection and the angle between the vectors.
3. Plot fields due to discrete charge distributions using Coulomb Law.
4. Plot the Electric Flux lines in 3D due to a point charge located at the origin.
5. Calculate and plot Potential and Electric Field in 2D due to two charges of different magnitudes and same sign that are placed along x-axis.
6. Plot and visualize Variable EM Fields and Potentials.
7. Calculate the electric energy stored due the electric field in cylindrical co-ordinates.
8. Find the energy stored in a Parallel-Plate Capacitor.

9. Verify Bio-Savart’s Law and plot magnetic field due to a current carrying finite wire.
10. Determine and Verify Electric field across dielectric-dielectric media.
11. Plot $\nabla\times E = -\partial B/\partial t$ in full 3D, using the proper term for the electric and magnetic counterparts and visualize Maxwell's equations using MATLAB.
12. Plot E-Field and H-Field.
13. For the given Primary Constants.
    a) Find the secondary Constants Z_o, α, β, γ, ω and Velocity of propagation
    b) Find the Propagation Constant for Lossless Transmission Line
    c) Verify the Condition for Distortion less Transmission line.

REFERENCE BOOKS/LABORATORY MANUALS:

1. Lonnngren Savov, “*Fundamentals of Electromagnetics with MATLAB*”, Sitech Publications, 2007.
2. Matthew N. O. Sadiku, Ph.D, “*Numerical Techniques in Electromagnetics*”, third edition, CRC Press, New York, Washington,2009.

SOFTWARE/Tools used: MATLAB

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	2	3	-	-	-	-	-	-	-	3	-	-
CO2	3	2	2	3	3	-	-	-	-	-	-	-	3	-	-
CO3	3	2	3	2	3	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	3	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-	2	-	-
Average	3	2.5	2.5	2.2	3	-	-	-	3	3	-	-	2.75	-	-
Course Correlation Level	3	3	3	2	3	-	-	-	**3**	**3**	-	-	3	3	-

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

II B. Tech. - I Semester

(19BT30432) ELECTRONIC DEVICES AND CIRCUITS LAB

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: A Course on Basic Electrical and Electronics Engineering.

COURSE DESCRIPTION: Integrator and Differentiator, Clippers and Clampers, Transistor switch, h-parameter calculation, Drain and Transfer characteristics of FET, Frequency response of CE and CS amplifiers, UJT Relaxation oscillator, Characteristics of DIAC and SCR

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

CO1: Analyze the response of RC circuits for square input.

CO2: Analyze the characteristics of BJT, FET, DIAC and SCR.

CO3: Design BJT and FET Amplifiers and evaluate the performance parameters from the frequency response.

CO4: Develop the basic applications of diode, transistor and UJT for desired specifications.

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

List of Exercises/List of Experiments:

(Minimum **Ten** Experiments are to be conducted)

1. Design RC integrator and differentiator and determine their response to the square input.
2. Develop clipper circuit to clip positive and negative portions of the input waveform with two reference voltages.
3. Develop clamping circuits to clamp different positive and negative dc levels of the input signal.
4. Verify the switching action of a BJT with suitable circuit.
5. Verify input and output characteristics of BJT in Common Base configuration experimentally and find required h – parameters from the graphs
6. Verify the frequency response of Common Emitter Amplifier.
7. Study and draw the Drain and Transfer Characteristics of a JFET experimentally.
8. Verify the Frequency Response of Common Source Amplifier using JFET.
9. Study and draw the V-I Characteristics of DIAC experimentally.
10. Study and draw the V-I Characteristics of SCR experimentally.
11. Design a Relaxation Oscillator using UJT.
12. Design and analyze any biasing circuit using BJT.

REFERENCE BOOKS/LABORATORY MANUALS:

1. Navas K.A, *Electronics Lab Manual (Volume 2),* PHI Learning Private Ltd. 6th Edition, 2018.

SOFTWARE/Tools used: -

ADDITIONAL LEARNING RESOURCES:

1. www.vlab.co.in, Basic Electronics Lab, An initiative of MHRD under NMEICT.

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	2	-	-	-	-	-	-	-	-	2	-	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	2	-	-
CO4	3	2	3	2	-	1	1	1	-	-	-	-	3	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-	2	-	-
Average	3	2.5	3	2	-	1	1	1	3	3	-	-	2.2	-	-
Course Correlation Level	3	3	3	2	-	1	1	1	3	3	-	-	2	-	-

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

II B. Tech. – I Semester
(19BT30433) **SIGNALS AND SYSTEMS LAB**

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

PRE-REQUISITES: -

COURSE DESCRIPTION: Generation of various signals and sequences; convolution and correlation; verification of linearity and time invariance properties; sampling theorem verification; Transform Techniques and Transfer function of system.

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

CO1: Analyse the properties of systems by performing basic operations on various signals and sequences generated using MATLAB tool.

CO2: Apply Fourier and Laplace transformation techniques on signals and systems to analyze spectrum and pole zero plots.

CO3: Develop systems to separate and remove the noise components from the noisy signals.

CO4: Work independently and in teams to solve problems with effective Communication.

List of Exercises/List of Experiments:

(Minimum **Ten** experiments are to be conducted)

1. Perform basic Operations on Matrices.
2. Generate various signals and Sequences such as Unit Impulse, Unit Step, Square, Saw Tooth, Triangular, Sinusoidal, Ramp, Sinc function.
3. Perform operations on Signals and Sequences (Addition, Multiplication, Scaling, Shifting, Folding) and Compute Energy and Average Power.
3. Find the Even & Odd Parts of Signal or Sequence and Real & Imaginary Parts of a Signal.
5. Verify Linearity and Time Invariance Properties of a System.
6. Compute Unit Sample, Unit Step and Sinusoidal Responses of the given LTI System and Verify its Stability.
7. Find the Fourier Transform of a given Signal and plot its Magnitude and Phase spectrum.
8. Find Convolution of Signals and Sequences.
9. Perform Autocorrelation and Cross correlation of Signals and Sequences.
10. Sampling Theorem Verification.
11. Find Laplace Transform for a given function, Locate Zeros and Poles in Pole-Zero map (S-Plane) for the given Transfer Function and verify stability.
12. Find the response of Low pass and High pass filters with speech signal as input.

REFERENCE BOOKS/LABORATORY MANUALS:

1. Luis F. Chaparro, *signals and systems using MATLAB*, Academic Press, 2011.

2. Michael J. Roberts, *Signals and Systems Analysis Using Transform Methods and MATLAB*, McGraw-Hill, Second Edition, 2012.

SOFTWARE/Tools used: MATLAB

ADDITIONAL LEARNING RESOURCES:

1. http://ssl-iitg.vlabs.ac.in/

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	-	-	-	-	-	-	-	-	-	3
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-	3
CO3	3	3	3	2	3	1	-	-	-	-	-	-	-	-	3
CO4	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	3	2.6	2.3	2	3	1	-	-	3	3	-	-	-	-	3
Course Correlation Level	**3**	**3**	**3**	**2**	**3**	**1**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**3**

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

II B. Tech. – I Semester
(19BT3MC01) **ENVIRONMENTAL SCIENCE**
(Mandatory Course)
(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: -

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 resources to solve complex environmental problems and natural resource management considering society, environment and sustainability.
CO2: Analyze ecosystems and 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 problems through appropriate tools and techniques following latest developments considering society, ethics, environment and sustainability.
CO4: Analyze social 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: ENVIRONMENTAL 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, 6thEdition, 2018.
2. ErachBarucha, *Environmental Studies,* Orient Blackswan, 2ndEdition, 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, 2ndEdition, 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:

1. B. S. Chauhan, *Environmental Studies*, University Science Press, 2nd Edition, 2018.
2. 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
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

II B. Tech. - II Semester
(19BT50201) **CONTROL SYSTEMS**
(Common to ECE and EIE)

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

PRE-REQUISITES: A course on Signals and Systems.

COURSE DESCRIPTION: Concepts of control system; Transfer function of various physical systems; Time response analysis; Frequency response analysis; Controller design and state space analysis.

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

- CO1: Develop the mathematical model for various physical systems to determine the transfer function by applying the fundamental principles.
- CO2: Analyze the time response of first and second order system to evaluate steady state errors.
- CO3: Analyze stability of a system in time and frequency domains.
- CO4: Design compensator for a system using bode plot and root locus technique to meet the desired specification for sustainable operation.
- CO5: Apply state space method to model the system, to investigate controllability and observability.

DETAILED SYLLABUS:

UNIT-I: MATHEMATICAL MODELING OF SYSTEMS (11 Periods)

Introduction to control systems — Classification of open loop and closed loop control systems with examples; Modelling of physical systems — Transfer function of mechanical systems, electrical systems, Armature control and field control of DC motor – electrical analogy of mechanical systems; Block diagram reduction and Signal flow graph.

UNIT-II: TIME RESPONSE ANALYSIS (07 Periods)

Standard test signals; Time response of first and second order systems — Time-domain specifications, steady state error — static and dynamic error constants;Effects of Proportional, Integral and Derivative controllers.

UNIT-III: STABILITY ANALYSIS (11 Periods)

Introduction to stability, Routh-Hurwitz stability criterion – Relative stability; Root locus — rules to construct root loci, effect of pole and zero additions on the root loci. Frequency domain specifications, Bode plot, Polar plot and Nyquist Criterion, Correlation between time and frequency response.

UNIT-IV: DESIGN OF COMPENSATORS (08 Periods)

Introduction to Compensators, Lag, Lead, Lead-Lag; Compensator design using root locus and Bode plots.

UNIT-V: STATE SPACE ANALYSIS **(08 Periods)**

Concept of state, state variable, state model; Transfer function to state space and state space to transfer function representation; Modelling of physical system in state space; State transition matrix and its properties – solution of state equations – diagnolization of state matrix; Controllability and observability using Kalman's test.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. A. Anand kumar, *Control Systems*, PHI learning Pvt Ltd., 2ndedition, 2014.
2. Katsuhiko Ogata, *Modern Control Engineering*, Pearson Education Publishers, 5thedition, 2010.

REFERENCE BOOKS:

1. Nagrath I.J. and Gopal M, *Control Systems Engineering*, New Age International Publications, 5thedition, 2010.
2. Richard C. Dorf and Robert H. Bishop, *Modern Control Systems*, Prentice Hall, 12thedition, 2010.
3. BenjaminC. Kuo and Farid Golnaraghi, *Automatic Control Systems*, John Wiley & Sons Publications, 8th edition, 2002.
4. Nagoorkani, *Control Systems*, RBA Publications, 2nd edition, 2006.

ADDITIONAL LEARNING RESOURCES:

1. NPTEL_CONTROL SYSTEMS: https://nptel.ac.in/courses/107/106/107106081/
2. EDX_INTRODUCTION TO CONTROL SYSTEMS: https://www.edx.org/course/introduction-to-control-system-design-a-first-look

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
CO1	3	3	-	-	1	1	--	--	--	--	--	--	3	--	--
CO2	3	3	-	1	-	-	--	--	--	--	--	--	3	--	--
CO3	3	3	-	1	1	-	--	--	--	--	--	--	3	--	--
CO4	3	3	3	1	1	-	1	--	--	--	--	--	3	--	--
CO5	3	3	-	--	1	-	--	--	--	--	--	--	3	--	--
Average	3	3	3	1	1	1	1	--	--	--	--	--	3	--	--
Course Correlation Level	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**--**	**--**	**--**	**--**	**--**	**3**	**--**	**--**

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

II B. Tech. - II Semester

(19BT40401) **ANALOG COMMUNICATIONS**

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

PRE-REQUISITES: Courses on Electronic Devices and circuits & Signals and Systems.

COURSE DESCRIPTION: Continuous wave modulations; Modulators and De-Modulators; Transmitters; Receivers; Noise performance; Pulse modulations; Multiplexing.

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

CO1: Evaluate total power, Bandwidth, and efficiency of Various Continuous Wave Modulations.

CO2: Analyze the performance of different modulation systems by evaluating Signal to Noise Ratio.

C03: Analyze various Transmitter & Receivers circuits and receiver parameters.

CO4: Analyze various pulse modulations and demodolations in transmission.

DETAILED SYLLABUS:

UNIT-I: AMPLITUDE MODULATION & DEMODULATION (12 Periods)

Elements of Communication Systems, Modulation, Need for Modulation, Amplitude Modulation (AM), Generation of AM waves - Square law modulator, switching modulators; Demodulation of AM waves – Square law detector, Envelope detector; Double sideband suppressed carrier (DSBSC), Generation of DSBSC waves - Balanced modulator, Ring modulator; Coherent detection of DSBSC waves - Costas receiver, squaring loop; Single sideband modulation (SSB), Generation of SSB waves - Frequency Discrimination Method, Phase Discrimination Method; Demodulation of SSB waves, Vestigial sideband (VSB) modulation & demodulation, Frequency division multiplexing.

UNIT-II: ANGLE MODULATION & DEMODULATION (09 Periods)

Basic Definitions Phase modulation (PM) and frequency modulation (FM), Single-Tone FM, Bandwidth of angle modulated waves - Narrow band frequency modulation (NBFM) and Wide band frequency modulation (WBFM); Transmission Bandwidth of FM Waves, Generation of FM waves – Indirect FM, Direct FM; Demodulation of FM Waves- Frequency Discrimination, PLL Demodulator**.**

UNIT-III: NOISE IN COMMUNICATION SYSTEMS (09 Periods)

Noise in Analog communication System, Signal to Noise ratio in AM, DSB & SSB System, Signal to Noise ratio in Angle Modulation System, Threshold effect in Angle Modulation System, Pre-emphasis & De-emphasis, FM Capture Effect.

UNIT-IV: TRANSMITTERS AND RECEIVERS (10 Periods)

Radio Transmitter - Classification of Transmitters, AM Transmitter, FM Transmitter; Radio Receivers - Receiver Types, Tuned radio frequency receiver, Super heterodyne receiver, Intermediate frequency, AGC, FM Receiver, Amplitude limiting; Comparison FM with AM Receiver, Radio Receiver measurements - Sensitivity, Selectivity, and fidelity.

UNIT-V: PULSE MODULATION **(05 Periods)**

Analog pulse modulation schemes, Pulse amplitude modulation (PAM) & demodulation, Pulse-Time Modulation – Pulse Duration and Pulse Position modulations, and demodulation schemes; Time division multiplexing.

Total Periods: *45*

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Simon Haykin, *Communication Systems*, Wiley-India edition, 3rd edition, 2010.
2. R.P. Singh, SP Sapre, *Communication Systems*, TMH, 2nd Edition, 2007.

REFERENCE BOOKS:

1. HerbertTaub & Donald L Schilling, *Principles of Communication Systems*, Tata McGraw Hill, 3rd Edition, 2009.
2. B. P. Lathi, *Modern Digital and Analog Communication Systems*," Oxford Univ. press, 3rd Edition, 2006.

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
Average	3	3	2	3	-	-	-	-	-	-	-	-	-	3	-
Course Correlation Level	**3**	**3**	**2**	**3**	-	-	-	-	-	-	-	-	-	**3**	-

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

II B. Tech. – II Semester

(19BT40402) ELECTRONIC CIRCUIT ANALYSIS AND DESIGN

(Common to ECE and EIE)

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

PRE-REQUISITES: Courses on Basic Electrical and Electronic Engineering & Electronic Devices and circuits.

COURSE DESCRIPTION: Demonstrate Single Stage Amplifiers; Multi Stage amplifiers; Frequency Response; Negative Feedback Amplifiers; Oscillators; Large Signal Amplifiers; Tuned Amplifiers.

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

CO1: Design multistage amplifiers using voltage divider bias to determine the Gain, Bandwidth, Input and Output Impedances.

CO2: Analyze transistors a thigh frequencies using Hybrid-π Model to determine the gain and bandwidth.

CO3: Design negative Feedback Amplifiers with high stability and positive feedback amplifiers to generate sustained oscillations.

CO4: Analyze different classes of Power Amplifiers to improve power efficiency and understand frequency response of single stage tuned amplifiers.

DETAILED SYLLABUS:

UNIT-I: DESIGN OF LOW FREQUENCY AMPLIFIERS (10 Periods)

BJT Amplifiers: Classification of Amplifiers, Distortion in amplifiers, Different coupling schemes used in amplifiers, Design and analysis of RC coupled amplifier, effect of coupling and bypass capacitors, Multistage Frequency Effects, Cascode amplifier, Darlington pair, Bootstrapped Darlington circuit.

MOSFET Amplifiers: MOS Small signal model, Common source amplifier, Common Gate Amplifier, Source follower-simple problems.

UNIT-II: TRANSISTOR AT HIGH FREQUENCY (10 Periods)

The Hybrid- pi (π) – Common Emitter transistor model, Hybrid-π conductance, Hybrid-π capacitances, validity of Hybrid-π model, CE short circuit current gain, current gain with resistive load, single stage CE transistor amplifier response, Gain-bandwidth product, Emitter Follower at Higher Frequencies-problems.

UNIT-III: NEGATIVE FEEDBACK AMPLIFIERS (09 Periods)

Concepts of feedback – Classification of feedback amplifiers – General characteristics of negative feedback amplifiers – Effect of Feedback on Amplifier characteristics – Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations – Method of analysis of Feedback amplifiers- Voltage series, Voltage shunt, Current series and Current shunt amplifiers-simple problems.

UNIT-IV: OSCILLATORS **(07 Periods)**

Conditions for oscillations, Classification, RC phase shift oscillator, Wien bridge oscillator, generalized analysis of LC oscillators, Quartz, Hartley and Colpitts Oscillators, Frequency stability-simple problems.

UNIT-V: LARGE SIGNAL AND TUNED AMPLIFIERS **(09 Periods)**

Large Signal Amplifiers: Classification, Class A Power Amplifier- Power conversion Efficiency, Transformer Coupled power Amplifier, Push Pull and Complimentary Symmetry Class B power amplifier, Class AB operation, Principle of operation of class –C Amplifier, Class D Power Amplifier, Class S power Amplifier, Transistor Power Dissipation, Heat Sinks.

Tuned Amplifiers: Introduction, Q-Factor, single stage Tuned Amplifiers- frequency response of tuned amplifiers.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Jacob Millman and Christos C.Halkias, *Integrated Electronics,* McGraw-Hill Education, 2nd edition, 2010.
2. Adel S. Sedra, Kenneth C. Smith , *Micro Electronic Circuits Theory and applications*, OXFORD international student edition 5th edition, ,2009

REFERENCE BOOKS:

1. Robert L. Boylestad and Louis Nashelsky, *Electronic Devices and Circuits Theory*, Pearson Education, 10th Edition, 2009.
2. David A. Bell, *Electronic Devices and Circuits,* Oxford University press, 5th Edition, 2014.
3. S. Salivahanan, N. Suresh Kumar, A Vallvaraj, *Electronic Devices and Circuits*, 3rd Edition, MC Graw Hill Education,2013

CO-PO-PSO Mapping Table

Course outcome	**Program Outcomes**														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	2	-	1	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	1	-	-	-	-	-	-	-	-	3	-	-
Average	**3**	**2.7**	**3**	**1.5**	-	**1**	-	-	-	-	-	-	**3**	-	-
Course Correlation Level	**3**	**3**	**3**	**2**	-	**1**	-	-	-	-	-	-	**3**	-	-

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

II B. Tech. – II Semester

(19BT40403) **LINEAR AND DIGITAL IC APPLICATIONS**

(Common to ECE and EIE)

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

PRE-REQUISITES: Courses on Network Analysis, Switching Theory and Logic Design & Electronic Devices and Circuits

COURSE DESCRIPTION: Linear & Non-Linear Applications of Op-Amp; IC 555 timer and phase locked loops; Application of PLL; filters; A-D & D-A Converters; CMOS and Bipolar Logic Interfacing; HDL with combinational and sequential logic design.

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

CO1: Design different applications of op-amp, timer circuits and analyze PLL for specified applications.

CO2: Design active filters using op-amp for audio processing applications.

CO3: Analyze different analog to digital and digital to analog converters for data acquisition system.

CO4: Analyze Verilog HDL capabilities to model digital circuits.

CO5: Model combinational and sequential ICs using Verilog HDL to synthesize digital Circuits.

DETAILED SYLLABUS:

UNIT-I: OP-AMP APPLICATIONS, IC555 TIMERS & PLL (11 Periods)

Review of operational Amplifiers, Instrumentation amplifier, Log and Antilog amplifiers, RC phase shift oscillator.

Introduction to 555 timer, functional diagram, monostable and astable operations and applications. PLL - Introduction, block schematic, principles and description of individual blocks, Voltage Controlled Oscillator (IC 566).

UNIT-II: FILTERS & D-A AND A-D CONVERTERS (09 Periods)

Filters: First - order and second order LPF, HPF Butterworth Filters.

D-A Converter: Weighted resistor DAC, R-2R Ladder DAC.

A-D Converters: Flash type, Successive Approximation type and Dual slope ADC.

UNIT-III: Verilog HARDWARE DESCRIPTION LANGUAGE (08 Periods)

Introduction, Language Elements, operators, Expressions, Modeling-gate level modeling, data flow modeling, behavioral modeling, structural modeling.

UNIT-IV: COMBINATIONAL LOGIC DESIGN APPLICATIONS (08 Periods)

74x999 Adder and Subtractor, 74X138 3-to-8 Decoder,74x148 Priority Encoder,74x151 8X1 Multiplexer, 74x181 Arithmetic and Logic Unit,74x280 9-Bit Parity Generator, 74x85

4-bit Comparator, Barrel Shifter using 74x151 multiplexer, Simple Floating-Point Encoder, Dual priority Encoder, modeling of circuits by using Verilog HDL.

UNIT-V: SEQUENTIAL LOGIC DESIGN APPLICATIONS (09 Periods)

Flip-Flops- JK-74LS109 and D-74LS74. Counters - 74x163 binary counter, Modulo-11 & 193 counters with a counting sequence, Modulo-8 Binary counter, Excess 3 decimal Counter using 74X163,74x169 up/down counter, Self-Correcting Ring & Johnson Counter,3-bit LFSR Counter.74x194 universal shift register, Modeling of circuits using Verilog HDL.

Total Periods: *45*

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. D. Roy Chowdhury, *Linear Integrated Circuits*, New Age International (p) Ltd, 5thEdition, 2018.
2. John F. Wakerly, *Digital Design Principles & Practices*, Pearson Education Asia, 4thEdition, 2008.

REFERENCE BOOKS:

1. Ramakanth A. Gayakwad, *Op-Amps & Linear Integrated Circuits*, Pearson Education, 4th Edition, 2015
2. J. Bhaskar, *A Verilog HDL Primer*, Star Galaxy Publishing, 3rd Edition, 2018

ADDITIONAL LEARNING RESOURCES:

1. https://www.coursera.org/learn/electronics
2. https://www.youtube.com/results?search_query=james+roberge

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	2	-	2	-	1	-	-	-	-	3	-	-
CO2	3	2	3	-	-	-	-	1	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	1	-	-	-	-	3	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	2	3	2	-	2	-	-	-	-	-	-	3	-	-
Average	3	2.4	3	2		2		1	-	-	-	-	3	-	-
Course Correlation Level	**3**	**3**	**3**	**2**		**2**		**1**	-	-	-	-	**3**	-	-

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

II B. Tech. – II Semester

(19BT40404) **PROBABILITY AND STOCHASTIC PROCESSES**

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

PRE-REQUISITES: A course on Differential Equations and Multivariable Calculus.

COURSE DESCRIPTION: Probability theory; The Random Variable; Operations on Single and Multiple Random Variables; Temporal and spectral Characteristics of Stochastic Processes; Noise analysis.

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

CO1: Analyze the probability of occurrence of events in an experiment through axiomatic definitions, conditional, total probability and Bernoulli's trials.

CO2: Evaluate Moments by performing various operationson single and multiple random Variables.

CO3: Solve problems on stochastic process by analyzing the temporal and spectral characteristics.

CO4: Estimate various noises in communications to improve signal to noise ratio.

DETAILED SYLLABUS:

UNIT–I: PROBABILITY (08 Periods)

Probability introduced through Sets and Relative Frequency, Experiments and Sample Spaces - Discrete and Continuous Sample Spaces; Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Baye's Theorem, Independent Events, Bernoulli Trials.

UNIT-II: THE RANDOM VARIABLE (10 Periods)

Introduction, Random Variable Concept - Definition of Random variable, Condition for a function to be a Random Variable, Discrete and Continuous Random Variable; Distribution Function, Density Function Properties, The Gaussian Random Variable, Other distribution and density examples - Binomial, Poisson, Uniform, Exponential, Rayleigh; Conditional Distribution and Density Functions, Properties.

Operations on One Random Variable: Introduction, Expectation, Moments - Moments about Origin, Central Moments, Variance and Skew; Chebyshev's Inequality, Functions that give moments - Characteristic Function, Moment Generating Function; Transformations of a random Variable.

UNIT-III: MULTIPLE RANDOM VARIABLES (10 Periods)

Multiple Random Variables: Vector Random Variables, Joint Distribution and its Properties, Joint density and its Properties, Marginal Distribution and Density, Conditional Distribution and Density, Statistical Independence, Distribution and density of a sum of random variables, Central Limit Theorem.

Operations on Multiple Random Variables: Expected Value of a Function of Random Variables - Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables; Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT-IV: STOCHASTIC PROCESSES–TEMPORAL AND SPECTRAL CHARACTERISTICS (10 Periods)

Concept of Stochastic process, Stationary and Statistical Independence.

TEMPORAL CHARACTERISTICS: Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Correlation Functions- Auto correlation function and its properties, Cross correlation function and its properties, Covariance Functions; Gaussian Random Processes, Poisson Random Process.

SPECTRAL CHARACTERISTICS

Power density spectrum, properties of power density spectrum, relationship between power spectrum and auto correlation function, cross power density function, properties of cross power density function

UNIT-V: NOISE ANALYSIS (07 Periods)

Noise classification - Uncorrelated Noise, External Noise, Atmospheric Noise, Extraterrestrial Noise, Manmade Noise, Internal Noise, Shot Noise, Transit-Time Noise, Thermal noise,

Noise power, Noise voltage, Correlated Noise, Impulse Noise; Interference, Signal-to-Noise Power Ratio, Noise Factor and Noise Figure, Equivalent Noise Temperature.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Peyton Z. Peebles, *Probability, Random Variables & Random Signal Principles,* TMH, 4th Edition, 2017.
2. Wayne Tomasi, *Electronic communications systems*, Pearson Education, 5th Edition, 2004.

REFERENCE BOOKS:

1. George R. Cooper and Clare D. McGillem, *Probabilistic Methods of Signal and System Analysis,* Oxford, 3rd Edition, 2015.
2. Athanasios Papoulis and S. UnnikrishnaPillai, *Probability, Random Variables and Stochastic Processes,* PHI, 4th Edition, 2002.

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	3	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	-	3	-
Average	3	2.7	-	2.5	-	-	-	-	-	-	-	-	-	3	-
Course Correlation Level	3	3	-	3	-	-	-	-	-	-	-	-	-	3	-

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

II B. Tech. – II Semester

(19BT4BS01) **MATERIAL SCIENCE**

(Open Elective-1)

(Common EEE, ECE and EIE)

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; 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 composites, smart materials, biomimetic materials and nano materials.

CO2: Demonstrate essential information about structure and properties of various composites used in various engineering applications.

CO3: Understand the basic properties of electro-rheostatic, magneto-rheostatic and shape memory alloys used in device applications.

CO4: Accomplish the basic knowledge in nano materials to familiarize various nano structured device applications.

CO5: Outline the processing and properties of functionally graded materials and identify its applications in various fields.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO MATERIAL SCIENCE AND ENGINEERING **(08 Periods)**

Introduction - historical perspective - material science and engineering, classification of materials (metals, ceramics, polymers and composites) and advanced materials and their applications (biomaterials, smart materials and nano materials), modern materials needs. Processing, properties and applications of metals, polymers and ceramics (Qualitative).

UNIT-II: COMPOSITE MATERIALS **(10 Periods)**

Composite Materials - Classification, Laminated composites and Reinforced composite materials – Classification, structure and properties of sandwich composites – applications (commercial Aircraft, Marine Grade Sandwich, Automobile Grade Sandwich and Wind Turbine Blades), properties and applications of Nano composites - Advantages and Limitations of composites.

UNIT-III: SMART MATERIALS **(07 Periods)**

Classification of smart materials -Magneto-rheostatic (MR) and Electro-rheostatic (ER) materials - Shape Memory Alloys (SMA)- characteristics, Shape memory effect applications in different fields, advances in smart materials.

UNIT-IV: NANO AND BIOMIMETIC MATERIALS (10 Periods)

Nanomaterials: Introduction, Low dimensional structures and energy quantization. Fabrication of nano materials - Lithographic technique using photons, metallic, semiconducting and magnetic properties of nano materials and applications (renewable energy and nano electro-mechanical systems (NEMS)).

Biomimetic materials – Introduction- classification and their applications (Lotus effect, Dolphin sound wave technology and viper as a model in defence)

UNIT-V: EMERGING MATERIALS (10 Periods)

Functionally graded materials (FGM) - Types, processing, properties and potential applications, functionally graded fibre cement – structural material, Functionally Graded Nanoelectronic, Optoelectronic and Thermoelectric Materials (Qualitative) and its applications.

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.
3. Sulabha K Kulkarni, *Nanotechnology: Principles and Practices,* Springer, 3rd 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
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

II B. Tech. - II Semester

(19BT4HS02) **BUSINESS COMMUNICATION AND CAREER SKILLS**

(Open Elective-1)

(Common to EEE, ECE and EIE)

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 and Résumés; 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 (09 Periods)

Introduction: Communication Basics - Functions of Communication – Communication Networks - Interpersonal Communication – Informal Communication - Communication Barriers - Roles of a Manager.

UNIT-II: CORPORATE COMMUNICATION (09 Periods)

Introduction: Corporate Communication - Cross-Cultural Communication; Concept & Styles - Corporate Communication Strategy - Corporate Citizenship - Crisis Communication: Case Study.

UNIT-III: **WRITING BUSINESS MESSAGES &DOCUMENTS (09 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 **(09 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 **(09 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 McGraw- 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.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
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	-	-	2	-	-	-	-	2	-	-	-	-	-

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

II B. Tech. - II Semester

(19BT4HS04) ENTREPRENEURSHIP FOR MICRO, SMALL AND MEDIUM ENTERPRISES

(Open Elective-1)

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: -

COURSE DESCRIPTION: Introduction to Entrepreneur Development; Idea generation and formation of Business Plan; Micro and Small Enterprises; Institutional Finance and Support to Entrepreneur; Woman Entrepreneurship.

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

CO1: Demonstrate knowledge in concepts, functions, Micro and Macro units, NGOs, Bharatiya Mahila Bank, Women Entrepreneurship, Schemes and Programmes.

CO2: Analyze the idea generation, business plans, business acumen, institutional finance and rural entrepreneurship.

DETAILED SYLLABUS:

UNIT-I: ENTREPRENEURSHIP DEVELOPMENT (09 Periods)

Introduction to Entrepreneurship Development - Concept of Entrepreneurship – 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 (09 Periods)

Sources of Ideas – Methods of idea generation – Steps in Setting up of a Small Business Enterprise – Formulation of Business Plan – Contents and Significance of Business Plan – Common Errors in Business Plan Formulation – The role of incubation centers for promoting entrepreneurship and start-ups.

UNIT-III: MICRO AND SMALL ENTERPRISES (09 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 (09 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 (09 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 Bharatiya Mahila 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 & ShikhaSahai, *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. BholanathDutta, *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
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

II B. Tech. - II Semester

(19BT4HS06) GERMAN LANGUAGE

(Open Elective-1)

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: -

COURSE DESCRIPTION: Oral communication; Basic grammar; Basic writing; Berufsdeutcsch (Business German)

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

CO1: Communicate everyday using familiar words with expressions and simple sentences.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION (09 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 1^{st} and 2^{nd} type, verb Conjugation 3^{rd} type, 'Wh' questions (simple sentences) Nominative (definite and indefinite) Articles

UNIT-II: CITY AND FOOD (09 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 (09 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 (09 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 (09 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. Heuber,Tangram Aktuelleins, HeuberVerlag Publications, 2011.

REFERENCE BOOKS:

1. Anta Kursisa, Gerhard Newner, Sara vicenta, Fir fuer Deutsch 1 und Deutsch 2, HeuberVerlag Publications, 2005.
2. Herman Funk, Studio D A1 Cornelsen, GOYAL SAAB Publication, Year 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
CO1	3	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Average	3	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Level of correlation of the course	3	-	-	-	-	-	-	-	-	2	-	-	-	-	-

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

II B. Tech. - II Semester

(19BT4HS08) **INDIAN HISTORY**

(Open Elective-1)

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: -

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 (08 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 (09 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 (06 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, Changing Nature 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, 21^{st} 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
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

II B. Tech. - II Semester

(19BT4HS10) **PERSONALITY DEVELOPMENT**

(Open Elective-1)

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: A course on Soft Skills Laboratory

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 (09 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 (09 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 (09 Periods)

Importance – Difference between Behavior and Attitude - Changing Negative Attitude- Impact of Attitudes on others - Unproductive Attitudes –Assess your Behaviour.

UNIT-IV: COMMUNICATION RELATIONSHIP (09 Periods)

Introduction – Positive and Negative Characteristic Traits - Grapevine Communication – Open Communication; Team Player - Leadership styles – Performance Expectations - Electronic Communication; Text Messaging – Voicemail – E-Mail

UNIT-V: CRITICAL WORK SKILLS AND ETHICS (09 Periods)

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, 10^{th} edition Indian Reprint, 2011. (6^{th} 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, 2^{nd} Revised Edition, 2011.
2. Stephen P. Robbins and Timothy A. Judge*, Organizational Behaviour*, Prentice Hall, Delhi, 16^{th} edition, 2014.

ADDITIONAL LEARNING RESOURCES

1. 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
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

II B. Tech. - II Semester

(19BT4HS12) **WOMEN EMPOWERMENT**

(Open Elective-1)

(Common to EEE, ECE and EIE)

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 (09 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 (09 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 (09 Periods)

Introduction- Present Scenario - Changes in Policy &Programme - National Plan of Action- Women's Cells and Bureau - Increase in work participation rate- Discrimination in labour market - 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 (09 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 (09 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. Nayak Sarojini, Nair Jeevan(2017), "*Women's Empowerment in India*". Pointer Publishers, Jaipur
2. Sahay Sushama (2013), "*Women and Empowerment*" Discovery Publishing House, New Delhi.

REFERENCE BOOKS:

1. Baluchamy. S (2010), "*Women's Empowerment of Women*". Pointer Publishers, Jaipur.
2. Khobragade Grishma (2020), "*Women's Empowerment: Challenges and Strategies Empowering Indian Women,* Books clinic Publishing, Chhattisgarh.
3. https://www.economicsdiscussion.net/entrepreneurship/women-entrepreneurs-in-india
4. 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
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

II B. Tech. - II Semester

(19BT4HS14) **CONSTITUTION OF INDIA**

(Open Elective-1)

(Common to EEE, ECE and EIE)

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: Gain knowledge in Parliamentary proceedings, Election Commission, Public Services and Foreign Policy of India.

CO2: Apply the reasoning informed by the various aspects in the Constitution, its provisions to assess societal issues and the consequent responsibilities relevant to the professional engineering practice.

DETAILED SYLLABUS:

UNIT-I: PREAMBLE AND ITS PHILOSOPHY (08 Periods)

Introduction and Evolution of Indian Constitution, preamble and its philosophy

UNIT-II: UNION LEGISLATURE (09 Periods)

The Parliament, Parliamentary Structure, Process of Legislation; President of India – Powers and Functions; Vice President, Prime Minister and Council of Ministers; Constitution Amendment Procedure and Financial Legislation.

UNIT-III: FEDERALISM IN INDIA (10 Periods)

Features of Federal System, Centre-State relations, Directive Principles of State Policy, Administrative Relationship between Union and States; Governors - Powers and Functions; State Legislature - Composition and powers; Chief Ministers - Powers and Functions, Council of Ministers; The Election Commission – Powers and Functions.

UNIT-IV: JUDICIARY AND PUBLIC SERVICES (09 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 (09 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 BOOK:

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
CO1	1	-	-	-	-	3	2	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	3	-	3	-	-	-	-	-	-	-
Average	1.5	-	-	-	-	3	2	3	-	-	-	-	-	-	-
Level of correlation of the course	2	-	-	-	-	3	2	3	-	-	-	-	-	-	-

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

II B. Tech. - II Semester

(19BT40205) RELIABILITY AND SAFETY ENGINEERING

(Open Elective-1)

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: Courses on Differential Equations and Multi-Variable Calculus & 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 (09 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 (09 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 (09 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 **(09 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 **(09 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*, 2^{nd} edition, Springer, New York, 2013.
2. Frank R. Spellman, Nancy E. Whiting, *Safety Engineering: Principles and Practices*, 3^{rd} edition, Rowman& Littlefield, 2018.

REFERENCE BOOKS:

1. Charles E. Ebeling, *An introduction to reliability and maintainability engineering*, 2^{nd} edition Tata McGraw-Hill Education, 2010.
2. Dan Petersen, *Techniques of Safety Management: A Systems Approach*, 4^{th}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
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

II B. Tech. - II Semester

(19BT50107) ENVIRONMENTAL POLLUTION AND CONTROL

(Open Elective-1)

(Common to EEE, ECE and EIE)

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 POLLUTIONCONTROL (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
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	1.4	-	1	2	1	-	-	-
Level of correlation of the course	3	3	-	2	2	2	2	1	-	1	2	1	-	-	-

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

II B. Tech. - II Semester

(19BT50108) PLANNING FOR SUSTAINABLE DEVELOPMENT

(Open Elective-1)

(Common to EEE, ECE and EIE)

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 world 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, Mirilia Bonnes, 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
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	-	-	-	-	-
Level of correlation of the course	3	3	-	-	1	2	2	1	-	2	-	-	-	-	-

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

II B. Tech. - II Semester

(19BT50109) **RURAL TECHNOLOGY**

(Open Elective-1)

(Common to EEE, ECE and EIE)

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

PREREQUISITES: -

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: Analyze non 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 SaansadAdarsh 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, 2^{nd} Edition 2018.
2. S. V. Prabhath and P. Ch. Sita Devi, *Technology and Rural India*, Serials Publications, 1^{st} Edition, 2012.

REFERENCE BOOKS:

1. R. Chakravarthy and P. R. S. Murthy, *Information Technology and Rural Development*, Pacific Book International, 1^{st} Edition, 2012.
2. Shivakanth Singh, *Rural Development Policies and Programmes*, Northern Book Centre, 1^{st} Edition, 2002.
3. Katar Singh and Anil Shishodia*, Rural Development: Principles, Policies, and Management,* SAGE Publications India Private Limited, 4^{th} Edition, 2016.
4. A. Vinayak Reddy, M. Yadagira Charyulu, *Rural Development in India: Policies & Initiatives,* New Century Publications, 1^{st} Edition, 2008.

ADDITIONAL LEARNING RESOURCES:

1. L. M. Prasad, *Principles and Practice of Management*, S. Chand & Sons, 9^{th} Edition, 2019.
2. Venkata Reddy, K., *Agriculture and Rural Development - Gandhian Perspective*, Himalaya Publishing House, 1^{st} 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
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	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

II B. Tech. - II Semester

(19BT50505) **ETHICAL HACKING**

(Open Elective-1)

(Common to EEE, ECE and EIE)

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

PREREQUISITES: -

COURSE DESCRIPTION: Ethical hacking, Network and computer attacks, Foot printing, 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 foot printing 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 (09 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 (09 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 (09 Periods)

Foot printing: Using web tools for foot printing, 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 (09 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 (09 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
CO1	3	-	-	-	-	3	-	3	-	-	-	-	-	-	-
CO2	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
Level of correlation of the course	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-

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

II B. Tech. - II Semester

(19BT51207) **AI IN HEALTHCARE**

(Open Elective-1)

(Common to EEE, ECE and EIE)

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 (08 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: THE ROLE OF MAJOR CORPORATIONS IN AI IN HEALTHCARE (08 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 (09 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, Med Manthra Publications*, First 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, First 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 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	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	2	-	2	2	-	-	-	-	-	-	-	-
CO3	2	-	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	2	2	-	-	-	-	-	-	-	-	-
CO5	2	-	-	-	2	2	-	-	-	-	-	-	-	-	-
Average	2	2	2	2	2	2	2	-	-	-	-	-	-	-	-
Level of correlation of the course	2	2	2	2	2	2	2	-	-	-	-	-	-	-	-

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

II B. Tech. - II Semester

(19BT51506) **BIOINFORMATICS**

(Open Elective-1)

(Common to EEE, ECE and EIE)

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 (09 Periods)

Biological information, Retrieval methods for DNA sequence, protein sequence and protein structure information

UNIT-II: DATABASES (09 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 (09 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 (09 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 **(09 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*" 4th Edition, Oxford University Press, 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**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	2	2	-	-	-	-	-	-	-	-	-	-
Average	3	2.5	2.3	2	2.6	-	-	-	-	-	-	-	-	-	-
Level of correlation of the course	3	3	3	2	3	-	-	-	-	-	-	-	-	-	-

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

II B. Tech. – II Semester
(19BT40431) **DIGITAL DESIGN WORKSHOP**

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

PRE-REQUISITES: Courses on Switching Theory and Logic Design & Electronic Devices and Circuits.

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, 4^{th} 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

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	-	2	2	2	2	-	-	-	-	3	-	-
CO2	3	2	3	-	2	2	2	2	-	-	-	-	3	-	-
CO3	3	3	2	-	3	2	-	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	3	2.33	2.66	-	2.33	2	2	2	3	3	-	-	3	-	-
Course Correlation Level	**3**	**3**	**3**	**-**	**3**	**2**	**2**	**2**	**3**	**3**	**-**	**-**	**3**	**-**	**-**

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

II B. Tech. - II Semester

(19BT40432) ELECTRONIC CIRCUIT ANALYSIS AND DESIGN LAB

(Common to ECE and EIE)

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

PREREQUISITES: A course on Electronic Devices and Circuits

COURSE DESCRIPTION: Design, Simulation and verification of BJT and FET Amplifiers; Multistage Amplifiers; Feedback Amplifiers; Oscillators; Power Amplifiers; Tuned Amplifiers.

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

CO1: Design Multistage amplifiers and determine Gain, Bandwidth, Input and Output impedances for specified applications.

CO2: Design negative feedback amplifiers to determine Gain, Bandwidth, Input and Output Impedances

CO3: Design Oscillator circuits to generate sustained oscillations

CO4: Analyze power amplifiers to determine efficiency.

CO5: Work individually and in groups to solve problems with effective communication.

List of Exercises/List of Experiments:

Part-A: Design and Simulation of the following circuits

(Minimum **Seven** Experiments are to be conducted):

1. Two Stage RC Coupled Amplifier
2. Cascode Amplifier
3. Common Source MOSFET amplifier
4. Current shunt Feedback Amplifier
5. Voltage Series Feedback Amplifier
6. Wien Bridge Oscillator using Transistors
7. RC Phase Shift Oscillator using Transistor
8. Class A Power Amplifier (Transformer less)
9. Class B Complementary Symmetry Amplifier

Part-B: Design and verification of the following circuits
(Minimum **Three** Experiments are to be conducted):

1. Two Stage RC Coupled Amplifier
2. Cascode Amplifier
3. Current shunt Feedback Amplifier
4. Voltage Series Feedback Amplifier
5. LC Oscillator
6. RC Phase Shift Oscillator
7. Class A Power Amplifier

REFERENCE BOOKS/LABORATORY MANUALS:

1. Md H Rashid , *Introduction to PSpice Using OrCAD for Circuits and Electronics*, PHI, 3rd edition, 2012
2. S. Poorna Chandra, B. Sasikala *"Electronics Laboratory Primer"*, S. Chand & Company Ltd. 1st Reprint Edition 2014

SOFTWARE/Tools used:

- PSPICE /Multisim

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	2	2	2	2	1	-	-	-	-	3	-	-
CO2	3	2	3	2	2	-	-	-	-	-	-	-	3	-	-
CO3	3	2	3	2	2	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	-	2	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-	3	-	-
Average	3	2.7	2.5	2	2	2	2	1	3	3	-	-	3	-	-
Course Correlation Level	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**3**	**3**	**-**	**-**	**3**	**-**	**-**

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

II B. Tech. – II Semester

(19BT40433) **LINEAR AND DIGITAL IC APPLICATIONS LAB**

(Common to ECE and EIE)

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

PRE-REQUISITES: A course on Switching Theory and Logic Design

COURSE DESCRIPTION: Design and verification of Op-Amp applications; Timers; ADC and DAC; Simulation and synthesis of combinational and sequential circuits; Simulation tools.

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

CO1: Design various op-amp applications and timers circuits for societal applications.

CO2: Implement filters, timers, D-A converter using Op-amps and digital circuits for specified applications

CO3: Analyze performance parameters for combinational and sequential circuits using any simulation tool.

CO4: Work independently and in teams to solve problems with effective Communication.

LIST OF EXPERIMENTS:

PART-A: Design the following circuits
(Minimum **Five** Experiments are to be conducted):

1. RC Phase shift oscillator circuit using Op-Amp 741.
2. Instrumentation Amplifier using Op-Amp 741 with required gain.
3. Differentiator & Integrator using Op-Amp 741.
4. Applications of 555 timer (Monostable / Astable Multivibrator) with given duty cycle and frequency.
5. Active first and second order LPF / HPF filter for a given cut off frequency using Op-amp 741.
6. D-A converter (R-2R ladder) using Op-amp 741 with required voltage levels.

PART B: **Perform simulation and synthesis of the following Digital circuits**
(Minimum **FIVE** experiments are to be conducted using **Verilog HDL**)

1. Arithmetic and Logic Unit using IC 74x181
2. Barrel Shifter using 74x151 multiplexer
3. Floating Point Encoder
4. Dual Priority Encoder
5. Self-Correcting Ring Counter
6. Universal Shift Register using IC 74x194
7. 3-bit Linear Feedback Shift Register

REFERENCE BOOKS/LABORATORY MANUALS:

1. Ramakanth A. Gayakwad, *Op-Amps & Linear ICs*, PHI, 3rd Edition, 1998.
2. John F. Wakerly, *Digital Design Principles & Practices*, Pearson Education Asia, 4th Edition, 2008.

SOFTWARE/Tools used:

XILINX/ Multisim

ADDITIONAL LEARNING RESOURCES:

1. https://www.multisim.com/ - Online tool used for linear circuit simulations.
2. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/cool_developers/index.html

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	-	2	2	2	2	-	-	-	-	3	-	-
CO2	3	2	3	-	-	2	2	2	-	-	-	-	3	-	-
CO3	3	3	2	-	3	2	-	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	3	2.33	2.66	-	2.5	2	2	2	3	3	-	-	3	-	-
Course Correlation Level	**3**	**3**	**3**	**-**	**3**	**2**	**2**	**2**	**3**	**3**	**-**	**-**	**3**	**-**	**-**

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

II B. Tech. - II Semester

(19BT315AC) DESIGN THINKING

(Audit Course)

(Common to ECE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	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:

UNIT-I: INTRODUCTION TO DESIGN THINKING (06 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 (06 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 (06 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.

UNIT-IV: PROTOTYPING (06 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 (06 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

TEXT BOOKS:

1. S.Salivahanan, S.Suresh Kumar, D. Praveen Sam, "*Introduction to Design Thinking*", Tata McGraw 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 , 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
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	2.6	1	2	2	1	-	-	-	-	-	-	-
Level of correlation of the course	1	3	2	3	1	2	2	1	-	-	-	-	-	-	-

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

III B. Tech. – I Semester
(19BT50401) DIGITAL COMMUNICATIONS

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

PRE-REQUISITES: Courses on Signals and Systems, Analog Communications & Probability and Stochastic Processes.

COURSE DESCRIPTION: Digitization techniques - Pulse Code Modulation (PCM), Differential Pulse Code Modulation (DPCM), Delta modulation(DM) and Adaptive Delta Modulation; Digital Baseband and Pass band signal transmission; Detection of Baseband and Pass band signals and error probability; Information Theory - Source and channel coding techniques.

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

CO1: Analyze the Signal to Noise Ratio in Pulse Code Modulation and Delta modulation systems.

CO2: Analyze different Base Band, Band Pass Data Transmissions and derive bit error probabilities.

CO3: Evaluate Channel capacity of Discrete and Continuous Channels.

CO4: Analyze various error detection and correction codes to enable reliable data transmission.

DETAILED SYLLABUS:

UNIT-I: PULSE DIGITAL MODULATION (11 Periods)

Pulse Code Modulation (PCM): PCM Generation and Reconstruction, Quantization noise, Non uniform Quantization and Companding, Differential Pulse Code Modulation (DPCM), Delta modulation (DM) and Adaptive Delta Modulation.

Noise in PCM: Calculation of Quantization noise, Output Signal Power, Effect of thermal noise in PCM, Output Signal to Noise Ratio(SNR) in PCM.

Noise in DM: Quantization Noise in DM, Output signal power, Effect of thermal noise in DM, Output Signal to Noise Ratio in DM; Comparison of PCM and DM systems.

UNIT-II: BASE BAND DATA TRANSMISSION (07 Periods)

Elements of Base band Binary PAM Systems, Inter symbol Interference, Eye Pattern, Baseband Shaping, Correlative coding.

UNIT-III: BAND PASS DATA TRANSMISSION (10 Periods)

Band Pass Data Transmission: Introduction, Amplitude Shift Keying (ASK); Frequency Shift Keying (FSK); Phase Shift Keying (PSK); Quadrature PSK and M-ary PSK; Differential Phase Shift Keying (DPSK); Probability of error, Optimum filter, Matched filter, Calculation of error Probability of ASK, PSK, FSK.

UNIT-IV: INFORMATION THEORY **(09 Periods)**

Information Theory: Information and entropy, conditional entropy and redundancy, Information rate, Mutual information and its properties. Error Free Communication over Noisy Channel, Channel Capacity of Discrete Memory less Channel, Channel Capacity of Continuous Channel, Hartley Shannon's theorem, bandwidth –S/N trade off.

Source Coding: Shannon Fano Coding, Huffman Coding.

UNIT-V: ERROR CONTROL CODES **(08 Periods)**

Linear Block Codes: Matrix description of Linear Block Codes, Error detection and error Correction capabilities of linear block codes. Cyclic Codes.

Convolution Codes: Introduction, encoding of convolution codes, time domain approach, transform domain approach. Graphical approach: State, Tree and Trellis diagram. Decoding using Viterbi algorithm.

Total Periods: *45*

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Herbert Taub. Donald L Schiling, Goutam Sana, *Principles of Communication Systems*, McGraw-Hill, 4th Edition, 2012.
2. B.P.Lathi, Zhi Ding *Modern Digital and Analog Communication Systems*, Oxford, 4th Edition, 2012.

REFERENCE BOOKS:

1. Simon Haykin, *Digital Communications Systems*, Wiley, 2013.
2. K. Sam Shanmugam, *Digital and Analog Communication Systems*, Wiley, 2019.
3. R.P Singh and S.D Sapre, *Communication Systems Analog and Digital*, *McGraw Hill Education*, 3rd Edition, 2017.

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	1	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
Average	3	3	2	1.5	-	-	-	-	-	-	-	-	-	3	-
Course Correlation Level	**3**	**3**	**2**	**2**	-	-	-	-	-	-	-	-	-	**3**	-

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

III B. Tech. – I Semester

(19BT50402) DIGITAL SIGNAL PROCESSING

(Common to ECE and EIE)

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

PRE-REQUISITES: A course on Signals and Systems.

COURSE DESCRIPTION: Continuous and discrete signals and sequences; systems**;** DFT and FFT algorithms for the analysis of discrete sequences; design and realization of Digital IIR and FIR filters; Programmable DSPs and Architecture of TMS 320C6X.

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

CO1: Analyze discrete-time systems using suitable transforms.
CO2: Apply Discrete and Fast Fourier Transforms to analyze the response of linear systems.
CO3: Design and realize IIR and FIR digital filters by applying transformation and windowing Techniques.
CO4: Demonstrate the Architecture of DSP Processors.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO DIGITAL SIGNAL PROCESSING (10 Periods)

Review of Discrete-time signals, systems and their classification. Discrete-Time systems described by difference equations.

Frequency analysis of Discrete Time signals:

Fourier series for DT periodic signal and power density spectrum, the Fourier transform of DT aperiodic signals and energy density spectrum, convergence of Fourier transforms. Review of Z-transforms, Applications, solution for difference equations of digital filters.

UNIT-II: DISCRETE AND FAST FOURIER TRANSFORMS (09 Periods)

DFS representation of periodic sequences, properties of Discrete Fourier Series.

Discrete Fourier Transforms (DFT): Properties of DFT, linear filtering methods based on DFT, Relationship of FT to Z Transform, frequency analysis of signals using DFT.

Fast Fourier transforms (FFT): Radix-2 Decimation in time (DIT) and Decimation in frequency (DIF) FFT algorithms, Inverse FFT.

UNIT-III: IIR DIGITAL FILTERS (08 Periods)

Design of IIR digital filters from analog filters-IIR filter design by approximation of derivatives, impulse invariance and bilinear transformation. Characteristics of commonly used analog filters, Frequency transformations. Structural realization of IIR systems-direct, cascade and parallel form structures, Transposed form.

UNIT-IV: FIR DIGITAL FILTERS (08 Periods)

Symmetric and anti-symmetric FIR filters, Design of linear phase FIR digital filters using windowing techniques, Frequency sampling technique, Comparison of IIR and FIR filters. Structural realization of FIR filters-direct, cascade-form structures and linear phase structures.

UNIT-V: INTRODUCTION TO DSP PROCESSORS (10 Periods)

Introduction to programmable DSPs: Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in P-DSPs, Multiple access memory, multiported memory, VLIW Architecture, Pipelining, Special addressing modes, On-Chip Peripherals.

Architecture of TMS 320C6X: Introduction, Features of 'C6X Processors, Internal Architecture, CPU, General-Purpose Register Files, Functional Units and Operation, Data Paths, Control Register File.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. J. G. Proakis and D.G. Manolakis, "*Digital Signal Processing: Principles, Algorithms and Applications,*" Prentice Hall, Fourth Edition, 2007.
2. B.Venkataramani, M. Bhaskar, "*Digital Signal Processors – Architecture, Programming and Applications,*" TATA McGraw Hill, Second Edition, 2010.

REFERENCE BOOKS:

1. Alan. V. Oppenheim, Ronald.W. Schafer and John.R. Buck, "*Discrete-Time Signal Processing,*" Pearson Education, Second Edition, 2006.
2. Emmanuel C. Ifeachor& Barrie. W. Jervis, "*Digital Signal Processing*," Pearson Education / Prentice Hall, Second Edition, 2002.

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	2	1	-	-	-	-	-	-	-	-	-	3
CO2	3	2	-	1	3	-	-	-	-	-	-	-	-	-	3
CO3	3	2	3	1	2	-	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Average	3	2.3	3	1.3	2	-	-	-	-	-	-	-	-	-	3
Course Correlation Level	**3**	**3**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

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

III B. Tech. – I Semester

(19BT50403) **VLSI DESIGN**

(Common to ECE and EIE)

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 (08 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: SUB SYSTEM 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 sholeh Eshraghian, *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 & Practices*, Pearson Education Asia, 4th Edition, 2008.
2. John M. Rabaey, *Digital Integrated Circuits: A Design Perspective*, PHI, 2nd Edition, 2003.

CO-PO-PSO Mapping Table

Course outcome	Program outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	3	2	-	-	-	2	-	-	-	-	3	-	-
CO4	3	2	3	2	-	1	1	2	-	-	-	-	3	-	-
Average	3	2.5	3	2	-	1	1	2	-	-	-	-	3	-	-
Course Correlation Level	**3**	**3**	**3**	**2**	**-**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

III B. Tech. – I Semester

(19BT50404) **ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**

(Professional Elective-1)

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

PRE-REQUISITES: Courses on Electronic Devices and circuits & Network Analysis

COURSE DESCRIPTION: Science of Measurement; Construction and principle of operation of Ammeters, Voltmeters, Ohmmeters; Potentiometers; Design of Bridges Signal Analyzers and Oscilloscopes; Transducers; Display Devices and Recorders; Data Acquisition Systems and Telemetry.

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

CO1: Select the suitable measuring instruments to measure parameters like voltage, current, resistance, frequency and time by applying fundamental concepts of measuring

CO2: Identify the suitable transducers for measurement of non-electrical parameters.

CO3: Design AC and DC bridges for measurement of resistance, capacitance and Inductance.

CO4: Analyze the characteristics of the signal using suitable signal analyzer.

CO5: Apply suitable display devices and recorders based on the application.

CO6: Demonstrate the knowledge on Data Acquisition System and telemetry concepts.

DETAILED SYLLABUS:

UNIT-I: MEASUREMENTS AND MEASURING SYSTEMS (10 Periods)

Static characteristics – Accuracy, Precision, Resolution, Sensitivity, measurement Errors; Dynamic Characteristics - Speed of response, fidelity, Lag, Dynamic error and Statistical Analysis; Basic meter movement; Ammeters – Multirange, Universal Shunt, Extending Ranges; DC voltmeters – Multirange, Range extension, Loading, Transistorized Voltmeter; AC voltmeters – Rectifier type, Thermocouple Type; Ohmmeters - Series type and Shunt type; Calibration of DC Instrument & Ohmmeter, Multimeter for Voltage, Current & Resistance measurements.

UNIT-II: TRANSDUCERS AND BRIDGES (10 Periods)

Transducers: Classification of Transducers; Measurement of Displacement (Resistance, Capacitance, Inductance, LVDT), Force (Strain Gauges), Pressure (Piezoelectric Transducers), Temperature (Resistance Thermometers, Thermocouples, Thermistors); Measurement of Velocity, Acceleration, Vibration, Moisture and pH value.

Bridges: Wheatstone bridge, Kelvin Bridge, Practical Kelvin's double bridge, Maxwell's bridge, Hay's bridge, Schering bridge, Wien Bridge, Anderson Bridge, Errors and precautions in using bridges, Q-meter.

UNIT-III: SIGNAL ANALYZERS AND OSCILLOSCOPES (12 Periods)

Signal Analyzers: Wave analyzers -Frequency Selective Wave Analyzer, Heterodyne Wave Analyzer, Application of Wave Analyzers, Harmonic Distortion Analyzers, Total Harmonic Distortion; Spectrum Analyzers – Basic Spectrum Analyzer, Spectral Displays, Spectra of Different Spectrum Analyzers.

Oscilloscopes: Oscilloscope Block diagram, Cathode Ray Tube, Vertical Deflection System, Delay Line, Horizontal Deflection System - Triggered Sweep, Delayed sweep; CRO Probes, Dual Beam & Trace CROs, Measurement of Amplitude, Frequency and Phase (Lissajous method), Sampling Oscilloscope, Analog Storage Oscilloscope, Digital Storage Oscilloscope.

UNIT-IV: DISPLAY DEVICES AND RECORDERS (07 Periods)

Display Devices: Segment Displays – Seven Segment Display, Dot Matrix Display; LCD Display, BCD to 7 Segment Converter, BCD to Dot Matrix Converter.

Recorders: Strip Chart Recorder and X-Y Recorder.

UNIT-V: DATA ACQUISITION SYSTEMS AND TELEMETRY (06 Periods)

Data Acquisition System: Generalized Data Acquisition System, Single and Multi Channel DAS.

Telemetry: General Telemetry System, Types of Telemetry Systems, Land Line Telemetry Systems –Voltage, Current and Position Telemetering Systems; Introduction to Radio Frequency Telemetry.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. A.D. Helfrick and W.D. Cooper, *Modern Electronic Instrumentation and Measurement Techniques*, PHI, 5th Edition, 2006.
2. A.K. Sawhney, *A Course in Electrical & Electronic Measurement and Instrumentation*, Dhanpat Rai & Company Private Limited, New Delhi, 18th Edition,2007.

REFERENCE BOOKS:

1. David A. Bell *Electronic Instrumentation & Measurements*, PHI, 2nd Edition, 2003.
2. H.S. Kalsi, *Electronic instrumentation*, TMH, 3rd Edition, 2015.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/105/108105153/
2. https://swayam.gov.in/nd1_noc19_ee44/preview

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
CO1	2	2	-	-	3	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	2	-	-	-	-	3	-	-	-	-	-	-	3	-	-
CO6	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
Average	2.5	2.5	3	-	3	3	-	-	-	-	-	-	3	-	-
Course Correlation Level	3	3	3	-	3	3	-	-	-	-	-	-	3	-	-

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

III B. Tech – I Semester
(19BT50405)**FIBER OPTIC COMMUNICATIONS**
(Professional Elective-1)

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

PRE-REQUISITES: Courses on Engineering Physics, Electronic Devices & Circuits, Analog Communications and Digital Communications.

COURSE DESCRIPTION: Single and Multimode fibers; Fiber materials; Fiber Joints; Optical sources and detectors; Power launching in to the fiber; Optical links; WDM; Introduction to optical networks.

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

CO1: Demonstrate knowledge on structure, properties, fabrication and advantages of optical fibers.

CO2: Analyze attenuation losses and signal distortion in optical fibers.

CO3: Analyze the performance Optical sources and Detectors

CO4: Demonstrate Power launching & coupling, splicing and fiber connectors.

CO5: Analyze Analog optical link to determine Carrier to Noise ratio and Digital optical link to determine Link budgets and power penalties.

CO6: Demonstrate the concepts of WDM and various components of optical Multiplex and De-multiplexer.

DETAILED SYLLABUS:

UNIT-I: OVERVIEW OF FIBER OPTIC COMMUNICATION (08 periods)

The General system, Advantages of Optical Fiber Communication, Modes in a planar guide, Phase and group velocity, Goos-Haenchen shift.

Cylindrical Fiber-Modes, Mode Coupling, Step index fibers, Graded index fibers; Single mode fibers, Fiber materials, Fiber Fabrication, Mechanical properties of Fibers.

UNIT-II: FIBER LOSSES (07 Periods)

Attenuation, Absorption, Scattering, Bending and Core & Cladding losses. Signal Distortion in Fibers - Pulse Broadening, Intermodal Delay, Intramodal or chromatic dispersion, Overall Fiber Dispersion in Multi Mode and Single Mode Fibers, Polarization-Mode Dispersion, Design optimization of Single-Mode Fibers.

UNIT-III: OPTICAL SOURCES AND DETECTORS (11 Periods)

OPTICAL SOURCES: Light Emitting Diodes **-** LED Structures, Light Source Materials, Internal Quantum Efficiency,Modulation capability,Power-Bandwidth product, Laser Diodes**-** Modes and Threshold Conditions, Laser Diode Rate Equations, External Quantum Efficiencies, Resonant Frequencies.

OPTICAL DETECTORS: Physical Principles of Photo Diodes, Photo Detector Noise, Detector Response Time, Avalanche Multiplication Noise, Structures for InGaAs & APDs, Temperature Effect on Avalanche Gain, Comparisons of Photo Detectors.

UNIT-IV: POWER LAUNCHING AND COUPLING (07 Periods)

Source to Fiber Power Launching, Lensing Schemes for Coupling Improvement, Fiber-to-Fiber Joints, Fiber alignment and joint loss, LED coupling to single mode fibers, Fiber Splices, Fiber Connectors.

UNIT-V: OPTICAL LINKS AND COMPONENTS (12 Periods)

DIGITAL LINKS: Point-to-Point Links, budgets, Power penalties.

ANALOG LINKS: Overview, Carrier to Noise ratio, Multi-channel Transmission techniques, RF over Fiber, Radio over Fiber Links.

WDM concepts and Components: Overview of WDM, Components (Qualitative treatment only) - Passive Optical Couplers, Isolators and circulators, Fiber Grating Filters, Multiplexing and De-multiplexing, Introduction to Optical Networks.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Gerd Keiser, *Optical Fiber Communications*, McGraw Hill International, 4th Edition, 2009.
2. John M. Senior, *Optical Fiber Communications principles and practice*, Pearson Edn, 3rd Edition, 2010.

REFERENCE BOOKS:

1. Max Ming-Kang Liu, *Principles and Applications of optical Communications,* TMH,2010.
2. S.C.Gupta, *Optical Fiber Communication and its Applications*, PHI, 2011.

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
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	2	-	-	-	-	-	-	-	-	2	-	3
CO4	3	2	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	3	2	-	-	-	-	-	-	-	-	3
CO6	3	-	-	-	-	-	-	-	-	-	-	-	3	2	-
Average	3	2.5	3	2	3	2	-	-	-	-	-	-	2.6	2.6	3
Course Correlation Level	**3**	**3**	**3**	**2**	**3**	**2**	-	-	-	-	-	-	**3**	**3**	**3**

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

III B. Tech. – I Semester
(19BT50406) **FPGA ARCHITECTURES AND APPLICATIONS**
(Professional Elective-1)

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

PRE-REQUISITES: Courses on Switching Theory and Logic Design & Linear and Digital IC Applications.

COURSE DESCRIPTION: Evolution of Programmable Devices, Design with PLDs, FPGA-Organization, Programming, Xilinx-XC2000, XC3000, XC4000 Architectures, Programming Technologies, Anti-Fuse Programmed FPGAs, Design Applications.

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

CO1: Implement Boolean functions using programmable logic devices to develop a digital system.

CO2: Analyze FPGA's and its programmable technologies to assess the impact of digital functions in the design and development of digital system.

CO3: Analyze Xilinx & Actel based FPGA architectures, place and route designs for high speed digital Circuits.

CO4: Develop various sub systems using FPGA for specified applications.

DETAILED SYLLABUS:

UNIT-I: DESIGNING OF PROGRAMMABLE LOGIC DEVICES (09 Periods)

Introduction, Simple Programmable Logic Devices – Read Only Memories, Programmable Logic Arrays, Programmable Array Logic, Sequential Programmable Logic Devices (22CEV10), Implementation of a serial Adder with Accumulation.

UNIT-II: FIELD PROGRAMMABLE GATE ARRAYS (08 Periods)

Introduction to FPGAs, FPGA Programming Technologies, Programmable Logic Block Architectures, Programmable Interconnects, and Programmable I/O blocks in FPGAs, Dedicated Specialized Components of FPGAs, Applications of FPGAs.

UNIT-III: SRAM Programmable FPGAS (08 Periods)

Introduction, Programming Technology, Device Architecture, the Xilinx XC2000, XC3000 and XC4000 Architectures.

UNIT-IV: ANTI-FUSE PROGRAMMED FPGAS (10 Periods)

Introduction, Programming Technology, Device Architecture, The Actel ACT1, ACT2 and ACT3 Architectures.

UNIT-V: DESIGN APPLICATIONS **(10 Periods)**

General Design Issues, A Fast Video Controller, A Position Tracker for a Robot Manipulator, A Fast DMA Controller, Designing Counters with ACT devices.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Stephen M. Trimberger, *Field Programmable Gate Array Technology*, Springer International Edition,Eighth Indian Reprint 2015.
2. Charles H. Roth Jr, LizyKurian John, *Digital Systems Design using VHDL, 3rd edition,* Cengage Learning, 2017.

REFERENCE BOOKS:

1. John V. Oldfield, Richard C. Dorf, *Field Programmable Gate Arrays*, Wiley India,2008.
2. Pak K. Chan/SamihaMourad, Wayne Wolf, *Digital Design Using Field Programmable Gate Arrays*, Pearson Low Price Edition,2009.

ADDITIONAL LEARNING RESOURCES

http://www2.eng.cam.ac.uk/~dmh/4b7/resource/section16.htm

https://nptel.ac.in/courses/106103016/21

https://nptel.ac.in/courses/106105161/54

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	**-**	**-**
CO2	3	3	-	-	-	1	-	-	-	-	-	-	3	**-**	**-**
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	**-**	**-**
CO4	3	2	3	-	-	1	-	-	-	-	-	-	3	**-**	**-**
Average	3	2.7	2.5	-	-	1	-	-	-	-	-	-	3	**-**	**-**
Course Correlation Level	3	3	3	-	-	1	-	-	-	-	-	-	3	**-**	**-**

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

III B. Tech. - I Semester
(19BT50407) **RADAR ENGINEERING**
(Professional Elective-1)

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

PREREQUISITES: Courses on Analog Communications and Digital Communications.

COURSE DESCRIPTION: Radar equation; Targets; classification of radars; MTI and pulsed radar; Tracking with radar; radar receivers; Echo signal detection in the presence of noise; Navigational Aids.

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

CO1: Solve problems pertaining to prediction of radar parameters such as range, doppler frequency, signal strength by analyzing the principles of radar systems.

CO2: Apply appropriate techniques for signal detection, acquisition and tracking of various radar signals.

CO3: Analyze various types of radar displays, receivers, array antennas.

CO4: Apply appropriate techniques for detection of radar signals in the presence of noise.

CO5: Analyze the features of navigational aids such as VOR (VHF Omni Directional Range), ILS (Instrument Landing Systems).

DETAILED SYLLABUS:

UNIT-I: RADAR EQUATION (10 Periods)

Introduction, Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation,SNR, Envelope Detector, False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.

UNIT-II: DOPPLER RADAR (11 Periods)

Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, Illustrative Problems. FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar, MTI- Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters, MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler radar.

UNIT-III: RADAR TRACKING **(08 Periods)**

Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two- coordinates), Phase Comparison Monopulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

UNIT-IV: RADAR RECEIVERS AND DETECTION CRITERIA **(10 Periods)**

Radar display types, Duplexers – Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes.

Detection of Radar Signals in Noise–Detection criteria, Neyman-Pearson Observer, Likelihood-Ratio Receiver, Constant false Alarm Rate (CFAR), CFAR Receiver.

UNIT-V: FUNDAMENTALS OF NAVIGATIONAL AIDS **(06 Periods)**

Introduction and Types of Navigational Aids,VHF Omni Directional Range (VOR) navigation system-salient features-principle of operation- advantages and limitations, ILS (Instrument Landing Systems), Principle of operation.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Merrill I. Skolnik, *Introduction to Radar Systems*, TMH Special Indian Edition, 2nd Edition, Reprint 2017.
2. G S N Raju,*Radar Engineering and Fundamentals of Navigational Aids,* I.K. International Pvt. Ltd, 1stEdition, 2010.

REFERENCE BOOKS:

1. Merrill I. Skolnik, *Introduction to Radar Systems*, TMH, 3rd Edition, Reprint 2017.
2. Byron Edde, *Radar Principles, Technology, Applications*, Pearson Education, 2004.

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
CO1	3	3	-	3	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	3	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	3	-	-	-	-	-	-	-	-	3	3
CO5	3	3	-	-	-	3	-	-	-	-	-	-	-	3	-
Average	3	2.6	-	-	3	3	-	-	-	-	-	-	-	3	3
Course Correlation Level	**3**	**3**	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

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

III B. Tech. – I Semester

(19BT4HS01) BANKING AND INSURANCE

(Open Elective-2)

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: -

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 (09 Periods)

Meaning - Importance of banking - Functions of banking - **Reserve Bank of India**: Functions – Role of RBI in sustainable development.

UNIT-II: BANK-CUSTOMER RELATIONSHIP (09 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 (09 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 (09 Periods)

Concept of risk, risk *Vs* uncertainty. **Insurance**: Definition, Insurance as risk mitigation mechanism, elements of insurance.

UNIT-V: INSURANCE OVERVIEW (09 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. Jyotsna Sethi 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
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

III B. Tech. – I Semester

(19BT4HS03) COST ACCOUNTING AND FINANCIAL MANAGEMENT

(Open Elective-2)

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: -

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 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 (09 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 & PREPARATION OF COST SHEET (09 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 & VARIANCE ANALYSIS (09 Periods)

Introduction to Standard Costing & Variances – Variance Analysis: Material variances, Labour variances (Simple Problems).

UNIT-IV: FINANCIAL MANAGEMENT& RATIO ANALYSIS (09 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 (09 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 edition, 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
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	-	-	-	-

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

III B. Tech. – I Semester

(19BT4HS05) GENDER AND ENVIRONMENT

(Open Elective-2)

(Common to EEE, ECE and EIE)

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 & community, Gender and sustainable development, Gender in environmental justice, Gender &environmental security.

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

CO1: Apply the knowledge of gender & 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 (09 Periods)

Introduction–Gender and Environment–Development of gender roles–Society, gender & 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 & COMMUNITY (09 Periods)

Organization of the household – Domestic division of labour - Food: growing, harvesting, shopping, preparing, and cooking.

Gender & Power- Planning – Politics – NGO – Gendering of environmental protest – Environmental decision-making.

UNIT-III: GENDER ANDSUSTAINABLE DEVELOPMENT (09 Periods)

Concept of sustainability & its achievement – Concept of sustainable development – Ecological Modernization – Gender & sustainability debates – Gender & sustainable development debates - Gender in policy documents – Gender, poverty & equity in sustainable development.

UNIT-IV: GENDER IN ENVIRONMENTAL JUSTICE (09 Periods)

Normative Concerns (Fairness, Inequality & Justice) - Making sense of Environmental justice – Ecological debt, Transnational harm, & human rights – Ecological justice – Gender & Environmental Justice – Gender, Vulnerability & risk – Women in environmental justice movements – Knowledge & participation – Gender, sustainability & justice as guiding concepts.

UNIT-V: GENDER AND ENVIRONMENTAL SECURITY (09 Periods)

Connections between security & the environment – **Gender, environment & security**: Sustainability as security - poverty & 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 (ed). (2000). "*Empowering Indian Women*" Publication Division, Government of India, New Delhi.
2. Ronnie Vernooy, (Ed). (2006). "*Social and gender Analysis Natural Resource Management: Learning studies and lessons from Aisa*" Sage, New Delhi.
3. Swarup, Hemlata and Rajput, Pam. (2000). *Gender Dimensions of Environmental and Development Debate: The Indian Experience*" In SturatS. Nagel, (ed). "India‟s Development and Public Policy", Ashgate, Burlington.

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	-	-	-	-	-	-	-	-
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

III B. Tech. – I Semester

(19BT4HS07) INDIAN ECONOMY

(Open Elective-2)

(Common to EEE, ECE and EIE)

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 (09 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 (09 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 (09 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 (06 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, 62^{nd} revised edition, 2010.
2. Misra. S. K. and V. K. Puri., *Indian Economy*: Its Development Experience, Himalaya Publishing House, Mumbai, 32^{nd} 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
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

III B. Tech. – I Semester

(19BT4HS09) **LIFE SKILLS**

(Open Elective-2)

(Common to EEE, ECE and EIE)

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: Gain 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 (09 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 (09 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 (09 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 (09 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 (09 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 (2018) *Soft Skills*, S. Chand and Company Limited, New Delhi.
2. Manmohan Joshi (2017) *Soft Skills*, bookboon.com, Bangalore.

REFERENCE BOOKS:

1. Meenakshi Raman and Prakash Singh (2013), *Business Communication*, Oxford University Press, New Delhi.
2. Jeff Butterfield (2011) *Soft Skills for Everyone*, Cengage Learning India Private Limited, Delhi.

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	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

III B. Tech. – I Semester

(19BT4HS11) **PROFESSIONAL ETHICS**

(Open Elective-2)

(Common to EEE, ECE and EIE)

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 (09 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 (08 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 (09 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 (09 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., Nata Govindarajan, M., Natarajan, S. and Senthil Kumar, 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
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

III B. Tech. – I Semester

(19BT4HS13) INDIAN TRADITION AND CULTURE

(Open Elective-2)

(Common to EEE, ECE and EIE)

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: Understand the impact of socio religious reforms and movements on Indian tradition and culture to improve harmonious relations within society.

DETAILED SYLLABUS:

UNIT-I: BASIC TRAITS OF INDIAN CULTURE (09 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. Chaturvidha purushardhas, Chaturashrma and Chaturvarna theory.

UNIT-II: HUMANISTIC REFORMS UNDER JAINISM AND BUDDHISM (09 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 (09 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 (09 Periods)

Western impact on India, Introduction of western education, social and cultural awakening and social reform movements of Rajaramohan Roy - Dayanandha Saraswathi-Anne Besant (theosophical society).

UNIT-V: REFORM MOVEMENTS FOR HARMONIOUS RELATIONS (09 Periods)

Vivekananda, Eswarchandravidyasagar and Veeresalingam - emancipation of women and struggle against caste. Rise of Indian nationalism. Mahatma Gandhi- Nonviolence and satyagraha and eradication of untouchability.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOK:

1. Valluru Prabhakaraiah, *Indian Heritage and Culture*, Neelkamal Publications Pvt. Ltd. Delhi, First 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**
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

III B. Tech. – I Semester

(19BT40106) DISASTER MITIGATION AND MANAGEMENT

(Open Elective-2)

(Common to EEE, ECE and EIE)

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: Analyze 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: Analyze 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: Analyze 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 Hazards and Disasters*, Cengage Learning, 3rd Edition, 2011.
2. *Disaster Management in India,* A Status 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
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	3	2.8	3	2.4	2	2	1.6	2	-	1.6	3	2	-	-	-
Level of correlation of the course	3	3	3	3	2	2	2	2	-	2	3	2	-	-	-

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

III B. Tech. – I Semester

(19BT40107) **SUSTAINABLE ENGINEERING**

(Open Elective-2)

(Common to EEE, ECE and EIE)

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, 544p (ISBN: 978-1-119-49393-8).
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.

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	-	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	-	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

III B. Tech. – I Semester

(19BT40108) CONTRACT LAWS AND REGULATIONS

(Open Elective-2)

(Common to EEE, ECE and EIE)

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. Subba Rao, G.C.V., *Law of Contracts I & II*, S. Gogia & Co., 11th Edition, 2011.
2. Jimmie Hinze, *Construction Contracts,* McGraw Hill, 3nd Edition, 2011.

REFERENCES BOOKS:
1. Kishore Gajaria, *GT Gajaria's Law Relating to Building and Engineering Contracts in India*, Lexis Nexis Butterworths 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. Akhileshwar Pathak, *Contract Law*, Oxford University Press, 2011.

ADDITIONAL LEARNING RESOURCES:
1. P.C. Markanda, Naresh Markanda, Rajesh Markanda, *Building and Engineering Contracts- Law and Practice*, Vol-I and II, 5thEdition, 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
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	2.4	2.4	3	3	-	3	-	3	-	2	1	2	-	-	-
Level of correlation of the course	3	3	3	3	-	3	-	3	-	2	1	2	-	-	-

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

III B. Tech. – I Semester

(19BT40306) GLOBAL STRATEGY AND TECHNOLOGY

(Open Elective-2)

(Common to EEE, ECE and EIE)

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 & DEVELOPMENT STRATEGIES (09 Periods)

Concept, Evolution of R and D Management, R and D as a business, R and 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, 3rd Edition, 2002.
2. C. S. G. Krishnamacharyulu and Lalitha Ramakrishnan, *Management of Technology*, Himalaya Publishing House, Second Edition, 2012.

REFERENCE BOOKS:

1. White and Bruton, *The Management of Technology and Innovation: A Strategic Approach*, Cengage Learning, 1st Edition, 2007.
2. S.K.Mandak, *Ethics in Business and Corporate Governance*, TMH, 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
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

III B. Tech. – I Semester

(19BT40307) MANAGEMENT SCIENCE

(Open Elective-2)

(Common to EEE, ECE and EIE)

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*, Dhanpat Rai 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**
CO1	3	1	1	-	-	1	-	2	-	-	-	-	3	1	1
CO2	3	2	1	-	-	1	-	1	-	-	-	-	3	2	1
CO3	3	3	2	1	1	1	-	-	-	-	-	-	3	2	1
CO4	3	1	1	-	-	1	-	-	-	-	-	-	3	2	1
CO5	3	3	3	1	-	1	-	-	-	-	3	-	3	2	1
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

III B. Tech. – I Semester

(19BT40504) **CYBER LAWS AND SECURITY**

(Open Elective-2)

(Common to EEE, ECE and EIE)

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 (09 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 (09 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 (09 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 (09 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 (09 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(S):

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. Vivek Sood, *Cyber Law Simplified*, McGraw Hill,2018.
3. Pavan Duggal, *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
CO1	3	-	-	-	-	3	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	3	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	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

(19BT50208) **INTELLECTUAL PROPERTY RIGHTS**

(Open Elective-2)

(Common to EEE, ECE and EIE)

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; Trade Secrets; 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 amendments enforced 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:

1. Subramanian, N., &Sundararaman, M. (2018). *Intellectual Property Rights – An Overview*. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
2. World Intellectual Property Organisation. (2004). *WIPO Intellectual property Handbook*. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.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
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	2	-	-	-	-	3	-	2	-	-	-	-	-	-	-

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

III B. Tech. – I Semester

(19BT50409) **GREEN TECHNOLOGIES**

(Open Elective-2)

(Common to EEE, ECE and EIE)

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 (09 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 (09 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 (09 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 (09 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 (09 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. Konstantinos Samdanis, 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*, Khanna Publishers, 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, Thomais Vlachogianni, *Green Chemistry and Green Engineering*, SynchronaThemata, 2012.

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	2	2	-	-	-	-	-	-	-	-
CO2	3	1	-	-	-	2	3	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	2	3	-	-	-	-	-	-	-	-
CO4	3	3	-	-	2	3	3	2	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	3	-	-	-	-	-	-	-	-
Average	3	2.2	-	-	2	2	3	2	-	-	-	-	-	-	-
Course Correlation Level	**3**	**2**	**-**	**-**	**2**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

III B. Tech. – I Semester

(19BT50207) COMPUTER ORGANIZATION AND ARCHITECTURE

(Inter Disciplinary Elective-1)

(Common to ECE, EEE and EIE)

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

PRE-REQUISITES: A course on Digital Electronics.

COURSE DESCRIPTION: Concepts of computer structure, architecture and organization, Memory systems, Computer Arithmetic, 8085 Architecture, programming and Peripherals interfacing, Register transfer Hardwired control unit and Microprogrammed control unit.

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

- CO1: Understand the functional aspects of various functional units of a computer and also develop memory architecture of primary storage devices of required capacity.
- CO2: Understand the architecture and pin description of 8085 microprocessor and analyze the instruction cycle of various instructions using timing diagram.
- CO3: Develop optimized programs using 8085 assembly instructions for simple programs, memory and IO peripheral interface.
- CO4: Design of hardwired and microprogrammed control using by understanding the concept of computer arithmetic and organization.

DETAILED SYLLABUS:

UNIT-I: STRUCTURE OF COMPUTERS AND MEMORY SYSTEMS (07 Periods)

Structure of Computers: Computer Types, Functional Units, Basic Operational concepts, Bus Structures, Software and Performance.Memory System: Internal organization of memory chips—S SRAM, DRAM, ROM and cache memory, Memory hierarchy—speed, size and cost. Auxiliary memory—Magnetic disk, Flash memory.

UNIT-II: 8085 ARCHITECTURE (11 Periods)

Microprocessor evolution and types, introduction to 8085 architecture, Pin description, Register Organization, Timing Diagram, Instruction Set: Data transfer, arithmetic and logic, branch control, I/O and machine control instructions.

UNIT-III: 8085 PROGRAMMING AND INTERFACING (10 Periods)

Addressing modes, Interrupts of 8085, Simple programs, Interfacing– Memory interfacing, memory mapped I/O and I/O mapped I/O, Programble peripheral interface IC 8255: Internal architecture and Modes of operation.

UNIT-IV: COMPUTER ORGANISATION **(08 Periods)**

Organization—Register Transfer, Bus and memory transfers, Instruction Codes, Stored Program Organization, Indirect Address, Computer registers, Common Bus System, Computer Instructions, Instruction Set Completeness, RISC Vs CISC processors, Timing and control and Instruction cycle.

UNIT-V: MICRO-PROGRAMMED CONTROL AND PIPELINING HAZARDS **(09 Periods)**

Microprogrammed Control: Control memory, address sequencing, Microprogram Example, design of control unit; Pipelining: Basic concepts, Data Hazards, Instruction Hazards, Out of order execution.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. M. Moris Mano, *Computer System Architecture*, Pearson/PHI, 3rd edition, 2008.
2. Ramesh S Gaonkar, *Microprocessor - Architecture, Programming and Applications with the 8085*, Penram International Publishing Private Limited, 5th edition, 2007.

REFERENCE BOOKS:

1. Carl Hamacher, ZvonksVranesic, SafeaZaky, *Computer Organization*, Mc Graw Hill, 5thedition, 2002.
2. William Stallings, *Computer Organization and Architecture*, Pearson/PHI, 6th edition, 2003.

ADDITIONAL LEARNING RESOURCES:

1. NPTEL_CAO: https://nptel.ac.in/courses/106/105/106105163/.
2. Coursera: https://www.coursera.org/learn/comparch
3. EDX : https://www.edx.org/learn/computer-architecture

CO-PO and PSO Mapping:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	**3**	**3**	**3**	**1**	**1**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**3**	**--**	**--**
CO2	**3**	**2**	**2**	**--**	**1**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**3**	**--**	**--**
CO3	**3**	**2**	**2**	**--**	**1**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**3**	**--**	**--**
CO4	**3**	**2**	**2**	**1**	**2**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**3**	**--**	**--**
Average	**3**	**2.25**	**2.25**	**1**	**1.25**	--	--	--	--	--	--	--	**3**	--	--
Course Correlation Level	3	2	2	1	1	--	--	--	--	--	--	--	3	--	--

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

III B. Tech. - I Semester

(19BT40501) COMPUTER NETWORKS

(Inter Disciplinary Elective- 1)

(Common to CSSE, ECE and EIE)

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 sub netting 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 (09 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 (09 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 (09 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 **(09 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 **(09 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/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**
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

(19BT21501) OBJECT ORIENTED PROGRAMMING THROUGH JAVA

(Inter Disciplinary Elective- 1)

(Common to ECE and EIE)

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 this course, the 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 To kenizer, 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, Array List, Linked List, Hash Set.

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 BOOK:

1. Herbert Schildt, *Java the Complete Reference*, Ninth Edition, Oracle Press, 2014.

REFERENCE BOOKS:

1. Sachin Malhotra and Saurab Choudhary, *Programming in Java*, Second 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

- 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
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	2.25	3	-	-	-	-	-	-	-	-	-	-	-	-
Level of correlation of the course	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-

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

III B. Tech. – I Semester

(19BT50408) MICROELECTROMECHANICAL SYSTEMS

(Inter Disciplinary Elective- 1)

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

PRE-REQUISITES: A Course on Engineering Physics.

COURSE DESCRIPTION: Overview of Micro Electro Mechanical Systems (MEMS), working principles of microsensors and microactuators, materials, micro fabrication processes, MEMS accelerometers, packaging of Microsystems and applications over different fields.

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

CO1: Demonstrate MEMS Components like microsensors and microactuators.

CO2: Understand working methodologies of MEMS accelerometers.

CO3: Use micro fabrication techniques and device packaging methods in manufacturing MEMS devices.

CO4: Analyze various MEMS devices for engineering applications.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO MEMS AND MICROSYSTEMS (09 Periods)

Introduction to MEMS, Energy domains and transducers, sensors and actuators, Microsystems versus MEMS, miniaturization, MEMS materials.

UNIT-II: MICROSENSORS & ACTUATORS (09 Periods)

Microsensors: Classification of physical sensors, Integrated, Intelligent or Smart sensors, Sensor Principles and Examples: Thermal sensors, Pressure, Flow, Inertial, Gyro sensors, Bio Sensors.

Microactuators: Electromagnetic and Thermal microactuation, Mechanical design of microactuators, Microactuator examples, microvalves, micropumps, micromotors.

UNIT-III: MEMS ACCELEROMETERS (07 Periods)

Micro accelerometers for MEMS, Temperature and Damping analysis, Piezoelective accelerometer, Piezoresistive accelerometer, Piezocapacitive accelerometer technology.

UNIT-IV: MEMS FABRICATIONAND PACKAGING (12 Periods)

Review of Fabrication process-Photolithography, ion implantation, diffusion, oxidation, chemical vapor deposition, physical vapor deposition, deposition by Epitaxy, Czochralski process.

Micromachining technology of MEMS, Microstereolithography; Introduction to microsystem packaging, objectives and general considerations in packaging design, three levels of microsystem packaging.

UNIT-V: MEMS APPLICATIONS (08 Periods)

Applications of MEMS in the automotive industry, avionics and space applications and commercial applications, RF MEMS, optical MEMS, Introduction to Bio MEMS and microfluidics.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOK:

1. Tai-Ran Hsu, *MEMS & Microsystems, Design and Manufacture*, McGraw Hill Education (India) Pvt. Ltd., 27th reprint, 2018.

REFERENCE BOOKS:

1. G.K.Ananthasuresh, K.J.Vinoy, *Micro and Smart Systems*, New Delhi publication, 1^{st} edition, 2011 Education (India) Pvt. Ltd.
2. Nitaigour Premchand Mahalik, *MEMS*, McGraw Hill Education (India) Pvt. Ltd., 11^{th} reprint, 2016.

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**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	2	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	1	-
CO3	3	2	-	-	3	-	-	-	-	-	-	-	3	1	-
CO4	3	3	-	-	-	3	-	-	-	-	-	-	-	3	-
Average	3	2.3	-	-	3	3	-	-	-	-	-	-	3	1.8	
Course Correlation Level	**3**	**3**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	

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

III B. Tech. – I Semester

(19BT61531) INTERNET OF THINGS LAB

(Common to ECE, EEE and EIE)

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 independently and 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 Hakin Cassimally, *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-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	2	-	3	-	-	2	2	-	-	-	-	-	-	-	-
CO2	2	-	2	-	-	2	3	-	-	-	-	-	-	-	-
CO3	1	3	2	-	1	1	1	-	-	-	-	-	-	-	-
CO4	1	2	2	-	3	1	1	1	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	1.5	2.5	2.2	-	2	1.5	1.7	1	3	3	-	-	-	-	-
Level of correlation of the course	2	3	2	-	2	2	2	1	3	3	-	-	-	-	-

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

III B. Tech. –I Semester

(19BT50431) ANALOG AND DIGITAL COMMUNICATIONS LAB

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

PRE-REQUISITES: Courses on Signals and systems & Analog Communications.

COURSE DESCRIPTION: Simulation and verification of various analog and digital modulation schemes.

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

CO1: Analyze, measure and validate the practical observations by applying the conceptual knowledge of various Analog modulations.

CO2: Analyze, measure and validate the practical observations by applying the conceptual Knowledge of various Digital modulation schemes &Techniques.

CO3: Simulate various Analog and Digital modulations Using MATLAB tool.

CO4: 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. Amplitude modulation and demodulation(AM, DSB-SC,SSB)
2. Frequency modulation and demodulation.
3. Pulse Analog Modulation & Demodulation (PAM,PWM,PPM)
4. Verification of Sampling Theorem
5. Study the Pulse code modulation system.
6. Study the Delta Modulation system.
7. Perform Digital carrier modulations (ASK, PSK, FSK, DPSK)
8. Spectral analysis of AM signals using spectrum analyzer.
9. Generate the AM and FM signals using MATLAB
10. Generate the PSK & FSK modulation and demodulation signals using MATLAB
11. Generate the QPSK & DPSK modulation and demodulation signals using MATLAB
12. Generate the PCM and DM modulation and demodulation signals using MATLAB
13. Design of Matched filter and constellation diagrams using MATLAB.

REFERENCE BOOKS/LABORATORY MANUALS:

1. Herbert Taub. Donald L Schiling, Goutam Sana, *Principles of Communication Systems*, McGraw-Hill, 4th Edition, 2012.
2. B.P.Lathi, Zhi Ding *Modern Digital and Analog Communication Systems*, Oxford, 4th Edition, 2012.
3. Simon Haykin, *Digital Communications Systems*, Wiley, 2013.
4. K. Sam Shanmugam, *Digital and Analog Communication Systems*, Wiley, 2019.
5. R.P Singh and S.D Sapre, *Communication Systems Analog and Digital*, *McGraw Hill Education*, 3rd Edition, 2017.

SOFTWARE/Tools used: MATLAB

Major Equipments required for Laboratories:

1. CROs: 20MHz
2. Function Generators: 2MHz
3. Spectrum Analyzer
4. Regulated Power Supplies: 0-30V
5. MAT Lab/Equivalent Simulation Package with Communication tool box
6. Analog and Digital Modulation and Demodulation Trainer Kits.

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
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	3	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	3	3	-	-	3	-	-	-	3	3	-	-	-	3	-
Course Correlation Level	**3**	**3**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**3**	**-**

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

III B. Tech. - I semester

(19BT50432) 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 formson socially relevant project.

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
CO1	3	3	3	3	3	3	-	3	-	-	-	3	3	3	3
CO2	-	-	-	-	-	-	3	-	-	-	3	-	3	3	3
CO3	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Course Correlation Level	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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

III B. Tech. - I Semester

(19BT503AC) **FOUNDATIONS OF ENTREPRENEURSHIP**

(Audit Course)

(Common to CE, ME, ECE, EEE and EIE)

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

PREREQUISITE: --

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:

CO1: Demonstrate knowledge on personal attributes that enable best use of entrepreneurial opportunities.
CO2: Apply suitable method to protect creativity and innovation.
CO3: Design and prepare high impact strategic and business plan.
CO4: Analyze the major steps and requirements in order to convert innovative idea into a successful start-up.
CO5: 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, Factors that contribute to the success of entrepreneurs, Ethics and social responsibility of entrepreneurs.

UNIT-II: **ENTREPRENEURIAL PROCESS** **(06 Periods)**

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 **(06 Periods)**

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, Eighth Edition, 2013.
2. Marc J Dollinger, *Entrepreneurship: Strategies and Resources*, Pearson, Third Edition, 2003.

REFERENCE BOOKS:

1. Vasant Desai, *Dynamics of Entrepreneurial Development and Management,* Himalaya Publ. House, 2004.
2. *Harvard Business Review on Entrepreneurship,* HBR Paper Back.
3. Thomas W. Zimmerer& 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
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

III B. Tech. - II Semester

(19BT6HS01) **PRINCIPLES OF BUSINESS ECONOMICS AND ACCOUNTANCY**

(Common to ECE, EEE and EIE)

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

PRE-REQUISITES: -

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 (09 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 (09 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 (09 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 & CAPITAL (09 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 & TALLY ERP 9.0 (09 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. Larry M. Walther, *Financial Accounting,* Create Space Independent Publishing Platform, July 2017.

REFERENCE BOOKS:

1. Joseph G.Nellis and David Parker, *Principles of Business Economics*, Pearson Education Canada, 2nd edition, 2016.
2. S.P. Jain and K.L. Narang, *Financial Accounting*, Kalyani Publishers, Ludhiana, 12th edition, 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
CO1	3	1	-	-	-	-	-	-	-	2	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	2	-	-	-	-	-
CO3	-	1	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	1	2	-	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	1	-	-	-	-	-	-	-	3	-	2	-	-	-
Average	2	1.4	-	-	-	-	-	-	-	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

III B. Tech. – II Semester
(19BT60401) **ANTENNAS AND PROPAGATION**

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

PRE-REQUISITES: A Course on Electromagnetic Fields and Transmission Lines

COURSE DESCRIPTION: Antenna Parameters; Wire antennas; Antenna Arrays; VHF, UHF and Microwave antennas; Antenna Measurements and Wave propagation.

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

CO1: Design various antennas with required radiation levels for communication needs, meeting the public health and safety conditions.

CO2: Develop high gain antenna arrays for satellite, radar and mobile applications.

CO3: Analyze antenna parameters such as radiation pattern, directivity and gain by various measurement methods.

CO4: Analyze different modes of wave propagation through various layers of atmosphere.

DETAILED SYLLABUS:

UNIT-I: ANTENNA BASICS AND THIN LINEAR WIRE ANTENNAS (10 Periods)

Introduction, Radiation mechanism, Antenna parameters patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective height; Antenna Field Zones, Antenna theorems, Friis transmission equation, Retarded potentials, Radiation from small electric dipole, Quarter wave monopole and half wave dipole Current distributions, Field components, Radiated power, Radiation resistance, Beam width, Directivity, Effective area and Effective height; Natural current distributions, far-fields and patterns of Thin linear center-fed antennas of different lengths, Illustrative problems.

UNIT-II: ANTENNA ARRAYS (09 Periods)

Point sources- Definition, Patterns, arrays of 2 isotropic sources different cases; Principle of pattern multiplication, Uniform linear arrays - Broadside arrays, End fire arrays, EFA with increased directivity, Derivation of their characteristics and comparison, BSA with non-uniform amplitude distribution - General considerations and Binomial arrays, Arrays with parasitic elements, Yagi-Uda arrays, Folded dipoles & their characteristics, Illustrative problems.

UNIT-III: VHF, UHF AND MICROWAVE ANTENNAS (10 Periods)

Helical Antennas - Helical geometry, Helix modes, Practical design considerations for monofilar helical antenna in axial and normal modes ,Horn antenna, Microstrip antennas - Introduction, Features, Advantages and limitations; Rectangular patch antennas - Geometry and parameters, characteristics of microstrip antennas, Impact of different parameters on characteristics; Reflector types-paraboloidal, cassegrain, feed methods for parabolic reflectors; RF radiation hazards and solutions, Illustrative problems.

UNIT-IV: ANTENNA MEASUREMENTS **(07 Periods)**

Introduction, Concepts- Reciprocity, Near and far fields, Coordinate system, Sources of errors, Pattern measurement arrangement, Measurement of Directivity, Gain(by comparison, Absolute and 3-Antenna Methods), Radiation pattern.

UNIT-V: WAVE PROPAGATION **(09 Periods)**

Introduction, Modes of wave propagation, Ground wave propagation, Space wave propagation- Introduction, field strength variation with distance and height, effect of earth's curvature, absorption; Super refraction, M-curves and duct propagation, scattering phenomena, troposphere propagation, fading. Sky wave propagation - Introduction, structure of Ionosphere, refraction and reflection of sky waves by Ionosphere, Ray path, Critical frequency, MUF, LUF, OF, Virtual height and Skip distance, Relation between MUF and Skip distance, Multi-Hop propagation.

Total Periods: *45*

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOK:

1. John D. Kraus and Ronald J. Marhefka and Ahmad S.Khan, *Antennas and Wave Propagation*, TMH, 4th Edition, 2017.

REFERENCE BOOKS:

1. C.A. Balanis, *Antenna Theory*, John Wiley & Sons, 2nd Edition, 2007.
2. G.S.N.Raju, *Antennas and Wave Propagation*, Pearson Education India, 1st Edition, 2006.

ADDITIONAL LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc20_ee20/unit?unit=7&lesson=8
2. https://onlinecourses.nptel.ac.in/noc20_ee20/unit?unit=7&lesson=9

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	2	-	1	1	1	-	-	-	-	-	3	-
CO2	3	2	3	2	-	1	1	1	-	-	-	-	-	3	-
CO3	3	3	-	-	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
Average	3	2.5	3	2	2	1	1	1	-	-	-	-	-	3	-
Course Correlation Level	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

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

III B. Tech. - II semester

(19BT60402) **MICROCONTROLLERS**

(Common to ECE and EIE)

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

PREREQUISITES: Courses on Switching Theory and Logic Design & Linear and Digital IC Applications

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: Develop Programs 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 (07 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 **(08 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

CO-PO-PSO Mapping Table

Course outcome	Program outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	3	-	-	1	-	-	-	-	-	-	3	-	-
CO4	3	2	3	1	-	1	-	1	-	-	-	-	3	-	-
Average	3	2.5	3	1	-	1	-	1	-	-	-	-	3	-	-
Course Correlation Level	3	3	3	1		1		1	-	-	-	-	3	-	-

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

III B. Tech. – II Semester

(19BT60403) ADVANCED DIGITAL SIGNAL PROCESSING

(Professional Elective- 2)

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

PRE-REQUISITES: A Course on Digital Signal Processing

COURSE DESCRIPTION: Digital filter banks; Parametric and Non-Parametric Power Spectrum Estimation methods; Linear Prediction; Computationally efficient algorithms.

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

CO1: Design digital Filter Banks to improve performance characteristics of digital systems in multidisciplinary environments like image processing, wireless communication, biomedical engineering, speech processing, video processing, etc

CO2: Realize, compare and estimate power spectrum using different Non-Parametric and Parametric Methods in the frequency analysis of systems.

CO3: Develop optimal Lattice Forward and Backward Predictors for Radar signal Processing and Remote sensing.

CO4: Analyze various DSP algorithms in Linear filtering.

DETAILED SYLLABUS:

UNIT-I: MULTIRATE FILTER BANKS (10 Periods)

Decimation, Interpolation, Sampling rate conversion by a rational factor I/D, Multistage Implementation of sampling rate conversion. Digital Filter Banks: Two-Channel Quadrature-Mirror Filter Bank, Elimination of aliasing, condition for Perfect Reconstruction, Polyphase form of QMF bank, Linear phase FIR QMF bank, IIR QMF bank, Acquisition of high quality data, Multirate narrow band digital filtering.

UNIT-II: POWER SPECTRAL ESTIMATIONS (08 Periods)

Estimation of spectra from finite duration observation of signals, Non Parametric Methods: Bartlett, Welch, Blackmann&Tukey methods. Performance Characteristics of Nonparametric Power Spectrum Estimators, Computational Requirements of Nonparametric Power Spectrum Estimates.

UNIT-III: PARAMETRIC METHODS OF POWER SPECTRAL ESTIMATION (08 Periods)

Autocorrelation & Its Properties, Relation between auto correlation & model parameters, Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation.

UNIT-IV: LINEAR PREDICTION (10 Periods)

Forward and Backward Linear Prediction – Forward Linear Prediction, Backward Linear Prediction, Optimum reflection coefficients for the Lattice Forward and Backward Predictors. Solution of the Normal Equations: Levinson Durbin Algorithm, Schur Algorithm. Properties of Linear Prediction Filters

UNIT-V: DSP ALGORITHMS **(09 Periods)**

Fast DFT algorithms based on Index mapping, Sliding Discrete Fourier Transform, DFT Computation Over a narrow Frequency Band, Split Radix FFT, Linear filtering approach to Computation of DFT using Chirp Z-Transform.

Total Periods: *45*

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. John G. Proakis, Dimitris G. Manolakis, *Digital signal processing, principles, Algorithms and applications,* Prentice Hall, 4th edition, 2007.
2. Sanjit K Mitra, "*Digital signal processing, A computer base approach",* McGraw-Hill Higher Education, 4th edition, 2011.

REFERENCE BOOKS:

1. Emmanuel C Ifeacher Barrie. W. Jervis, "*DSP-A Practical Approach*", Pearson Education, 2nd edition, 2002.
2. A.V. Oppenheim and R.W. Schaffer, "*Discrete Time Signal Processing",* PHI, 2nd edition, 2006.

CO-PO-PSO Mapping Table

Course outcome	**Program outcomes**														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	-	-	1	-	-	-	-	-	-	-	-	3
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	3	-	-	2	-	-	-	-	-	-	-	-	-	3
Average	3	2.5	3	-	2	-	-	-	-	-	-	-	-	-	**3**
Course correlation Level	**3**	**3**	**3**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

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

III B. Tech. – II Semester

(19BT60404) **ARM AND AVR CONTROLLERS**

(Professional Elective- 2)

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

PRE-REQUISITES: Courses on Switching Theory and Logic Design & Linear and Digital Integrated Circuits.

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 (09 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 (09 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 (09 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 **(08 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

CO-PO-PSO Mapping Table

Course outcome	**Program Outcomes**														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	2	2	1
CO2	3	3	3	2	2	1	-	-	-	-	-	-	2	2	1
CO3	3	3	3	2	1	1	2	3	-	-	-	-	2	1	1
CO4	3	2	3	2	3	1	3	2	-	-	-	-	-	1	1
Average	3	2.7	2.7	2	2	1	2.5	2.5	-	-	-	-	2	1.5	1
Course Correlation Level	**3**	**3**	**3**	**2**	**2**	**1**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**2**	**1**

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

III B. Tech. – II Semester

(19BT60405) DIGITAL IC DESIGN

(Professional Elective- 2)

(Common to ECE and EIE)

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

PRE-REQUISITES: A Course on VLSI Design

COURSE DESCRIPTION: Introduction to MOS transistors; Characteristics of CMOS digital circuits; Transistor Sizing; memory design; Design strategies; Design of subsystems.

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

CO1: Design combinational and Sequential logic circuits using various design styles.

CO2: Analyze timing issues to improve the performance of sequential logic circuits.

CO3: Develop memories and sub systems using CMOS logic for high speed networks.

CO4: Analyze design methodologies and tools at various levels of abstraction.

DETAILED SYLLABUS:

UNIT-I: CMOS INVERTER CHARACTERISTICS AND DESIGN STYLES (09 Periods)

MOS Inverters: Introduction, Definitions and Properties, Static CMOS Inverter, Static and Dynamic Power Dissipation, CMOS inverter delay time definitions and calculations

Design of Combinational Logic Gates in CMOS: Introduction, Static CMOS Design, Dynamic CMOS Design, Domino and NORA logic, Power Consumption in CMOS Gates.

UNIT-II: DESIGN OF SEQUENTIAL LOGIC GATES IN CMOS (10 Periods)

Introduction, Static Sequential Circuits, Dynamic Sequential Circuits, Non-Bistable Sequential Circuit, Logic Style for Pipelined Structures.

Timing Issues in Digital Circuits: Introduction, Clock Skew and Sequential Circuit Performance, Clock Generation and Synchronization.

UNIT-III: HIGH SPEED NETWORK AND MEMORY DESIGN (09 Periods)

Methods of Logical Effort for transistor sizing - Power consumption in CMOS Gates, Low power CMOS design. CMOS Memory design – SRAM, DRAM.

UNIT-IV: SUBSYSTEM DESIGN PROCESS (09 Periods)

General arrangement of 4-bit Arithmetic Processor, Design of 4-bit shifter, Design of ALU sub-system, Implementing ALU functions with an adder, Multipliers,

modified Booth�much's algorithm.

UNIT-V: DESIGN METHODOLOGY AND TOOLS **(08 Periods)**

Introduction, Structured Design Strategies, Design Methods, Design Flows, Design Economics, Data Sheets and Documentation.

Total Periods: *45*

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Jan M Rabaey, *"Digital Integrated Circuits‖*, Pearson, 2nd Edition, 2016.
2. Kamran Eshranghian, Douglas A.Pucknell and Sholeh Eshranghian‖, *Essential of VLSI Circuits and Systems"*, PHI, 1st edition, 2005.

REFERENCE BOOKS:

1. Sung-Mo Kang & Yusuf Leblebici, *CMOS Digital Integrated Circuits*-‖, McGraw Hill, 3rd edition, 2003.
2. Neil H. E. Weste, David Money Harris, *"CMOS VLSI Design-A Circuit and Systems Perspective",* Pearson Education, 4th Edition, 2011.

CO-PO-PSO Mapping Table

Course outcome	**Program outcomes**														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	-	-	-	-		-	-	-	-	3	-	-
CO2	3	3	-	-	-	-	-		-	-	-	-	3	-	-
CO3	3	2	3	-	-	-	-		-	-	-	-	3	-	-
CO4	3	3	-	-	-	-	-	1	-	-	1	-	3	-	-
Average	3	2.5	3	-	-	-	-	1	-	-	1	-	3	-	-
Course Correlation Level	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**3**	**-**	**-**

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

III B. Tech. – II Semester

(19BT60406) **SATELLITE COMMUNICATIONS**

(Professional Elective- 2)

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

PREREQUISITES: Courses on Analog Communications and Digital Communications.

COURSE DESCRIPTION: Orbital Aspects; Satellite Subsystems; Satellite Link Design; Earth Station Technology; Multiple Access; Orbit Considerations; Global Positioning System.

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

- CO1: Solve problems on satellite's orbital mechanics by analyzing various satellite orbits, launches, launch Vehicles, kepler's laws of planetary motion.
- CO2: Design efficient satellite uplink-downlink budgets for the given parameters by analyzing various subsystems of satellite such as Telemetry, Tracking and Command, Power, Altitude and Orbit control system.
- CO3: Apply appropriate multiple accessing techniques to enhance the performance of satellite systems such as FDMA, TDMA and CDMA techniques.
- CO4: Analyze various LEO, GEO & NGSO constellation satellites and their design aspects for various satellite applications.
- CO5: Analyze the principles of global positioning systems, GPS Receiver Operation and satellite based Navigation Services in India such as GAGAN (GPS Aided Geo Augmented Navigation) and IRNSS (Indian Regional Navigation Satellite System).

DETAILED SYLLABUS :

UNIT-I: INTRODUCTION, ORBITAL MECHANICS AND LAUNCHERS (10 Periods)

Origin of Satellite Communications, Historical Background, Basic Concepts of Satellite Communications, Frequency Allocations for Satellite Services, Applications, Future Trends of Satellite. Orbital Mechanics, Kepler's Laws of planetary motion, Look Angle Determination, Orbital Perturbations, Orbit Determination, Launches and Launch Vehicles, Orbital Effects in Communication Systems Performance.

UNIT-II: SATELLITE SUBSYSTEMS AND SATELLITE LINK DESIGN (10 Periods)

Satellite Subsystems - Attitude and Orbital Control System, Telemetry, Tracking, Command and Monitoring, Power Systems, Communication Subsystems, Satellite Antennas, Equipment Reliability and Space Qualification. Basic Transmission Theory, System Noise Temperature and G/T ratio, Design of Uplink and Down Links, Design of Satellite Links for specified C/N.

UNIT-III: EARTH STATION TECHNOLOGY AND MULTIPLE ACCESS (09 Periods)

EARTH STATION: Introduction, Transmitters, Receivers, Antennas, Tracking Systems, **MULTIPLE ACCESS:** Frequency Division Multiple Access (FDMA), Intermodulation, Calculation of C/N, Time Division Multiple Access (TDMA) Frame Structure, DAMA, Code Division Multiple Access (CDMA), Spread Spectrum Transmission and Reception.

UNIT-IV: LOW EARTH ORBIT AND NON-GEOSTATIONARY SATELLITE SYSTEMS

(08 Periods)

Orbit Consideration, Coverage and Frequency Considerations, Delay and Throughput Considerations, System Considerations, Operational NGSO Constellation Designs and comparisons.

UNIT-V: THE GLOBAL POSITIONING SYSTEM AND SATELLITE NAVIGATION

(08 Periods)

THE GLOBAL POSITIONING SYSTEM: GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Message, GPS Signal Levels, Timing Accuracy, GPS Receiver Operation, GPS C/A Code Accuracy.

SATELLITE NAVIGATION: Introduction to Satellite based Navigation Services in India: GAGAN (GPS Aided Geo Augmented Navigation) and IRNSS(Indian Regional Navigation Satellite System)

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Timothy Pratt, Charles W Bostian and Jeremy E Allnutt, WSE, *Satellite Communications,* Wiley publications, 2ndEdition, 2003.
2. Dennis Roddy, *Satellite communications,* McGraw Hill, 4thEdition, 2009.

REFERENCE BOOKS:

1. Wilbur L.Pritchard, Henri G.Suyderhoud and Robert A. Nelson, *Satellite Communications Engineering,* Pearson Publications, 2ndEdition, 2008
2. D.C.Agarwal, *Satellite communications,* Khanna Publications, 7thEdition, 2009.

ADDITIONAL LEARNING RESOURCES

Weblinks:https://www.isro.gov.in/applications/step-towards-initial-satellite-based-navigation-services-india-gagan-irnss

CO-PO-PSO Mapping Table

Course outcome	Program outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	3	-	-	-	-	2	-	-	-	-		3	-
CO3	3	2	-	-	3	-	-	-	-	-	-	-	-	3	
CO4	3	3	1	-	-	2	-	-	-	-	-	-	-	3	-
C05	3	3		-	-	2	2	-	-	-	-	-	-	3	-
Average	3	2.6	2	-	3	2	2	2	-	-	-	-	-	3	-
Course correlation Level	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

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

III B. Tech. – II Semester

(19BT60407) **IMAGE PROCESSING**

(Professional Elective- 3)

(Common to CSE, EEE, ECE and EIE)

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

PRE-REQUISITES: A course on Digital Signal Processing.

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, 4th Edition, 2018.
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-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	2	3	-	-	-	-	-	-	-	-	-	3
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-	3
CO3	3	2	-	2	3	2	2	-	-	-	-	-	-	-	3
CO4	3	3	2	2	2	2	2	2	-	-	-	-	-	-	3
CO5	3	3	2	2	2	2	2	-	-	-	-	-	-	-	3
CO6	3	3	-	-	2	-	-	-	-	-	-	-	-	-	3
Average	3	2.5	2	2	2.5	2	2	2	-	-	-	-	-	-	3
Course Correlation Level	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

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

III B. Tech. – II Semester

(19BT60408) NANOSTRUCTURES AND NANOTECHNOLOGY

(Professional Elective- 3)

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

PRE-REQUISITES: Courses on Engineering Physics, Engineering Chemistry & Electronic Devices and Circuits.

COURSE DESCRIPTION: Nanostructures – Classification and Peculiarities, Characterization and Properties of Nanomaterials, Micro Electro-Mechanical Systems (MEMS) & Nano Electro-Mechanical Systems (NEMS), Carbon Nanotubes (CNT) – Properties and Synthesis, Interdisciplinary Applications of Nanomaterials.

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

CO1: Analyze the peculiarities of nanostructured materials, their characterization and properties to solve structural, mechanical and electrical problems in manufacturing Nanostructures.

CO2: Apply physical techniques to fabricate nanostructured materials

CO3: Analyze the chirality of carbon nanotube and synthesize for various applications.

CO4: Identify the appropriate nanomaterial in Quantum Devices, Emitters, Photo electrochemical Cells, Photonic Crystals and Plasmon Waveguides for societal application.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO NANOSTRUCTURED MATERIALS (09 Periods)

Gleiter's classification of nanostructured materials, Classification of nanostructures by dimensionality, Concept of “surface form engineering” in nanomaterial science, Extended internal surface, Increasing of surface energy and tension, Grain boundaries, Instability of 3D0 NSM due to grain growth.

UNIT-II: CHARACTERIZATION OF NANOMATERIALSAND PROPERTIES (11 Periods)

Structural Characterization: X-ray diffraction (XRD),Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Chemical Characterization: Optical spectroscopy, Electron spectroscopy, Ionic spectrometry, Physical Properties of Nanomaterials: Melting points and lattice constants, Mechanical properties, Optical properties Electrical conductivity.

UNIT-III: NANOSTRUCTURES FABRICATION BY PHYSICAL TECHNIQUES (09 Periods)

Introduction, Lithography, Nanomanipulation and Nanolithography,Soft Lithography, Assembly of Nanoparticles and Nanowires, Other Methods for Microfabrication.

UNIT-IV: CARBON NANOTUBES (CNT)–PROPERTIES AND SYNTHESIS

(08 Periods)

Dimensions, Chirality, Material Properties, Mechanical Properties, Electrical Properties, Optical Properties, Thermal Properties, Nanotube Growth Methods, Chemical Vapor Deposition, Thermal Chemical Vapor Deposition, Applications

UNIT-V: INTERDISCIPLINARY ARENA OF NANOMATERIALS (08 Periods)

Molecular Electronics and Nanoelectronics, Nanobots, Biological Applications of Nanoparticles, Catalysis by Gold Nanoparticles, Band Gap Engineered Quantum Devices, Nanomechanics Carbon Nanotube Emitters, Photoelectrochemical Cells, Photonic Crystals and Plasmon Waveguides.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Pokropivny, Vladimir, RynnoLohmus, Irina Hussainova, Alex Pokropivny, and Sergey Vlassov, "*Introduction to nanomaterials and nanotechnology*", Tartu, Estonia: Tartu University Press, 2007.
2. Guozhong Cao and Ying Wang, "*Nanostructures and Nanomaterials: Synthesis, Properties, and Applications",* Imperial College Press, 2004.

REFERENCE BOOKS:

1. Bhushan, Bharat, "*Springer Handbook of Nanotechnology*", 2nd edition, 2006.
2. A I Gusev and A ARempel, "*Nanocrystalline Materials*", Cambridge International Science Publishing, 1st Indian edition, 2008.
3. Kamal K. Kar, "*Carbon Nanotubes: Synthesis, Characterization and Applications",* Research Publishing Services, 1st edition, 2011.

ADDITIONAL LEARNING RESOURCES

1. *Introduction to Nanotechnology,* nanohub.org
2. https://nptel.ac.in/courses/103103033/module9/lecture1.pdf

CO-PO-PSO Mapping Table

Course outcome	Program outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	-	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	2	2	-	2	2	-	-	-	-	-	3	-	-
Average	3	2.7	2	2	3	2	2	-	-	-	-	-	3	-	-
Course Correlation Level	3	3	2	2	3	2	2	-	-	-	-	-	3	-	-

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

III B. Tech. – II Semester

(19BT60409) TESTING AND TESTABILITY

(Professional Elective- 3)

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

PRE-REQUISITES: Courses on Linear and Digital IC Applications and 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 (09 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 (06 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 **(09 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. Miron Abramovici, 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.McIntyre, *"Introduction to VLSI Testing",* Prentice Hall, 1st Illustrated Edition,1998.

ADDITIONAL LEARNING RESOURCES:

1. https://www.classcentral.com/course/swayam-digital-vlsi-testing-7956

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
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	2	2	-	2	3	-	-	-	-	3	-	-
CO4	3	-	-	-	-	-	-	3	-	-	-	-	3	-	-
Average	3	3	2	2	-	-	2	3	-	-	-	-	3	-	-
Course correlation Level	**3**	**3**	**2**	**2**	**-**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

III B. Tech. – II Semester

(19BT60410) WIRELESS SENSOR NETWORKS

(Professional Elective- 3)

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

PRE-REQUISITES: Courses on Analog Communications & Digital Communications.

COURSE DESCRIPTION: Wireless Sensor Networks (WSN) architecture, types, Quality measures of wireless channels, various MAC protocols, Sensor deployment and routing related protocols, congestion control and cross layer architectures in WSNs.

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

CO1: Analyze the Single node architecture, Sensor nodes and nodes mobility.

CO2: Analyze physical layer design issues of wireless sensor networks.

CO3: Develop the MAC and link layer protocols for efficient energy usage.

CO4: Build minimum path routing protocols and data aggregation schemes for efficient energy utilization.

CO5: Apply sensing models and cross layer approaches for coverage and performance of WSNs.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO WIRELESS SENSOR NETWORKS (10 Periods)

Challenges for wireless sensor networks, Comparison of sensor network with ad-hoc network, Single node architecture - Hardware components, energy consumption of sensor nodes. Examples of sensor nodes - Mica Mote, EYES Nodes, BTnodes. Network architecture: Sensor network scenarios - types of sources and sinks, single hop versus multi-hop networks, multiple sinks and sources, Three types of mobility.

UNIT-II: PHYSICAL LAYER (07 Periods)

Introduction, wireless channel and communication fundamentals – frequency allocation, modulation and demodulation, Physical layer and transceiver design consideration in wireless sensor networks - Energy usage profile, choice of modulation, Antenna considerations.

UNIT-III: DATA LINK LAYER (10 Periods)

MAC protocols: fundamentals of wireless MAC protocols - Requirements and design constraints for wireless MAC protocols, Important classes of MAC protocols, MAC protocols for wireless sensor networks. Low duty cycle protocols and wakeup concepts - STEM, S-MAC. Contention-based protocols - CSMA protocols, PAMAS. Schedule-based protocols - LEACH, BMAC, Traffic-adaptive medium access protocol (TRAMA).

Link Layer protocols – fundamentals task and requirements, error control - Causes and characteristics of transmission errors, ARQ techniques.

UNIT-IV: NETWORK LAYER (09 Periods)

Gossiping and agent-based uni-cast forwarding - Basic idea, Randomized forwarding. Energy-efficient unicast, Broadcast and multicast - Source-based tree protocols, Shared, core-based tree protocols. Mobile nodes - Mobile sinks, Mobile data collectors, Mobile regions. Data centric and content-based networking - Introduction, Data-centric routing, Data aggregation.

UNIT-V: TRANSPORT LAYER AND CROSS LAYER DESIGN (09 Periods)

The transport layer and QoS in wireless sensor networks - Quality of service/reliability, Transport protocols. Coverage and deployment - Sensing models, Uniform random deployments: Poisson point processes, Reliable data transport. Congestion control and rate control - Congestion situations in sensor networks. The CODA congestion-control framework.

Cross-Layer Design: Definition, Cross-layer architectures for Sensor Networks: Sensor Protocol, TinyCubus, Lu.

Total periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Holger Karl, Andreas willig *"Protocol and Architecture for Wireless Sensor Networks"*, John wiley publication, Oct 2007.
2. Raja Jurdak, *"Wireless Ad Hoc and Sensor Networks: A Cross-Layer Design Perspective"*, Springer Series, New York, 2007.

REFERENCE BOOKS:

1. Fengzhao, Leonidas, Guibas, *"Wireless Sensor Networks: an information processing approach* –publication, Elsevier, 2004.
2. Edgar H .Callaway,*"Wireless Sensor Networks: Architecture and protocol"*, 1^{st} Edition, CRC press 2003.
3. C.S.Raghavendra Krishna, M.Sivalingam and Taribznati, *"Wireless Sensor Networks"*, Springer publication, 2006.

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
CO1	3	3		-	-	-	-	2	-	-	-	-	-	3	-
CO2	3	3		-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	3	-	-	2	1	-	-	-	-	-	-	3	-
CO4	3	2	3	-	-	-	1	-	-	-	-	-	-	3	-
CO5	3	2	2	-	3	-	-	-	-	-	-	-	-	3	-
Average	3	2.4	2.6	-	3	2	1	2	-	-	-	-	-	3	-
Course Correlation Level	**3**	**3**	**3**	**-**	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

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

III B. Tech. –II Semester

(19BT60502) MACHINE LEARNING

(Inter Disciplinary Elective- 2)

(Common to CSE, CSSE, ECE and EIE)

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
(09 Periods)

Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning, Concept learning task, Concept learning as search, FIND-S, Versionspaces and candidate elimination algorithm, Inductive bias.

UNIT-II: DECISION TREE LEARNING AND KERNEL MACHINES (09 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 (09 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, Gibbsalgorithm, Naive Bayes classifier, An Example – Learning to classify text; Bayesian belief networks, EMAlgorithm.

UNIT-V: INSTANCEBASED LEARNING AND REINFORCEMENT LEARNING (08 Periods)

Instance Based Learning:k-Nearest Neighbor learning, Locallyweighted 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, 4^{th}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
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO5	2	3	2	-	-	2	-	-	-	-	-	-	-	-	-
Average	**2.4**	**2.8**	**2.3**	**1**	-	**2**	-	-	-	-	-	-	-	-	-
Level of correlation of the course	**3**	**3**	**3**	**1**	-	**2**	-	-	-	-	-	-	-	-	-

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

III B. Tech. – II Semester

(19BT60201) POWER ELECTRONICS

(Inter Disciplinary Elective- 2)

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: A course on Electronic Devices and Circuits.

COURSE DESCRIPTION: Power semiconductor devices; Silicon Controlled Rectifier — Turn-on methods, Triggering and commutation circuits for SCR; Single phase and three phase controlled rectifiers; Choppers; AC voltage controllers and Cyclo-converters; Inverters.

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

CO1: Understand the switching operations/characteristics of uncontrolled, semi-controlled and fully controlled power semiconductor devices.

CO2: Analyze commutation circuits, buck and boost operations of DC-DC converters circuit for different duty cycles.

CO3: Analyze AC-DC, AC-AC and dual converters circuit operation and evaluate their output parameters for R & RL loads with different firing pulses.

CO4: Analyze the conduction modes and PWM techniques of DC-AC converters circuit by single phase or three phase topologies.

DETAILED SYLLABUS:

UNIT-I: POWER SEMICONDUCTOR DEVICES (11 Periods)

Introduction to power electronics, Power diode — switching characteristics. Power transistors — power BJT, power MOSFET, IGBT and their characteristics; Thyristor — basic theory and operation, static and dynamic characteristics; two transistor analogy, turn-on methods, UJT firing circuits, series and parallel operation; protection against dv/dt and di/dt, design of snubber circuit.

UNIT-II: PHASE CONTROLLED RECTIFIERS (11 Periods)

Single phase controlled rectifiers — half wave controlled rectifier, bridge connections semi and fully controlled rectifiers with R and RL loads, derivation of average load voltage and current, effect of freewheeling diode; effect of source inductance; Three phase controlled rectifiers — half and fully controlled rectifiers-midpoint connection with R load, Bridge connections with R and RL loads, derivation of average load voltage and current.

UNIT-III: COMMUTATION CIRCUITS AND CHOPPERS (07 Periods)

Thyristor forced commutation circuits; Chopper — step-down and step-up operation, control strategies, derivation of load voltage with R load. Load commutated chopper.

UNIT-IV: DUAL CONVERTERS & AC VOLTAGE CONTROLLERS (07 Periods)

Dual converters — circulating and non-circulating current modes of operation of single phase and three phase dual converters with R-Load; Single phase AC voltage controllers — two SCRs in anti-parallel with R and RL loads, derivation of RMS load voltage and load current;Cyclo-converters — single phase midpoint and bridge type (step-up and step-down operations) with R and RL loads.

UNIT-V: INVERTERS (09 Periods)

Single phase inverters — basic operation, voltage source inverters, current source inverter and basic series & parallel inverters. Voltage control by pulse width modulation techniques — single pulse, multiple pulse and sinusoidal PWM techniques; Three phase bridge Inverters — $180^0$and 120^0conduction modes of operation.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Dr. P. S. Bimbhra, *Power Electronics*, Khanna Publishers, 6th Edition, Delhi, 2018.
2. M. D. Singh & K. B. Kanchandhani, *Power Electronics,* TataMcGraw - Hill Publishing Company, 2013.

REFERENCE BOOKS:

1. Mohan, Undeland, Robbins, *Power Electronics: Converters, Applications and Design*, 3rd Edition, Wiley, 2007.
2. Muhammad H. Rashid, *Power Electronics – Devices, Circuits and Applications*, 4th Edition, Pearson, 2017.

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/

CO-PO and PSO Mapping:

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	--	--
CO2	3	3	--	--	--	--	--	--	--	--	--	--	3	--	--
CO3	3	3	--	3	3	--	--	--	--	--	--	--	3	--	--
CO4	3	3	--	1	1	--	--	--	--	--	--	--	3	--	--
Average	3	3	--	2	2	--	--	--	--	--	--	--	3	--	--
Course Correlation Level	3	3	--	2	2	--	--	--	--	--	--	--	3	--	--

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

III B. Tech. – II Semester

(19BT60503) CRYPTOGRAPHY AND NETWORK SECURITY

(Inter Disciplinary Elective- 2)

(Common to CSE and ECE)

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 (09 Periods)

Computer security concepts, Security attacks, Security services, Security mechanisms, Model for network security, Symmetric cipher model, Substitution techniques - Monoalphabetic ciphers and Polyalphabetic ciphers.

UNIT-II: SYMMETRIC CIPHERS (07 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 (09 Periods)

Public Key Cryptography: RSA, Diffie-Hellman key exchange, Elgamal cryptographic system.

Cryptographic Data Integrity Algorithms: Hash Functions - Simple hash functions, Secure Hash Algorithm SHA-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 using symmetric 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 lesson plan

TEXT BOOK:

1. William Stallings, *Cryptography and Network Security: Principles and Practice*, Pearson, 8th Edition, 2020.

REFERENCE BOOKS:

1. William Stallings, *Network Security Essentials: Applications and Standards*, Pearson, 6th Edition, 2018.
2. Douglas R. Stinson, Maura B. Paterson, *Cryptography: Theory and Practice*, CRC Press, 4th Edition, 2018.
3. Atul Kahate, *Cryptography and Network Security*, McGraw Hill, 3rd Edition, 2017.

ADDITIONAL RESOURCES

- https://nptel.ac.in/courses/106105031/
- https://www.udemy.com/introduction-to-cryptography-online-course-rahsoft-crypto-certificate/
- https://www.coursera.org/learn/asymmetric-cryptography
- https://www.khanacademy.org/computing/computer-science/cryptography

CO-PO-PSO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	3	-	-	-	-	2	2	-
CO2	3	3	-	3	-	-	-	-	-	-	-	-	2	2	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	2	-
Average	**3**	**2.7**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
Level of correlation of the course	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

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

III B. Tech. - II Semester

(19BT51041) **PLC AND SCADA**

(Inter Disciplinary Elective- 2)

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

PREREQUISITES: A course on Switching Theory and Logic Design.

COURSE DESCRIPTION: Introduction to PLC, PLC ladder diagrams, programming on PLC, timers, counters and sequences used in PLC, Display Conventions and Navigation, Remote Terminal Units, Master Terminal Units, SCADA Works Station Application Programmes.

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

CO1: Demonstrate knowledge on programmable logic controllers and various functions of PLCs.

CO2: Develop PLC program, to solve various problems in process industries.

CO3: Demonstrate knowledge on various elements of SCADA Software.

CO4: Analyse the industrial process by using various displays in SCADA software and provide appropriate solutions.

DETAILED SYLLABUS:

UNIT-I: PLC BASICS AND PROGRAMMING (10 Periods)

Introduction, 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.

UNIT-II: LADDER DIAGRAMS, REGISTERS AND TIMER FUNCTIONS (10 Periods)

Digital logic gates, Boolean algebra PLC programming, Fail-Safe Circuits, characteristics of Registers, module addressing, holding registers, Input Registers, Output Registers. Timer function, Counter function & industrial applications.

UNIT-III: INTERMEDIATE AND DATA HANDLING FUNCTION (09 Periods)

Intermediate functions: Arithmetic functions, Number comparison functions, Number conversion functions. Skip, Master control relay, Jump functions, Sequencer functions and applications, Controlling of two-axis & three axis Robots with PLC, Matrix functions.

UNIT-IV: THE ELEMENTS OF SCADA SOFTWARE (10 Periods)

SCADA System Architecture - Field Devices and Signals, Programmable Process Controller, Communication Network, Central Control Facilities, Display Conventions and Navigation. Remote Terminal Units-Discrete control, analog control, Monitor discrete signals, monitor analog signals. Master terminal Units.

UNIT-V: SCADA WORKS STATION APPLICATION PROGRAMME (06 Periods)

Identifying the process areas, configuring HMI applications. Process Graphic Displays-Current Process Operations, Equipment Control Displays, Alarm and Event Summaries, Trends and Historical Reports, Maintenance Displays. Configuration of I/O Server, System graphic displays Sample Application: Water Treatment Plant SCADA System.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. John W. Webb & Ronald A. Reiss, *Programmable Logic Controllers Principles and Applications*, 5th edition, PHI, 2009.
2. Stuart G. Mc. Crady, *Designing SCADA Application Software A Practical Approach*, 1st Elsevier, 2013.

REFERENCE BOOKS:

1. Frank D. Petruzella, *Programmable Logic Controller*, 3rd edition, Tata McGraw-Hill Edition 2010.
2. Stuart A. Boyer, *Supervisory Control and Data Acquisition*, 3rd edition, ISA 2004.

WEBLINKS:

1. https://openautomationsoftware.com/use-cases/allen-bradley-wpf-scada/
2. https://new.siemens.com/global/en/products/automation/industry-software/automation-software/scada.html
3. https://ab.rockwellautomation.com/Programmable-Controllers
4. https://en.wikipedia.org/wiki/SCADA
5. http://www.isa.org
6. http://www.controleng.com
7. http://literature.rockwellautomation.com
8. http://www.automation.siemens.com

CO-PO and PSO Mapping:

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	--	--	-	-	-	-	-	-	-	-	2	2	-
CO2	3	3	2	--	-	3	-	-	-	-	-	-	2	2	-
CO3	3	3	--	-	-	-	-	-	-	-	-	-	2	2	-
CO4	3	2	--	2	-	2	-	-	-	-	-	-	2	2	-
Average	**3**	**2.75**	**2**	**2**	**--**	**2.5**	**--**	**--**	**--**	**--**	**--**	**--**	**2**	**2**	**-**
Course Correlation Level	**3**	**3**	**2**	**2**	**--**	**3**	**--**	**--**	**--**	**--**	**--**	**--**	**2**	**2**	**-**
Correlation Level:3-High 2-Medium 1-Low															

III B. Tech. – II Semester

(19BT60431) DIGITAL SIGNAL PROCESSING LAB

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

PRE-REQUISITES: A Course on Digital Signal Processing.

COURSE DESCRIPTION: Implementation of Convolution; DFT and FFT; Design of Analog, Digital FIR and IIR filters.

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

CO1: Analyze the response of LTI systems using linear and circular convolutions.

CO2: Analyze the spectrum of Discrete and analog signals using frequency Transformation techniques.

CO3: Design Analog filters and Digital FIR & IIR filters using transformation and Windowing techniques.

CO4: Work independently and in teams to solve problems with effective Communication.

List of Exercises/List of Experiments:

1. Verify linear convolution of aperiodic sequences using CCS on DSP processors and also verify using MATLAB.
2. Verify the circular convolution on Periodic sequences using CCS on DSP processors and also verify using MATLAB.
3. Verify N-point DFT & IDFT using CCS on DSP processors and also verify using MATLAB.
4. Verify N-point FFT algorithm using CCS on DSP processors and also verify using MATLAB.
5. Find the frequency response of analog Butterworth prototype filters (LP/HP/BP/BR) using MATLAB.
6. Find the frequency response of analog chebyshev prototype filters (LP/HP/BP/BR) using MATLAB.
7. Design FIR filter (LP/HP/BP/BR) using following windowing techniques with MATLAB
   A) rectangular window
   B) triangular window
8. Design FIR filter (LP/HP/BP/BR) using following windowing technique with MATLAB
   A) Hamming window
   B) Hanning window
   C) Blackman window
9. Design FIR filter (LP/HP/BP/BR) using Kaiser window with MATLAB.
10. Implement IIR Butterworth filter (LP/HP/BP/BR) using bilinear transformation techniques with MATLAB.
11. Implement IIR Chebyshev filter (LP/HP/BP/BR) using impulse-invariance transformation techniques with MATLAB.

REFERENCE BOOKS/LABORATORY MANUALS:

1. Vinay K. Ingle, John G. Proakis, "Digital Signal Processing Using MATLAB", Cengage Learning, Third Edition, 2012.
2. Emmanuel C. Ifeachor& Barrie. W. Jervis, "*Digital Signal Processing*," Pearson Education / Prentice Hall, Second Edition, 2002.
3. S. K. Mitra, "Digital Signal Processing: A computer based approach", McGraw Hill, 2011.

SOFTWARE/Tools used:

- MATLAB
- Code Composer Studio

ADDITIONAL LEARNING RESOURCES:

http://vlabs.iitkgp.ac.in/dsp/

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**
CO1	3	3	-	2	3	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	2	3	-	-	-	-	-	-	-	-	-	3
CO3	3	2	3	-	3	-	-	-	-	-	-	-	-	-	3
CO4	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	3	2.6	3	2	3	-	-	-	3	3	-	-	-	-	3
Course Correlation Level	**3**	**3**	**3**	**2**	**3**	-	-	-	**3**	**3**	-	-	-	-	3

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

III B. Tech. - II semester

(19BT60432) **MICROCONTROLLERS LAB**

(Common to ECE and EIE)

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

PRE-REQUISITES: Courses on Switching Theory and Logic Design & Linear and Digital IC Applications

COURSE DESCRIPTION: PIC Microcontrollers; Interfacing standard peripherals & Programming DAC, Stepper Motor, ADC, DAC, Keyboard, Seven Segment Display & Serial Communication**.**

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

CO1: Analyze the instruction set to program 8051 for control applications.

CO2: Analyze the instruction set to program PIC18 for computing applications.

CO3: Develop Programs using on chip resources and interface external components such as LCD, Keypad, and Motors for societal needs.

CO4: Work independently and in teams to solve problems with effective Communication.

LIST OF EXPERIMENTS: (Minimum Twelve experiments to be conducted)

PART: A (Programs using 8051)

1. Arithmetic operations using internal and external memory.
2. Programs using special instructions like SWAP, bit/byte, set/ reset etc.
3. Bank Switching & Branch operations

PART: B (Programs using PIC Microcontroller)

1. Arithmetic operations.
2. Logical & Branch operations
3. Bit manipulation operations.
4. Macros & Modular programming.
5. Time Delay programs.

PART: C (Interfacing with PIC microcontrollers)

1. Interface switches, LEDs, 7-segment display.
2. Interfacing of PIC18 with Keyboard and LCD.
3. Interfacing of PIC18 with DAC.
4. Interfacing using serial communication & DC Motor
5. Interfacing Stepper Motors

REFERENCE BOOKS/LABORATORY MANUALS:

1. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D, *The 8051 Microcontroller and Embedded Systems-using assembly and C*, PHI, 2006/ Pearson 2008
2. Muhammad Ali Mazidi, Rolin D. McKinlay, Danny causey, *PIC Microcontroller and Embedded Systems: Using C and PIC18*, Pearson Education, 2015.

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**
CO1	3	3	2	-	2	2	-	-	-	-	-	-	3	-	-
CO2	3	3	2	-	2	2	-	-	-	-	-	-	3	-	-
CO3	3	2	3	-	2	1	-	-	-	-	-	-	3	2	2
CO4	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	3	2.6	2.3	-	2	1.6	-	-	3	3	-	-	3	2	2
Course Correlation Level	3	3	3	-	2	2	-	-	3	3	-	-	3	2	2

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

III B. Tech. - II semester

(19BT60433) **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-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
CO1	3	3	3	3	3	3	-	3	-	-	-	3	3	3	3
CO2	-	-	-	-	-	-	3	-	-	-	3	-	3	3	3
CO3	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Course Correlation Level	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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

III B. Tech. - II semester

(19BT5MC01) **UNIVERSAL HUMAN VALUES**

(Mandatory Course)

(Common to CE, ME, EEE, ECE and EIE)

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: Analyse realistic 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 (06 Periods)

Human Values-Introduction; Self-Exploration - Natural Acceptance; Human Aspirations-Right understanding- the current scenario: understanding and living in harmony.

UNIT-II: HUMAN BEING AND SELF (06 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.

UNIT-III: FAMILY, THE SOCIETY AND THE NATIONS (06 Periods)

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; Universal harmonious order in society.

UNIT-IV: HARMONY WITH THE NATURE (06 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 PROFESSIONAL ETHICS (06 Periods)

Acceptance of human values; Ethical Human Conduct; Basis for Humanistic Education; Competence in professional ethics; Case studies: Holistic technologies, Management Models and Production Systems; Socially and ecologically responsible engineers, technologists and managers - enriching institutions and organizations.

Total Periods: 30

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOK:

1. R R Gaur, R Sangal, G P Bagaria, *Human Values and Professional Ethics*, Excel Books, New Delhi, 2010

REFERENCE BOOKS:

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidya Prakashan, 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
CO1	2	-	-	-	-	3	2	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	3	3	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	3	3	2	-	-	-	-	-	-	-
Average	2.6	-	-	-	-	3	2.6	2	-	-	-	-	-	-	-
Level of correlation of the course	3	-	-	-	-	3	3	2	-	-	-	-	-	-	-

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

IV B. Tech. - I Semester

(19BT6HS02) **ORGANIZATIONAL BEHAVIOR**

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: -

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 the behavior 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 (09 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 (09 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 (09 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 (09 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 (09 Periods)

Meaning – Nature of work change – Pressure for change – Change Process – Types of change – Factors influencing change – Organizational development process – OD 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**
CO1	3	1	-	-	-	-	-	-	2	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	2	-	-	1	-	-	-
CO3	-	-	-	1	-	-	-	-	3	-	-	2	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO5	-	1	-	-	-	-	-	-	3	-	-	2	-	-	-
Average	2.6	1.3	-	1	-	-	-	-	2.5	-	-	2.3	-	-	-
Level of correlation of the course	3	1	-	1	-	-	-	-	3	-	-	3	-	-	-

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

IV B. Tech. - I Semester

(19BT70401) **EMBEDDED SYSTEMS**

(Common to EEE, ECE and EIE)

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

PRE-REQUISITES: Courses on Switching Theory and Logic Design, Linear and Digital IC Applications & 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, 1stEdition, 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

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
CO1	3	3	-	1	-	-	-	-	-	-	-	-	2	1	-
CO2	3	3	2	3	2	2	-	-	-	-	-	-	2	2	-
CO3	3	3	3	2	2	2	-	2	-	-	-	-	1	2	2
CO4	3	3	2	2	2	2	-	2	-	-	-	-	1	1	1
Average	3	3	2.3	2	2	2	-	2	-	-	-	-	1.5	1.5	1.5
Course Correlation Level	**3**	**3**	**3**	**2**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

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

IV B. Tech. - I Semester
(19BT70402) MICROWAVE ENGINEERING

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

PREREQUISITES: A course on Electromagnetic Fields and Transmission Lines.

COURSE DESCRIPTION: Wave Propagation; Waveguide components; Microwave tubes; Microwave solid state devices; and Microwave measurements.

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

CO1: Analyze Waveguides as alternatives to transfer power at microwave frequencies.

CO2: Design microwave components using waveguides to analyze the Performance of microwave networks.

CO3: Analyze the Performance of microwave sources and solid state devices for high frequency radio applications.

CO4: Evaluate power, attenuation, frequency, VSWR and impedance by various measurement methods for industrial and societal applications.

DETAILED SYLLABUS:

UNIT-I: WAVEGUIDES (10 Periods)

Introduction, Microwave spectrum and bands, applications of Microwaves; Rectangular Waveguides-solution of wave Equation in Rectangular Coordinates, TE and TM mode analysis, Expressions for fields, Characteristic equation and cutoff frequencies, Filter characteristics, Dominant and degenerate modes, sketches of TE and TM mode fields in the cross section; Mode characteristics – phase and Group velocities, wavelengths and impedance relations, Power Transmission and Power Losses, Illustrative Problems.

UNIT-II: MICROWAVE COMPONENTS (10 Periods)

Scattering Matrix- Significance, Formulation and properties. S Matrix calculations for 2-port junction,Waveguide multiport junctions-E plane and H plane Tees, Magic Tee, Directional coupler; Ferrites- composition and characteristics, faraday rotation, ferrite components –Isolator and Circulator. Waveguide Discontinuities – Waveguide Windows, Tuning Screws and Posts, Matched Loads. Coupling mechanisms- probe, loop. Waveguide attenuators- resistive card, rotary vane Attenuators, Waveguide phase shifters – dielectric and rotary vane types, Illustrative problems.

UNIT-III: MICROWAVE SOURCES (12 Periods)

Limitations and losses of conventional tubes at microwave frequencies. Classification of Microwave tubes.Two cavity klystron (Only Qualitative Treatment). Reflex Klystrons-structure, Velocity Modulation, Applegate diagram, mathematical theory of bunching, power output, efficiency, oscillating modes and O/P characteristics. Slow wave structures; structure of Helix TWT and amplification process. Magnetrons - different types, cylindrical travelling wave magnetron – Hull cutoff and Hartree conditions, Illustrative Problems.

UNIT-IV: MICROWAVE SOLID STATE DEVICES **(08 Periods)**

Introduction, classification, applications, Transfer Electronic Devices, Gunn diode – RWH theory, Characteristics, basic modes of operation – Gunn oscillation modes, LSA Mode; Transit-Time Devices – IMPATT, TRAPATT and BARITT.

UNIT-V: MICROWAVE MEASUREMENTS and MODERN TRENDS **(05 Periods)**

MEASUREMENTS: Description of Microwave Bench – different blocks and their features, errors and precautions; Microwave power measurement- Bolometer method, Measurement of attenuation, frequency, low and high VSWR, Q of the cavity and impedance measurements.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Samuel Y. Liao, *Microwave devices and circuits*, Pearson Education, 3rd Edition, 2003.
2. M.Kulkarni, *Microwave and Radar Engineering*, Umesh Publications, 5th Edition, 2016.

REFERENCE BOOKS:

1. F.E. Terman, *Electronic and Radio Engineering*, McGraw-Hill, 4th Edition, 1955.
2. Sushrut Das, *Microwave Engineering*, Oxford University Press, 2014.

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
CO1	3	3	-	2	2	1	-	-	-	-	-	-	3	-	-
CO2	3	2	3	2	2	1	-	-	-	-	-	-	-	3	-
CO3	3	3	-	2	-	2	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	2	2	-	-	-	-	-	-	-	2	3
Average	3	2.7	3	2	2	1.5	-	-	-	-	-	-	3	2.6	3
Course Correlation Level	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**

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

IV B. Tech. – I Semester

(19BT71001) **BIOMEDICAL INSTRUMENTATION**

(Professional Elective - 4)

(Common to ECE and EIE)

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

PRE-REQUISITE: -

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 (09 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 (09 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 (09 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 (09 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 (09 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.

Total Periods: 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.

REFERENCES:

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

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	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	-	-	-	-	-	-	3	-	-	-	-	3	-	-
Average	3	3	-	-	-	-	-	3	-	-	-	-	3	2	-
Level of correlation of the course	3	3	-	-	-	-	-	3	-	-	-	-	3	2	-

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

IV B. Tech. – I Semester

(19BT70403) **ANALOG IC DESIGN**

(Professional Elective - 4)

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

PRE-REQUISITES: Courses on Electronic Devices and Circuits & Electronic Circuits analysis and design

COURSE DESCRIPTION: MOS Device Physics, Single Stage Amplifiers, Differential Amplifiers, Current Mirrors, Operational Amplifiers, Frequency Compensation, Bandgap Reference circuits.

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

CO1: Analyze small signal Models and layout considerations of MOS devices.

CO2: Analyze Single Stage Amplifiers, Differential Amplifiers and Current Mirrors.

CO3: Apply gain boosting techniques, frequency compensation techniques to achieve stability in operational amplifiers.

CO4: Analyze the bandgap reference circuits to meet the optimial solutions.

DETAILED SYLLABUS:

UNIT-I: BASIC MOS DEVICE PHYSICS (09 Periods)

The MOSFET – Structure, Symbol, Switch operation, MOS I/V Characteristics, Second Order Effects, MOS Device Models – Layout, Capacitances, Small – Signal Model, SPICE Models, NMOS versus PMOS Devices, Long Channel versus Short Channel Devices.

UNIT-II: SINGLE STAGE AMPLIFIERS (07 Periods)

General Considerations, Common Source Stage with different loads, Source Follower, Common – Gate Amplifier, Cascode Stage – Folded Cascode Stage.

UNIT-III: DIFFERENTIAL AMPLIFIERS AND CURRENT MIRRORS (11 Periods)

Single ended and Differential Operation, Basic Differential pair, Common Mode Response, Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors.

UNIT-IV: OPERATIONAL AMPLIFIERS AND COMPENSATION (10 Periods)

General Considerations, One-Stage Op-Amps, Two-Stage Op-Amps, Gain Boosting Techniques, Stability and Frequency Compensation – General Considerations, Multipole Systems, Phase Margin, Basic Frequency Compensation, Compensation of Two-Stage Op-Amps.

UNIT-V: BANDGAP REFERENCES **(08 Periods)**

Bandgap References: Supply-Independent Biasing, Temperature-independent References, PTAT Current Generation, Constant - Gm Biasing, Speed and Noise Issues.

Total Periods: *45*

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Behzad Razavi, "*Design of Analog CMOS Integrated Circuits*", McGraw Hill Education, 2nd edition, 2017.
2. David A.Johns, Ken Martin "*Analog Integrated Circuit Design*", Wiley , 2nd edition 2013.

REFERENCE BOOKS:

1. Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, "*Analysis and Design of Analog Integrated Circuits*", Wiley India, Fifth Edition, 2013.
2. Philip E. Allen and Douglas R. Holberg, "*CMOS Analog Circuit Design*". Oxford University Press, International third Edition/Indian Edition, 2012.

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
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	1	2	-	-	-	-	-	-	-	3	-	-
CO3	3	2	3	1	3	-	-	-	-	-	-	-	3	-	-
CO4	3	3	1	1	1	-	-	-	-	-	-	-	3	-	-
Average	3	2.75	2	1	2	-	-	-	-	-	-	-	3	-	-
Course Correlation Level	**3**	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

IV B. Tech. – I Semester

(19BT70404) CELLULAR AND MOBILE COMMUNICATIONS

(Professional Elective - 4)

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

PRE-REQUISITES: Courses on Analog Communications, Digital Communications & Antennas and Propagation.

COURSE DESCRIPTION: Concepts of cellular systems; Lee-model for cellular coverage; Desired C/I; Interference and reduction techniques; Frequency management in cellular systems; Handoff techniques; Various modulation techniques and Multiple Access techniques; 2G Systems – GSM, GPRS; 3G systems – WCDMA, 4G-LTE Systems.

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

CO1: Design antenna systems and to analyze cochannel interference in Cellular systems.

CO2: Analyze Point to point prediction model for different geographical conditions.

CO3: Apply appropriate handoff techniques for various scenarios to overcome call drops.

CO4: Demonstrate knowledge on 2G GSM, 3G WCDMA and 4G LTE cellular communication systems and their standards.

DETAILED SYLLABUS:

UNIT-I: (07 Periods)

INTRODUCTION TO CELLULAR MOBILE SYSTEMS

A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells.

ELEMENTS OF CELLULAR RADIO SYSTEMS DESIGN

Concept of frequency reuse channels, co-channel interference reduction factor, Design of Antenna systems for worst case, cell splitting

UNIT-II: (11 Periods)

INTERFERENCE REDUCTION AND CELL COVERAGE FOR SIGNAL: Introduction to co-channel interference, Exploring co-channel interference areas in a system, Design of different antenna systems, Diversity Receiver, Near End Far End Interference, Lee model.

FREQUENCY MANAGEMENT& CHANNEL ASSIGNMENT: Frequency Management, fixed channel assignment, non-fixed channel assignment, traffic & channel assignment.

HANDOFFS: Introduction tohandoff, types of handoff and their characteristics.

UNIT-III: **(08 Periods)**

GLOBAL SYSTEM FOR MOBILE (2G SYSTEMS): GSM architecture, Radio specifications, Communication channels in GSM, Mapping Logical channels on to Physical Channels, signaling during a call.

GPRS (2.5G SYSTEMS)

Introduction to GPRS, GPRS support nodes, GPRS Interfaces, GPRS procedures in Packet call setup, GPRS Mobility management.

UNIT-IV: THIRD GENERATION NETWORK (3G), UMTS **(09 Periods)**

Introduction to 3G, WCDMA concept, Parameters of 3G WCDMA Air interface, Spectrum allocation for WCDMA, 3G services, UMTS Reference network architecture and Interfaces, Air-interface architecture and processing, Channels on the Air Interface, Introduction to High-Speed Packet Data Access (HSPA)

UNIT-V: 4G-LTE SYSTEMS **(10 Periods)**

Introduction, Architecture of an evolved Packet system, LTE integration with 2G/3G network, E-UTRAN Interfaces, USER Equipment, LTE Mobility, LTE Radio interface, Principles of OFDM, LTE Multiple Access scheme, Single-Carrier FDMA, OFDMA verses SC-FDMA operation, Introduction to MIMO.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. William C. Y. Lee, *Mobile Cellular Telecommunications*, McGraw Hill, 2nd Edition, 1995.
2. Alexander Kukushkin, *Introduction to Mobile Network Engineering: GSM, 3G-WCDMA, LTE and the Road to 5G,* Wiley, First Edition, 2018.

REFERENCE BOOKS:

1. Theodore S Rappaport, *Wireless Communication Principles and Practice*, Pearson Education, 2nd Edition, 2002.
2. C. Y. Lee, *Wireless and Cellular Telecommunications*, McGraw Hill, 3rd Edition, 2006.

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
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	2	
CO3	3	2	-	-	3	-	-	-	-	-	-	-		1	
CO4	3	-	-	-	-	-	-	2	-	-	-	-	-	-	-
Average	3	3	3	-	3	-	-	2	-	-	-	-	-	2	-
Course Correlation Level	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

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

IV B. Tech. – I Semester

(19BT70405) **SPEECH PROCESSING**

(Professional Elective - 4)

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

PRE-REQUISITES: Courses on Signals and Systems & Digital Signal Processing

COURSE DESCRIPTION: Acoustic Theory of speech production; model for speech signals and speech processing systems; Mathematical analysis of speech signal - Homomorphic and LPC models; Speech and Speaker recognition systems.

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

CO1: Analyze digital models of speech signals for various losses in vocal tract by articulators and estimate pitch period and cepstrum.

CO2: Understand the operation of different types of synthesizers for speech synthesis.

CO3: Apply coding using different types of vocoders for speech coding.

CO4: Use Hidden Markov Model in speech recognition and speaker identification to classify speech for authentication.

DETAILED SYLLABUS:

UNIT-I: DIGITAL MODEL FOR THE SPEECH SIGNAL (10 Periods)

The process of speech production - the mechanism of speech production, acoustic phonetics. The Acoustic theory of speech production- sound propagation, uniform lossless tubes, Effect of losses in the vocal tract, Effect of radiation at the lips, Vocal tract transfer functions for vowels, the effect of nasal coupling, Excitation of sound in the vocal tract, Digital models for speech signals.

UNIT-II: TIME DOMAIN MODELS FOR SPEECH PROCESSING (10 Periods)

Introduction, Window considerations, Short time energy and average magnitude, Short time average zero crossing rate, Speech vs silence discrimination using Average energy and zero crossing, Pitch period estimation using parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Cepstral Analysis of Speech.

UNIT-III: SPEECH SYNTHESIS (07 Periods)

History of speech synthesis, Formant synthesisers, Linear predictive synthesisers, Copy synthesis, Phoneme synthesis, Concatenation of multi-phonemic units, Text-to-speech synthesis, Articulatory speech synthesis

UNIT-IV: SPEECH CODING (07 Periods)

Sub-band coding, Transform coding, Channel Vocoder, Formant vocoder, Cepstralvocoder, Linear predictive vocoders, The LPC-10 algorithm, Multi-pulse and RELP vocoders, Vector quantiser coders.

UNIT-V: SPEECH AND SPEAKER RECOGNITION SYSTEMS (11 Periods)

Basic pattern recognition approaches, parametric representations of Speech recognition, Speech recognition system- isolated digit recognition system. Speaker Verification vs. recognition, features that distinguish speaker, Speaker recognition system-speaker verification system, speaker identification systems, Hidden Markov models, Word recognition using HMMs, Training hidden Markov models.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. L.R. Rabiner and R.W. Schafer, *Digital processing of speech signals*, Pearson Education, 2006.
2. F. J. Owens, *Signal Processing of Speech*, Macmillan, 1993.

REFERENCE BOOKS:

1. Douglas O Shaughnessy, *Speech Communications*, Oxford University Press, 2nd Edition, 2000
2. L R Rabiner, BH Juang, B Yegnanarayana, *Fundamentals of Speech Recognition*, Pearson Education, 2009.

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**
CO1	3	3	2	2	2	-	-	-	-	-	-	-	-	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	1	2	3	1	1	1	-	-	-	-	-	-	3
CO4	3	2	1	2	3	1	1		-	-	-	-	-	-	3
Average	**3**	**2.2**	**1.3**	**2**	**2.6**	**1**	**1**	**1**	-	-	-	-	-	-	3
Course Correlation Level	**3**	**2**	**1**	**2**	**3**	**1**	**1**	**1**	-	-	-	-	-	-	3

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

IV B. Tech. - I Semester

(19BT70406) **ADAPTIVE SIGNAL PROCESSING**

(Professional Elective - 5)

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

PRE-REQUISITES: A Course on Digital Signal Processing.

COURSE DESCRIPTION: Development of adaptive filter theory; Method of steepest descent;Least-Mean-Square Algorithm and recursive least square algorithm; Kalman filtering algorithm; order-recursive adaptive filters.

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

CO1: Analyze Error- Performance Surface of linear optimum and adaptive filters.

CO2: Analyze Steepest-Descent Algorithm to assess the error performance of the Wiener filters.

CO3: Apply LMS and RLS Algorithms for error minimization in noise cancellation.

CO4: Apply kalman and non Linear adaptive filters in the fields of signal processing, communications, Bio-Medical, Instrumentation and control engineering for error optimization.

CO5: Analyze order recursive adaptive filters to estimate mean square error.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO ADAPTIVE SYSTEMS & DEVELOPMENT OF ADAPTIVE FILTER THEORY (10 Periods)

Eigen Value Problem,Properties of eigen values and eigen vectors(proof is not required), Eigen Filters, eigen Value computations.The Filtering problem,Linear Optimum Filters,Adaptive Filters,Linear Filter sturucters,Approaches to the development of linear adaptive filters. Linear Optimum Filtering: Statement of the problem, Principle of Orthogonality, Minimum Mean Square Error, Wiener- Hopf equations, Error- Performance Surface.

UNIT-II: METHOD OF STEEPEST DESCENT (07 Periods)

Basic Idea of Steepest-Descent Algorithm, Steepest-Descent Algorithm applied to the Wiener Filter, Stability of the Steepest-Descent Algorithm, Examination of the transient behavior of the Steepest-Descent Algorithm, the Steepest-Descent Algorithm as a deterministic search method, Virtue and limitation of the Steepest-Descent Algorithm.

UNIT-III: LEAST-MEAN-SQUARE ADAPTIVE FILTERS AND RECURSIVE LEAST-SQUARES ADAPTIVE FILTERS (10 Periods)

Overview of the structure and operation of the Least-Mean-Square Algorithm, Least-Mean-Square adaptation Algorithm, Applications-Adaptive Noise cancelling Applied to a Sinusoidal Interference and Adaptive Beam forming, Comparison of the LMS Algorithm with Steepest-Descent Algorithm.

Matrix Inversion lemma, exponentially weighted recursive least square algorithm, update recursion for the sum of weighted error squares, Single-Weight Adaptive Noise Canceller convergence analysis of RLS Algorithm.

UNIT-IV: KALMAN FILTERING & NON LINEAR ADAPTIVE FILTERING

(10 Periods)

Recursive Minimum Mean-Square Estimation for Scalar Random variables, Statement of Kalman filtering problem, The Innovations Process, estimation of the state using the Innovations Process, Filtering, Initial conditions, Extended kalman filter.

An overview of the Blind Deconvolution problem, Buss Gang Algorithm for blind Equalization.

UNIT-V: ORDER-RECURSIVE ADAPTIVE FILTERS (08 Periods)

Gradient-Adaptive Lattice Filter, order-recursive adaptive filters using least square estimation, adaptive forward linear prediction, adaptive backward linear prediction, conversion factor, least-square lattice predictor, angle-normalized estimation errors, first order state space models for lattice filtering.

Total periods: *45*

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOK:

1. Simon Haykin, *"Adaptive Filter Theory"*, Pearson Education, 5th edition, 2014.

REFERENCE BOOK:

1. Bernard Widrow, Samuel D. Strearns, *"Adaptive Signal Processing"*, Pearson Education, 1st edition, 2002.

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**
CO1	3	3	-	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	2	3	1	1	-	-	-	-	-	-	3	-
CO4	3	2	-	2	3	1	1	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	-	-	3	-
Average	3	2.6	-	2	3	1	1	-	-	-	-	-	-	3	-
Course Correlation Level	**3**	**3**	-	**2**	**3**	**1**	**1**	-	-	-	-	-	-	**3**	-

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

IV B. Tech. - I Semester

(19BT70407) ERROR CONTROL CODING

(Professional Elective - 5)

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

PRE-REQUISITES: Courses on Analog Communications and Digital Communications

COURSE DESCRIPTION:

Mathematical concepts related to coding; Channel coding techniques – Linear Block Codes, Cyclic Codes, Binary BCH Codes and Convolutional Codes

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

CO1: Understand mathematical concepts related to coding.

CO2: Analyze the concepts involved in formulation and computation of Linear Block Codes.

CO3: Analyze the concepts involved in formulation and computation of Cyclic Codes and Binary BCH Codes.

CO4: Analyze Convolutional Codes and different algorithms associated with Convolutional Coding.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION (10 Periods)

Coding for Reliable Digital Transmission and Storage – Types of codes, Modulation and coding, Maximum likelihood decoding, Types of errors, Error control strategies, Coded modulation. Introduction to Algebra- Groups & fields, Binary field arithmetic, Construction of Galois field and its basic properties, Computations, Vector spaces, matrices.

UNIT-II: LINEAR BLOCK CODES (10 Periods)

Linear Block Codes: Introduction linear block codes, Syndrome and Error detection, Error detection and Error correction capabilities of a Block code, Standard array and syndrome decoding, Probability of an undetected error for linear codes over a BSC, Single parity check codes, repetition codes, and self-dual codes, A class of single error correcting and double error detecting codes, Reed-Muller codes and other constructions, The squaring construction of codes, The Golay code, Interleaved codes, Illustrative Problems.

UNIT-III: CYCLIC CODES (08 Periods)

Cyclic Codes: Description of Cyclic codes, Generator and parity – check matrices of cyclic codes, Encoding of Cyclic codes, Syndrome computation and error detection, Decoding of cyclic codes, Cyclic Hamming codes, The (23,12) Golay code, Shortened cyclic codes, Cyclic product codes.

UNIT-IV: BINARY BCH CODES (08 Periods)

Binary primitive BCH codes, Decoding of BCH codes, Iterative algorithm for finding the error location polynomial & its iterative algorithm, Finding the error location numbers and error correction, Correction of errors and erasures, Implementation of Galois Field arithmetic, Implementation of error correction, Weighted distribution & Error detection of binary BCH codes, Illustrative Problems.

UNIT-V: CONVOLUTIONAL CODES: (09 Periods)

Convolutional Codes: Encoding of Convolutional codes, Structural properties and distance properties of Convolutional codes, The Viterbi Algorithm, Performance bounds for Convolutional codes, Construction of good Convolutional codes, Implementation and performance of the Viterbi algorithm, The soft output of Viterbi algorithm (SOVA), The BCJR algorithm, Punctured and Tail-biting Convolutional codes, Illustrative problems.

Total Periods: *45*

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Shu Lin, Daniel J. Costello, Jr., *"Error Control Coding,"* Pearson Publications, Second Edition, 2011.
2. Bernard Sklar, Pabitra Kumar Ray, *"Digital Communications Fundamentals and Applications,"* Pearson Publications, Second Edition, 2009.

REFERENCE BOOKS:

1. Thomas M. Cover and Joy A. Thomas, "*Elements of Information Theory*", John Wiley & Sons, 1st Edition, 1999.
2. John G. Proakis, "Digital Communications", Mc.GrawHill Publication, 5th Edition, 2008.

ADDITIONAL LEARNING RESOURCES:

NPTEL Courses

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
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	-	3	-
Average	3	2.7	2	2	-	-	-	-	-	-	-	-	-	3	-
Course Correlation Level	**3**	**3**	**2**	**2**	**-**	**-**	-	-	-	-	-	-	**-**	**3**	**-**

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

IV B. Tech. - I Semester

(19BT70408) **LOW POWER CMOS VLSI DESIGN**

(Professional Elective - 5)

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

PREREQUISITES: 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, 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 system levels 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/

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
CO1	3	2	2	2	-	-	-	3	-	-	-	-	3	-	-
CO2	3	3	2	2	-	-	-	3	-	-	-	-	3	-	-
CO3	3	2	3	2	1	-	1	3	-	-	-	-	3	-	-
CO4	3	2	2	2	3	-	1	3	-	-	-	-	3	-	-
Average	3	2.2	2.2	2	2	-	1	3	-	-	-	-	3	-	-
Course Correlation Level	**3**	**2**	**2**	**2**	**2**	**-**	**1**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

IV B. Tech. - I Semester

(19BT70409) **REAL TIME SYSTEMS**

(Professional Elective - 5)

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

PRE-REQUISITES: Courses on Switching Theory and Logic Design & Microcontrollers.

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 (09 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 (09 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 (09 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 **(09 Periods)**

Introduction, Failures- Causes, Types, Detection. Fault and Error Containment, Redundancy- Hardware, Software, Time, Integrated Failure Handling.

UNIT-V: OPERATING SYSTEMS **(09 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,1997

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.

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**
CO1	3	3	2	2	-	-	-	3	-	-	-	-	3	-	-
CO2	3	3	2	2	-	-	-	3	-	-	-	-	3	-	-
CO3	3	2	3	2	1	-	1	3	-	-	-	-	3	-	-
CO4	3	2	3	2	3	-	1	3	-	-	-	-	3	-	-
Average	3	2.5	2.5	2	2	-	1	3	-	-	-	-	3	-	-
Course Correlation Level	**3**	**3**	**3**	**2**	**2**	**-**	**1**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

IV B. Tech. - I Semester

(19BT70431) **ANTENNAS AND MICROWAVE ENGINEERING LAB**

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

PRE-REQUISITES: Courses on Antennas and propagation & Microwave Engineering.

COURSE DESCRIPTION: Design and Simulation of various antennas, study of characteristics microwave sources and components.

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

CO1: Design monopole, half wave dipole, yagi-uda, horn, patch etc., antennas for establishing wireless communication.

CO2: Analyze return loss, VSWR, Gain, Directivity, Radiation Pattern etc., of the Simulated antenna.

CO3: Analyze the characteristics of microwave sources and estimate the performance of microwave components.

CO4: Work independently and in teams to solve problems with effective Communication.

List of Exercises/List of Experiments:

PART-A: (Antennas)

(Minimum **six experiments** are to be conducted)

1. Design Monopole Antenna to operate at 1GHz and verify its associated parameters using HFSS Tool.
2. Design Half Wave Dipole Antenna to operate at 1GHz and verify its associated parameters using HFSS Tool.
3. Design Folded Dipole Antenna to operate at 500MHz and verify its associated parameters using HFSS Tool.
4. Design Yagi-Uda Array Antenna with minimum of five elements to operate at 500MHz and verify its associated parameters using HFSS Tool.
5. Design Helical Antenna to operate at 10GHz and verify its associated parameters using HFSS Tool.
6. Design Horn Antenna to operate at 10GHz and verify its associated parameters using HFSS Tool.
7. Design Microstrip Patch Antenna with strip feeding to operate at 2.4 GHz and verify its associated parameters using HFSS Tool.
8. Design Microstrip Patch Antenna with probe feeding to operate at 2.4 GHz and verify its associated parameters using HFSS Tool.

PART-B: (Microwave Engineering)

9. Using Microwave Bench setup, verify the mode and voltage characteristics of Reflex Klystron Oscillator.
10. Using Microwave Bench setup, verify the V-I characteristics of Gunn Diode Oscillator and find its dynamic resistance.
11. Using Microwave Bench setup, find the Attenuation Factor for the given rectangular waveguides.
12. Using Microwave Bench setup, find the Coupling Factor and Directivity for the given Directional Couplers.
13. Using Microwave Bench setup, find the VSWR for the given Antennas.
14. Using Microwave Bench setup, find cutoff wavelength, free space wavelength and guide wavelength for the given Waveguide.

Experiments Beyond Syllabus:

1. Using Microwave Bench Setup, measure the radiation pattern of the given horn antenna.
2. Using Microwave Bench Setup, prove reciprocity theorem as applicable to antennas.

REFERENCE BOOKS/LABORATORY MANUALS:

1. John D. Kraus and Ronald J. Marhefka and Ahmad S.Khan, *Antennas and Wave Propagation*, TMH, 4th Edition, 2010.
2. Samuel Y. Liao, Microwave devices and circuits, Pearson Education, 3rd Edition, 2003.
3. SVEC - ECE Department, *Antennas and Microwave Engineering Lab Manual*.

SOFTWARE/Tools used:

High Frequency Structure Simulator (HFSS Version 2016.2)/ Symica TCAD Tool

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
CO1	3	2	3	2	2	1	1	1	-	-	-	-	-	3	-
CO2	3	3	2	2	2	2	2	2	-	-	-	-	-	3	-
CO3	3	3	2	2	2	2	2	3	-	-	-	-	3	-	-
CO4		-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	3	2.6	2.3	2	2	1.6	1.6	2	3	3	-	-	3	3	-
Course Correlation Level	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**-**	**-**	**3**	**3**	**-**

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

IV B. Tech. - I Semester

(19BT70432) **EMBEDDED SYSTEMS LAB**

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

PRE-REQUISITES: Courses on Switching Theory and Logic Design, Linear and Digital IC Applications & 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, 1stEdition, 2008.
2. C P Ravikumar, *MSP430 Microcontrollers in Embedded System Projects*, Elite Publishing House, 1stEdition, 2012.

SOFTWARE/Tools used:

Code Composer Studio Version 6, Energia, MSP430 launch pads, Wi-Fi booster pack.

CO-PO-PSO Mapping Table

Course Outcome		Program Outcomes											Program specific outcomes		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO2**	**PSO 3**
CO1	3	3	1	2	2	-	-	-	-	-	-	-	2	2	-
CO2	3	3	2	3	2	1	1	-	-	-	-	1	2	2	-
CO3	3	3	3	2	1	1	-	-	-	-	-	2	2	3	-
CO4	3	3	3	2	1	1	1	2	-	-	-	2	-	2	3
C05	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	3	3	2.2	2.2	1.5	1	1	2	3	3	-	1.6	2	2.2	3
Course Correlation Level	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**2**	**3**	**3**	**-**	**2**	**2**	**2**	**3**

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

IV B.Tech. - I semester
(19BT70433) **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 the course, the students will be able to:

CO1: Analyze latest equipment, materials 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 Outcome	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
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
Course Correlation Level	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

(19BT704AC) PRINCIPLES OF OPERATING SYSTEMS

(Audit course)

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

PRE-REQUISITE: -

COURSE DESCRIPTION: Basics of Operating System; Process Management; Scheduling; Process Synchronization; Deadlocks; Memory Management; I/O Management; Disk Scheduling; File Systems.

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

CO1: Demonstrate knowledge on basics and types of Operating Systems, Process management and scheduling.

CO2: Analyze scheduling algorithms, process synchronization, Memory and I/O Management, File Organization and access methods

DETAILED SYLLABUS:

UNIT-I: (06 Periods)

INTRODUCTION TO OPERATING SYSTEM: Definition, need, objectives of Operating System; Evolution, Real-time Operating System; System Components; Services; System Calls; Types of Operating Systems; Virtual Machines; System Design and Implementation.

UNIT-II: (06 Periods)

PROCESS MANAGEMENT: Process, Process States; Multiple and Cooperating Processes; Process Control Block and Context Switching, Process Control, Inter Process Communication; Exception Conditions, Threads, Symmetric Multi-processing**.**

SCHEDULING: Basics, Scheduler; Types of Scheduling; Scheduling Criteria, CPU Scheduling Algorithms.

UNIT-III: (06 Periods)

PROCESS SYNCHRONIZATION: Introduction, Racing Problem, Critical Section, Mutual Exclusion; Semaphores, Producer Consumer Problem; Readers and writers Problem; Monitors, Message Passing.

DEADLOCKS: Introduction, conditions for deadlock; deadlock detection, prevention, avoidance, and recovery.

UNIT-IV: **(07 Periods)**

MEMORY MANAGEMENT: Introduction, Logical Vs Physical Addressing; Memory Management Requirement; Loading Program into main memory; Memory allocation; Page Replacement Algorithms.

I/O MANAGEMENT AND DISK SCHEDULING: I/O- devices, functions, and buffering; Spooling, Operating System design issues; Disk I/O, Disk Scheduling Algorithms.

UNIT-V: **(05 Periods)**

FILE SYSTEMS: Introduction, File attributes and Naming; File Organization and access methods; Directory Structures; File Protection and File System Organization.

Total Periods: 30

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. V. Ramesh, *Principles of Operating Systems,* University Science Press, 2010.
2. Abraham Silberschatz, Greg Gagne, Peter B. Galvin, *Operating System Concepts,* 7th Edition, Wiley India, 2011.

REFERENCE BOOK:

1. Wlliam Stallings, *Operating Systems, Internals and Design Principles*, 7th Edition, Pearson Education, 2013.

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
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	1	-	-
Average	2.5	3	-	-	-	-	-	-	-	-	-	-	1	-	-
Course Correlation Level	3	3	-	-	-	-	-	-	-	-	-	-	1	-	-

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

IV B. Tech. - II semester

(19BT80431) **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 the course, the students will be able to:

CO1: Create/Design Electronics and Communication Engineering systems or processes to solve complex Electronics and Communication Engineering 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 Electronics and Communication Engineering and allied problems.

CO3: Perform individually or in a team besides communicating effectively in written, oral and graphical forms on Electronics and Communication Engineering systems or processes.

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
CO1	3	3	3	3	3	3	-	3	-	-	-	3	3	3	3
CO2	-	-	-	-	-	-	3	-	-	-	3	-	3	3	3
CO3	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Course Correlation Level	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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

HONORS DEGREE

in

ELECTRONICS AND COMMUNICATION ENGINEERING

(SVEC-19 Regulations)

Honors Degree in Electronics and Communication Engineering

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)	19BH50401	ASIC Design	3	-	-	3	40	60	100
	19BH50402	Data communications and networks	3	-	-	3	40	60	100
	19BH50403	Detection and Estimation of Signals	3	-	-	3	40	60	100
	19BH50404	Physical Design Automation	3	-	-	3	40	60	100
III B.Tech II-Sem. (2 Theory)	19BH60401	Advanced Digital Communication Systems	3	-	-	3	40	60	100
	19BH60402	Audio signal processing	3	-	-	3	40	60	100
	19BH60403	Network-on-Chip Design	3	-	-	3	40	60	100
	19BH60404	RF IC Design	3	-	-	3	40	60	100
IV B.Tech I-Sem. (2 Theory)	19BH70401	Advanced Wireless Communications	3	-	-	3	40	60	100
	19BH70402	Optical networks	3	-	-	3	40	60	100
	19BH70403	Pattern Recognition	3	-	-	3	40	60	100
	19BH70404	VLSI Signal Processing	3	-	-	3	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 Honors degree.It is the responsibility of the student to acquire/complete prerequisite before taking therespective course.

III B. Tech. – I Semester
(19BH50401) **ASIC 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.

COURSE DESCRIPTION: ASIC design categories; Design Libraries; Design Entry; Logic Synthesis; Simulation; Testing; Physical design flow of ASIC.

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

CO1: Analyze full custom and semi custom ASIC's and its design types to improve the performance characteristics of digital systems in multidisciplinary environments like microprocessors, Digital Signal processing, wireless communication, biomedical engineering, speech processing, video processing, etc

CO2: Realize and estimate the parasitic calculations and logical effort in the analysis of programmable ASICs.

CO3: Analyze the low level schematic entry and logic synthesis of Finite state machines to estimate the performance of ASIC design.

CO4: Analyze various simulation types and its testing to estimate the static timing parameters of an ASIC.

CO5: Apply floor planning, Placement and routing methods to attain optimal solution for the development of ASICs.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO ASICS (09 Periods)

Types of ASICs- Full-Custom ASICs, Semicustom ASICs, Standard cell based ASICs, Gate- array based ASICs, Channeled Gate Array, Channel less Gate Array, Structured Gate Array, Field-Programmable Gate Arrays, ASIC Design Flow, ASIC Cell Libraries.

UNIT-II: ASIC LIBRARY DESIGN & PROGRAMMABLE ASICS (09 Periods)

ASIC LIBRARY DESIGN: Transistors as Resistors, Transistor Parasitic Capacitance, Logical Effort, Library cell design, Library Architecture, Gate-Array Design, Standard-Cell Design.

PROGRAMMABLE ASICs: Anti fuse, Static RAM, EPROM and EEPROM technology, Practical Issues, Specifications.

UNIT-III: LOW-LEVEL DESIGN ENTRY & LOGIC SYNTHESIS (09 Periods)

LOW-LEVEL DESIGN ENTRY: Schematic Entry, Hierarchical design, The cell library, Names, Schematic Icons & Symbols, Nets, Schematic Entry for ASICs, Connections, Vectored instances and Buses, Net list Screener, Back-Annotation.

LOGIC SYNTHESIS: A Logic-Synthesis Example**,** Verilog and Logic Synthesis, VHDL and Logic Synthesis, Finite-State Machine Synthesis.

UNIT-IV: SIMULATION, TESTING & ASIC CONSTRUCTION (10 Periods)

SIMULATION AND TESTING: Types of Simulation -Structural Simulation, Gate-Level Simulation, Static Timing Analysis, Formal Verification, Switch-Level Simulation, Transistor-Level Simulation, Faults, Fault simulation, Automatic Test-Pattern Generation.

ASIC CONSTRUCTION: Physical Design, System Partitioning, FPGA Partitioning, Partitioning Methods.

UNIT-V: FLOOR PLANNING, PLACEMENT & ROUTING (08 Periods)

FLOOR PLANNING AND PLACEMENT: Floor planning, Placement, Physical Design Flow, **ROUTING:** Global Routing, Detailed Routing, Special Routing, Circuit Extraction and DRC.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. M.J.S.Smith, "*Application - Specific Integrated Circuits*", Addison-Wesley Longman Inc 2008.
2. L.J.Herbst, "*Integrated circuit engineering*", OXFORD SCIENCE Publications, 1996.

REFERENCE BOOKS:

1. Neil H.E. Weste & Kamran Eshraghian," *Principles of CMOS VLSI Design : A System Perspective",* Addison – Wesley Publication, 2002.
2. John P.Uyemura, "*Introduction to VLSI Circuits and Systems*", Wiley Edition, 2002.

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	1	1	-	1	-	-	-	-	3	-	-
CO2	3	3	2	-	1	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	-	1	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	2	2	-	-	-	-	-	-	-	3	-	-
CO5	3	2	2	2	3	-	-	-	-	-	-	-	3	-	-
Average	3	2.8	2	2	1.6	1	-	1	-	-	-	-	3	-	-
Course Correlation Level	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

III B. Tech. - I Semester

(19BH50402) DATA COMMUNICATIONS AND NETWORKS

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

PRE-REQUISITES: Courses on Analog Communications and Digital Communications.

COURSE DESCRIPTION: Data types, Layered architecture, types, Network types, Quality measures, various Data link and MAC protocols, Network routing and congestion control protocols, Transport protocols and Example networks.

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

CO1: Demonstrate knowledge on various layered architectures, Application protocols and standards.

CO2: Design appropriate Data link and network protocols for Reliable Data transfer services.

CO3: Apply various network layer protocols for Data Communication and networking.

CO4: Analyze transport protocols for Congestion control, Connection establishment and release .

DETAILED SYLLABUS:

UNIT I: NETWORK MODELS & PHYSICAL MEDIA (10 Periods)

Introduction: Data Communications, Networks, The Internet, Protocols and Standards; Network Models: Layered Tasks, The OSI Model, Layers in the OSI Model, TCP/IP model, Addressing; Physical Layer and Media: Data Rate Limits, Performance; Bandwidth utilization: Multiplexing and Spreading, Multiplexing, Spread Spectrum; Transmission Media: Guided Media, Unguided Media; Switching: Circuit-Switched Networks, Datagram Networks, Virtual-Circuit Networks;

UNIT-II: DATALINK LAYER (11 Periods)

Error Detection and Correction: Introduction, Block Coding, Cyclic Codes: Cyclic Redundancy Check, Polynomials, Checksum; Data Link Control: Framing, Flow and Error Control, Protocols, Noiseless Channels, Noisy Channels, HDLC, Multiple Access: Random Access, Aloha, Controlled Access, Wired LANs: Standard Ethernet, Changes in the Standard, Fast Ethernet, Gigabit Ethernet; Wireless LANs: IEEE 802.11, Connecting Devices, Wireless WANs: Cellular Telephony, Satellite Networks, Virtual-Circuit Networks: Frame Relay, ATM.

UNIT-III: NETWORK LAYER (08 Periods)

Network Layer: Logical Addressing, IPv4 Addresses, IPv6 Addresses, Network Layer-Internet Protocol: Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6, Network Layer: Address Mapping, Error Reporting and Multicasting, Address Mapping, ICMP, Network Layer- Delivery, Forwarding and Routing: Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing Protocols.

UNIT IV: TRANSPORT LAYER **(09 Periods)**

Transport Layer: Process-to-Process Delivery, User Datagram Protocol (UDP), TCP, Congestion Control and Quality of Service, Data Traffic, Congestion, Congestion Control in TCP, Quality Service, Techniques to improve QoS, Integrated Services, Differentiated Services.

UNIT-V: APPLICATION LAYER **(09 Periods)**

DNS, WWW and HTTP, Network Management, Multimedia: Digitizing Audio and Video, Audio and Video Compression, Streaming Stored Audio/Video, Streaming Live Audio/Video, Real-Time Interactive Audio/Video, RTP, RTCP, Voice over IP.

Total Periods: 47

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOK:

1. Behrouza A. Forouzan, "*Data Communications and Networking*", TMH, Fourth Edition, 2007.

REFERENCE BOOKS:

1. Andrew S. Tanenbaum, "*Computer Networks*", Pearson education, 4th edition, 2003.
2. Behrouza A. Forouzan, Firouz Mosharraf, "*Computer Networks – A Top-Down Approach*", TMH, SIE, 2012.

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
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	3	1	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	1	3	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
Average	3	2	3	1	3	-	-	-	-	-	-	-	-	3	-
Course Correlation Level	**3**	**2**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

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

III B. Tech - I Semester

(19BH50403) DETECTION AND ESTIMATION OF SIGNALS

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

PRE-REQUISITES: A Course on Probability and Stochastic Processes**.**

COURSE DESCRIPTION: Decision criteria for single and multiple observations; Estimation techniques; Properties of estimators; parameter Estimation.

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

CO1: Apply different decision criteria for detection of signals with Single & multiple observations in additive Gaussian Noise and model Integrating Optimum & Matched Filter Receivers.

CO2: Apply different Estimation criteria and analyze properties of estimators to optimize error performance.

CO3: Estimate state and statistical parameters to evaluate the performance of the systems.

DETAILED SYLLABUS:

UNIT-I: DETECTION THEORY (09 Periods)

Binary Decisions: Single observation–Maximum-likelihood decision criterion, Neyman-Pearson criterion, Receiver operating characteristics, Probability-of-error criterion, Bayes risk criterion, Min-max criterion. Problem solving.

UNIT-II: BINARY DECISIONS: MULTIPLE OBSERVATIONS (09 Periods)

Vector observations, the general Gaussian Problem, Waveform Observation in Additive Gaussian Noise, The Integrating Optimum Receiver, Matched Filter Receiver, Problem solving.

UNIT-III: ESTIMATION THEORY (10 Periods)

Maximum-likelihood estimation, Bayes estimation criterion - Mean Square Error Criterion, Uniform Cost Function, Absolute-Value Cost Function. Linear minimum-Variance and Least Squares Method, Estimation in the presence of Gaussian noise - Linear observation, Non-linear estimation. Problem solving.

UNIT-IV: PROPERTIES OF ESTIMATORS (08 Periods)

Bias, Efficiency, Cramer-Rao bound, Asymptotic properties, Sensitivity and error analysis.

UNIT-V: STATE ESTIMATION & STATISTICAL ESTIMATION OF PARAMETERS

(09 Periods)

State Estimation: Prediction, Kalman filter, Problem solving.

Statistical Estimation of Parameters: Concept of sufficient statistics, Exponential families of Distributions, Exponential families and Maximum likelihood estimation, uniformly minimum-variance unbiased estimation.

Total Periods: *45*

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. James L.Melsa & David L.Cohn, "*Decision and Estimation Theory*", McGraw Hill, 1978.
2. Steven M. Kay, "Fundamentals of *Statistical Signal Processing Vol.1: Estimation Theory*, Prentice-hall, 1st edition 1993, Vol.2: *Detection Theory*", Prentice-hall Inc, 1st edition 1998.

REFERENCE BOOKS:

1. Harry L. Van Trees, "*Detection, Estimation and Modulation Theory*", Part 1, John Wiley & Sons Inc. 2nd edition, 2013.
2. Sophocles J.Orfanidis, "*Optimum Signal Processing*", McGraw Hill, 2nd edition, 2007.

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
CO1	3	3	2	2	3	1	-	-	-	-	-	-	-	3	2
CO2	3	3	-	2	3	-	-	-	-	-	-	-	-	3	2
CO3	3	3	-	2	2	1	-	-	-	-	-	-	-	3	2
Average	3	3	2	2	2.6	1	-	-	-	-	-	-	-	3	2
Course Correlation Level	**3**	**3**	**2**	**2**	**3**	**1**	-	-	-	-	-	-	-	**3**	**2**

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

III B. Tech. – I Semester

(19BH50404) PHYSICAL DESIGN AUTOMATION

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.

COURSE DESCRIPTION: Basics of VLSI design; Layout optimization; Simulation and synthesis; Physical design of FPGAs and MCMs.

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

CO1: Apply algorithmic graph theory to optimize area and reduce complexity in Physical Design Automation.

CO2: Analyze design rules, placement, partition and floorplan algorithms to solve compaction and routing problems in the development of layouts.

CO3: Analyze the gate and switch level simulation and perform two level logic synthesis.

CO4: Apply assignment and scheduling algorithms to model hardware and obtain high level synthesis.

CO5: Analyze various FPGA and MCM technologies to implement physical design cycle for the development of alternative and reconfigurable designs.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO VLSI DESIGN METHODOLOGIES (09 Periods)

Introduction to VLSI Design automation tools, Introduction to algorithmic graph theory, Computational Complexity, Tractable and Intractable problems, Combinational optimization.

UNIT-II: LAYOUT COMPACTION (09 Periods)

Design rules, Problem formulation, Algorithms for constraint graph compaction, Placement & Partitioning algorithms. Floor planning concepts- Shape functions and floor plan sizing, Types of routing problems.

UNIT-III: SIMULATION AND SYNTHESIS (08 Periods)

Gate Level Modeling and Simulation, Switch Level Modeling and Simulation.

Basic issues and Terminology, Binary-Decision diagrams, Two-Level logic Synthesis.

UNIT-IV: HIGH LEVEL SYNTHESIS (10 Periods)

Hardware modeling, internal representation of the input algorithm, allocation, assignment and scheduling algorithms, ASAP scheduling, Mobility based scheduling, list scheduling & force-directed scheduling.

UNIT-V: PHYSICAL DESIGN AUTOMATION OF FPGAs & MCMs (09 Periods)

FPGA technologies, Physical Design cycle for FPGAs, partitioning and Routing for segmented and staggered Models, MCM technologies, MCM physical design cycle.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXTBOOKS:

1. S.H.Gerez, "*Algorithms for VLSI Design Automation*", John wiley & Sons Pvt. Ltd, 2nd Edition 2008.
2. Naveed Sherwani, "*Algorithms for VLSI Physical Design Automation*", Springer International Edition, 3rd edition, 2005.

REFERENCE BOOKS:

1. Hill & Peterson, "*Computer Aided Logical Design with Emphasis on VLSI*",John Wiley & Sons Pvt. Ltd, 4th edition, 1993.
2. Wayne Wolf, "*Modern VLSI Design Systems on silicon*", Pearson Education Asia, 2nd Edition, 1998.

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**
CO1	3	3	-	2	3	-	-	1	-	-	-	-	3	-	-
CO2	3	3	-	1	-	-	-	1	-	-	-	-	3	-	-
CO3	3	3	1	2	-	-	-	1	-	-	-	-	3	-	-
CO4	3	2	-	2	3	-	-	1	-	-	-	-	3	-	-
CO5	3	3	-	-	2	-	-	1	-	-	-	-	3	-	-
Average	3	2.8	1	1.7	2.6	-	-	1	-	-	-	-	3	-	-
Course Correlation Level	**3**	**3**	**2**	**2**	**3**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

III B. Tech. – II Semester

(19BH60401) ADVANCED DIGITAL COMMUNICATION SYSTEMS

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

PRE-REQUISITES: A Course on Probability and Stochastic Processes.

COURSE DESCRIPTION: Characterization of Communication Signals and Systems, Digital Modulation Techniques, Optimum Receivers for the Additive Gaussian Noise Channel, Spread Spectrum Techniques, Multichannel and Multicarrier Systems.

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

CO1 : Demonstrate response of systems for Band Pass signal and signal space representations.

CO2 : Analyze various digital Modulation Techniques to improve the performance of digital communication systems.

CO3 : Analyze the performance of optimum receiver for Signals with Random Phase in AWGN Channel.

CO4 : Apply Spread Spectrum techniques in Anti jamming Application, Low-Detectability Signal Transmission and Code Division Multiple Access.

CO5 : Analyze the performance of Multichannel and Multicarrier systems.

DETAILED SYLLABUS:

UNIT-I: CHARACTERIZATION OF COMMUNICATION SIGNALS AND SYSTEMS (08 Periods)

Representation of Band Pass Signals and Systems–Representation of Band Pass Signals, Representation of Linear Band-Pass System, Response of a Band-Pass System to a Band-Pass Signal. Signal Space Representations – Vector Space Concepts, Signal Space Concepts, Orthogonal Expansion of Signals.

UNIT-II: DIGITAL MODULATIONS (09 Periods)

Digital Modulation – Factors that Influence the Choice of Digital Modulation, Bandwidth and Power Spectral Density of Digital Signals. Linear Modulation Techniques – BPSK, DPSK, QPSK, OQPSK, Π/4 QPSK. Constant Envelope Modulation Techniques – MSK, GMSK, Combined Linear and Constant Envelope Modulation Techniques – M-ary PSK, M-ary QAM.

UNIT-III: OPTIMUM RECEIVERS FOR THE ADDITIVE GAUSSIAN NOISE CHANNEL (09 Periods)

Optimum Receiver for Signals corrupted by AWGN –Correlation demodulator, Matched Filter Demodulator, Optimum Detector. Performance of the Optimum Receiver for Memory Less Modulation – Probability of Error for Binary Modulation, M-ary Orthogonal Signals, M-ary PAM, M-ary PSK, QAM. Optimum Receiver for Signals with Random Phase in AWGN Channel – Optimum Receiver for Binary Signals, Optimum Receiver for M-ary Orthogonal Signals.

UNIT-IV: SPREAD SPECTRUM TECHNIQUES (10 Periods)

Introduction, Model of Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Signals – Introduction, The Processing Gain and Jamming Margin. Applications of Direct Sequence Spread Spectrum Signals – Anti jamming Application, Low-Detectability Signal Transmission, Generation of PN-Sequences, Frequency-Hopped Spread Spectrum Signals, Other Types of Spread Spectrum Signals. Detection of spread spectrum signals- Matched filter receiver.

UNIT-V:–MULTICHANNEL AND MULTICARRIER SYSTEMS (09 Periods)

Rayleigh and Rician channels, Multichannel Digital Communications in AWGN Channels; Binary Signals, M-ary Orthogonal Signals. Multicarrier Communications; Single Carrier verses Multicarrier Modulation, Capacity of a Non ideal Linear Filter Channel, OFDM, Modulation & Demodulation in an OFDM.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. John G. Proakis, "*Digital Communications*", McGraw Hill Education, 5th edition, 2014,

REFERENCE BOOKS:

1. Simon Haykin, "*Digital Communication Systems*", 4th edition, Wiley Publication, 2021

2. P Ramakrishna Rao , "*Communication systems*", McGraw Hill Education (India) (2013).

ADDITIONAL LEARNING RESOURCES

1. https://nptel.ac.in/courses/108102096/
2. https://onlinecourses.nptel.ac.in/noc17_ec12/
3. https://nptel.ac.in/courses/117105144/
4. https://nptel.ac.in/courses/117105144/5

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
CO1	3	2	-	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	1	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	2	3	2	-	-	-	-	-	-	-	3	-
CO5	3	3	-	1	-	-	-	-	-	-	-	-	-	3	-
Average	3	2.6	1	1.8	3	2	-	-	-	-	-	-	-	3	-
Course Correlation Level	**3**	**3**	**1**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

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

III B. Tech. - II Semester

(19BH60402) AUDIO SIGNAL PROCESSING

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

PRE-REQUISITES: A course on Digital signal Processing.

COURSE DESCRIPTION:
Audio Coding Architecture, Audio Coder Attributes, Linear Prediction for narrow and wide band coding, psychoacoustic and perceptual entropy, transform coding for high-fidelity audio signals, audio standards and audio quality matrices.

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

CO1: Apply linear prediction coding in wide band audio coding.

CO2: Analyze various masking's for Codec Perceptual Model-MPEG1.

CO3: Apply various transform coding in audio coding standards.

CO4: Analyze quality metrics to measure the quality of generated audio signals.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION (09 Periods)
A General Perceptual Audio Coding Architecture, Audio Coder Attributes, Types of Audio Coders, Linear Prediction coding- Short Term Linear Prediction, Open-Loop Analysis-Synthesis Linear Prediction, Analysis-by-Synthesis Linear Prediction, Linear Prediction in Wideband Audio Coding.

UNIT-II: PSYCHOACOUSTIC PRINCIPLES (09 Periods)
Introduction, Absolute Threshold of Hearing, Critical Bands, Masking- Noise Masking Tone, Tone Masking Noise, Noise Masking Noise, Asymmetry of Masking; Non simultaneous Masking, Perceptual Entropy, Example Codec Perceptual Model-MPEG1; Perceptual Bit Allocation.

UNIT-III: TRANSFORM CODERS (09 Periods)
Introduction, Optimum Coding in the Frequency Domain, Perceptual Transform Coder, Brandenburg-Johnston Hybrid Coder, CNET Coders,Adaptive Spectral Entropy Coding, Differential Perceptual Audio Coder, DFT Noise Substitution, DCT with Vector Quantization, MDCT with Vector Quantization.

UNIT-IV: AUDIO CODING STANDARDS AND ALGORITHMS (09 Periods)
MIDI Versus Digital Audio, Multichannel Surround Sound, MPEG Audio Standards - MPEG1 Audio, MPEG2 BC, MPEG2 NBC, MPEG Surround and Spatial Audio Coding; Adaptive Transform Acoustic Coding (ATRAC), Lucent Technologies PAC, EPAC, Dolby Audio Coding Standards AC-2, Audio Processing Technology APT-x100, DTS – Coherent Acoustics.

UNIT-V: QUALITY MEASURES FOR PERCEPTUAL AUDIO CODING (09 Periods)

Subjective Quality Measures, Confounding Factors in Subjective Evaluations, Subjective Evaluations of Two-Channel Standardized Codecs, Subjective Evaluations of 5.1-Channel Standardized Codecs, Subjective Evaluations Using Perceptual Measurement Systems- CIR Schemes, NSE Schemes; Algorithms for Perceptual Measurement- PAQM, NMR, OASE; Standards for Perceptual Quality Measurement.

Total Periods: *45*

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOK:

1. Andreas Spanias Ted Painter Venkatraman Atti, *Audio Signal Processing and Coding*, John Wiley & Sons, Inc., Publications, 2007

REFERENCE BOOKS:

1. Udo Zolzer, *Digital Audio Signal Processing*, ,John Wiley & Sons, Inc., Publications, 2nd Edition 2008
2 Francis F. Li and Trevor J. Cox, *Digital Signal Processing in Audio and Acoustical Engineering*, CRC Press, 2019.

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
CO1	3	3	-	-	3	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	-	2	3	1	-	3	-	-	-	-	3	-	-
CO4	3	3	-	2	-	1	-	2	-	-	-	-	3	-	-
Average	3	2.7	1	2	3	1	-	2.5	-	-	-	-	3	-	-
Course Correlation Level	**3**	**3**	**1**	**2**	**3**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

III B. Tech. – II Semester

(19BH60403) **NETWORK ON-CHIP 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: NOC –Architecture Design, Switching Technique; Routing Algorithm; Fault tolerance; Testing; 2D and 3D NOC.

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

CO1: Analyze switching techniques and routing strategies in Network on-chip topologies to improve Quality of Service in communication applications.

CO2: Design Router architectures for reliable communication in network on-chip designs.

CO3: Develop routing algorithms to avoid deadlock problems in Routing Architecture. CO4: Apply test, fault tolerance, Power and monitoring strategies to reduce the occurrence of dead and Live lock condition during Fault tolerance.

CO5: Analyze protocols for the development of 3D Network-On-Chip Architectures.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO NOC (08 Periods)

Introduction to NoC, OSI layer rules in NoC, Interconnection Networks in Network-on-Chip Network Topologies, Switching Techniques, Routing Strategies, Flow Control Protocol, Quality-of-Service Support.

UNIT-II: ARCHITECTURE DESIGN (08 Periods)

Switching Techniques and Packet Format, Asynchronous FIFO Design, GALS Style of Communication, Wormhole Router Architecture Design, VC Router Architecture Design, Adaptive Router Architecture Design.

UNIT-III: ROUTING ALGORITHM (08 Periods)

Packet routing- Deadlock, Deadlock Recovery and Avoidance Livelock, QoS, congestion control and flow control, router design, network link design- Planar and Vertical Link, Routing Algorithms- Bufferless ,regular, Irregular Architectures.

UNIT-IV: TEST AND FAULT TOLERANCE OF NOC (08 Periods)

Test and Fault Tolerance Issues, Test Methods and Fault Models, Monitoring Services for Networks-on Chips- Monitoring Objectives and Opportunities, Monitoring Architecture and Information, Energy and Power Issues- Energy and Power Reduction Technology, Power Modeling Methodology.

UNIT-V: THREE-DIMENSIONAL INTEGRATION OF NETWORK-ON-CHIP

(08 Periods)

Three-Dimensional Networks-on-Chips Architectures, Resource Allocation for QoS On-Chip Communication, Networks-on-Chip Protocols.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOK:

1. Chrysostomos Nicopoulos, Vijay krishnan Narayanan, Chita R.Das, *"Networks-on - Chip Architectures Holistic Design Exploration"*, Springer, 2009.

REFERENCES:

1. Fayezge bali, Haythamelmiligi, Hqhahed Watheq E1-Kharashi, *Networks-on-Chips theory and practice*, CRC press, 1st Edition, 2009.
2. Konstantinos Tatas and Kostas Siozios, *Designing 2D and 3D Network-on-Chip Architectures*, 2013.
3. Palesi, Maurizio, Daneshtalab, Masoud *Routing Algorithms in Networks-on-Chip*, 2014.
4. Santanu Kundu, Santanu Chattopadhyay, *Network-on-Chip: The Next Generation of System on-Chip Integration,* CRC Press, 2018.

ADDITIONAL LEARNING RESOURCES

1. https://www.hindawi.com/journals/jece/2012/509465/
2. https://nptel.ac.in/courses/106103183/22

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
CO1	3	3	1	-	1	-	-	-	-	-	-	-	3	-	-
CO2	3	2	3	-	1	-	-	-	-	-	-	-	3	-	-
CO3	3	1	3	-	1	-	-	-	-	-	-	-	3	-	-
CO4	3	2	1	-	3	-	-	1	-	-	-	-	3	-	-
CO5	3	3	-	-	-	-	-	1	-	-	-	-	3	-	-
Average	3	2	2	-	1.5	-	-	1	-	-	-	-	3	-	-
Course Correlation Level	3	2	2	-	2	-	-	1	-	-	-	-	3	-	-

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

III B. Tech. – II Semester
(19BH60404) **RFIC 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:
Basics of RF IC Design, Assessment Parameters, Transceiver Architectures, Low Noise Amplifiers, Mixers, Oscillators, Phase Locked Loop, Power Amplifiers.

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

CO1: Analyze the effects of Nonlinearity and metrics in the evaluation of RF IC Designs.

CO2: Analyze various architectures and components of transceivers in RF systems.

CO3: Solve input matching problems and considerations for the development of Low Noise Amplifiers and Mixers.

CO4: Apply various design Techniques to improve the performance of oscillators.

CO5: Design Phase Locked Loops and Power Amplifiers to overcome non idealities for efficient operation at wide range of RF frequencies.

DETAILED SYLLABUS:

UNIT-I: BASIC CONCEPTS IN RF IC DESIGN (07 Periods)
Introduction to RF Design, Units in RF design, Time Variance and Nonlinearity, Effects of nonlinearity, random processes and Noise, Definitions of sensitivity and dynamic range, Passive impedance transformation, Scattering parameters.

UNIT-II: TRANSCEIVER ARCHITECTURES (11 Periods)
General considerations, Receiver Architectures - Basic Heterodyne receivers, Modern heterodyne receivers, Direct conversion receivers, Image-Reject receivers, Low-IF receivers. Transmitter Architectures - Direct Conversion transmitters, Modern direct conversion Transmitters, Heterodyne Transmitters.

UNIT-III: LNA AND MIXERS (10 Periods)
General considerations, Problem of input matching, Low Noise Amplifiers design topologies, Gain Switching, Band Switching, Mixers - General considerations, Passive down conversion mixers, Active down conversion mixers, Up conversion mixers.

UNIT-IV: OSCILLATORS (08 Periods)
Performance parameters, Basic principles, Cross coupled oscillator, Three point oscillators, Voltage Controlled Oscillators, phase noise, Quadrature Oscillators.

UNIT-V: PLL AND POWER AMPLIFIERS **(09 Periods)**

PLLs - Phase detector, Type-I PLLs, Type-II PLLs, PFD/CP Non idealities, Phase noise in PLLs. Power Amplifiers - General considerations, Classification of power amplifiers, High - Efficiency power amplifiers, Linearization techniques.

Total Periods: *45*

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOK:

1. B. Razavi, "*RF Microelectronics*", Prentice-Hall PTR, 2nd Edition, 2011.

REFERENCE BOOKS:

1. T. H. Lee, "*The Design of CMOS Radio-Frequency Integrated Circuits*", Cambridge University Press, 2^{nd} Edition, 2004.
2. R. Jacob Baker, Harry W. Li, D.E. Boyce, "*CMOS Circuit Design, Layout and Simulation*", Wiley-IEEE Press, 4^{th} Edition, 2019.

ADDITIONAL LEARNING RESOURCES:

http://www.mhhe.com/engcs/electrical/razavi/ppt.mhtml
https://nptel.ac.in/courses/117102012/

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	2	-	-	-	-	-	-	-	3	-	-
CO3	3	2	-	3	2	-	-	-	-	-	-	-	3	-	-
CO4	3	2	-	-	3	-	-	-	-	-	-	-	3	-	-
CO5	3	2	3	2	-	-	2	-	-	-	-	-	3	-	-
Average	3	2.4	3	2.3	2.3	-	2	-	-	-	-	-	3	-	-
Course Correlation Level	**3**	**3**	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

IV B. Tech. - I Semester

(19BH70401) **ADVANCED WIRELESS COMMUNICATIONS**

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

PREREQUISITES: Courses on Analog Communications and Digital Communications

COURSE DESCRIPTION: Introduction to wireless communication systems and cellular concept, Large and Small signal Propagation models, Equalization & Diversity techniques, Multiple access and Multiple Input and Multiple Output (MIMO) systems

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

CO1: Demonstrate the concepts of wireless communications and cellular systems

CO2: Analyze the characteristics of mobile radio propagation channels.

CO3: Apply appropriate equalization & diversity techniques for wireless communication systems

CO4: Apply various multiple access techniques for narrow and wideband systems.

CO5: Design MIMO systems for advanced wireless communications

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO WIRELESS COMMUNICATION SYSTEMS (09 Periods)

History of Wireless Communications, Wireless Vision, Technical Issues; Current Wireless Systems - Cellular Telephone Systems, Cordless Phones, Wireless Local Area Networks, Wide Area Wireless Data Services, Broadband Wireless Access, Paging Systems, Satellite Networks, Low-Cost & Low-Power Radios - Bluetooth and ZigBee, Ultrawideband Radios; Wireless Spectrum - Methods for Spectrum Allocation, Spectrum Allocations for Existing Systems; Standards.

UNIT–II: MOBILE RADIO PROPAGATION (09 Periods)

Large Scale Path Loss: Introduction, Free Space Propagation Model, Relating Power to Electric field, Propagation Mechanisms – Reflection, Diffraction, and Scattering. Outdoor and Indoor Environment Propagation Models, Practical Budget Design using Path Loss Models.

Small Scale Fading and Multipath: Small Scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small Scale Multipath Measurements, Parameters of Mobile Channels, Types of Small Scale Fading.

UNIT-III: EQUALIZATION & DIVERSITY TECHNIQUES (09 Periods)

Equalization: Introduction, Survey of Equalization Techniques, Linear and Non-linear Equalizers – Linear Transversal Equalizer, Decision Feedback Equalizer (DFE).

Diversity Techniques: Realization of Independent Fading Paths, Receiver Diversity – System Model, Selection Combining, Threshold Combining, Maximal Ratio Combining, and Equal Gain Combining, Rake receiver. Transmit Diversity–Channel known at Transmitter, Channel unknown at Transmitter – Alamouti Scheme, analysis.

UNIT-IV: MULTIPLE ACCESS TECHNIQUES (09 Periods)

Narrowband cellular systems: GSM system, Impact on network and system design, Impact on frequency reuse.

Wideband systems: CDMA**,** CDMA uplink, CDMA downlink, System issues, **OFDM**: Allocation design principles, Hopping pattern, Signal characteristics and receiver design, Sectorization

UNIT-V: Multiple Input Multiple Output (MIMO) Systems (09 Periods)

Introduction to MIMO, MIMO Channel Capacity, SVD and Eigen modes of the MIMO Channel, MIMO Spatial Multiplexing - BLAST, MIMO Diversity – OSTBC, MRT, Applications of MIMO - OFDM.

Total periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. T. S. Rappaport, "*Wireless Communications: Principles and Practice*," Pearson Education, 2nd Edition, 2010.
2. David Tse, Pramod Viswanath, "*Fundamentals of Wireless Communication*," Cambridge University Press, 2005.
3. Andrea Goldsmith, "*Wireless Communications*," Cambridge University Press, 2005.

REFERENCE BOOKS:

1. Aditya K. Jagannatham, "*Principles of Modern Wireless Communications Systems – Theory and Practice",* McGraw-Hill International, 2017.
2. William C.Y. Lee, "*Wireless and Cellular Telecommunications,*" 3rd edition, McGraw Hill, 2006.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117/104/117104099/
2. https://nptel.ac.in/courses/117/104/117104115/
3. https://nptel.ac.in/courses/117/105/117105132/

CO-PO-PSO Mapping Table

Course outcome	Program outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-		-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	-	-	2	-	-	-	-	-	-	3	-
CO3	3	2	3	2	3	-	-	-	-	-	-	-	-	3	-
CO4	3	2	2	3	3	-	-	-	-	-	-	-	-	3	-
CO5	3	2	3	2	2	-	-	-	-	-	-	-	-	3	-
Average	**3**	**2**	**2.5**	**2.2**	**2.6**	**-**	**2**	**-**	-	**-**	**-**	**-**	**-**	**3**	**-**
Course correlation Level	**3**	**2**	**3**	**2**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

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

IV B. Tech. - I Semester

(19BH70402) **OPTICAL NETWORKS**

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

PRE-REQUISITES: -

COURSE DESCRIPTION:

Introduction to Optical Networks, Transmission System Engineering, Client Layers of Optical Layer, WDM, Network Elements and Design, Network Topologies and Protection Schemes

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

CO1: Demonstrate the Optical networks, management techniques and functions.

CO2: Analyze Optical Amplifiers and Wavelength Conversion for Overall Design Considerations of optical networks

CO3: Solve problems in signaling and Routing for optical layers

CO4: Design optical network elements for routing networks

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO OPTICAL NETWORKS (09 Periods)

Telecommunications Networks Architecture, Services, circuit switching and packet switching, Optical Networks, The Optical Layer, Transparency and All-Optical Networks, Optical Packet Switching, Transmission Basics, Network Evolution,

UNIT-II: TRANSMISSION SYSTEM ENGINEERING (09 Periods)

System Model, Power Penalty, Transmitter, Receiver, Optical Amplifiers - Gain Saturation in EDFAs, Gain Equalization in EDFAs, Amplifier Cascades, Amplifier Spacing Penalty, Power Transient s and Automatic Gain Control, Lasing Loops, Crosstalk - Intra and inter channel crosstalk, crosstalk in networks, crosstalk reduction, Dispersion- Chromatic Dispersion Limits: NRZ and RZ Modulation, Wavelength Stabilization, Design of Soliton Systems, Design of Dispersion-Managed Soliton Systems, Overall Design Considerations-Fiber type, Transmitter power and Amplifier Spacing.

UNIT-III: CLIENT LAYERS OF OPTICAL LAYER (09 Periods)

SONET and SDH – multiplexing, VCAT and LCAS, SONET/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layers, Elements of a SONET/SDH Infrastructure, Optical Transport Networks -hierarchy, Frame structure, multiplexing, Generic Framing Procedure (GFP), IP- Routing and Forwarding, Quality of Service, Multiprotocol label switching-Labels and forwarding Quality of service, Signaling and Routing, Carrier Transport, Storage area networks-Fibre Channel.

UNIT-IV: WDM, NETWORK ELEMENTS AND DESIGN (09 Periods)

Optical line terminals, Optical line amplifiers, Optical Add/Drop Multiplexers-OADM Architectures, Reconfigurable OADMs, Optical Cross connecters - All optical cross connecters Cost Trade-Offs: A detailed ring network example, LTD and RWA Problems-Light path topology Design, Routing and Wavelength Assignment, Wavelength Conversion, Dimensioning Wavelength-Routing Networks, Statistical Dimensioning Models, First-Passage Model, Blocking Model, Maximum load Dimensioning Models-Offline light path Requests, Online RWA in Rings

UNIT-V: NETWORK TOPOLOGIES AND PROTECTION SCHEMES, MPLS AND OPTICAL NETWORKS (09 Periods)

Robust networks, Line and path protection switching, Types of topology, Point to point topology, bi-directional line-switched ring (BLSR), meshed topology, Passive optical networks, Metro optical networks 28 MPLS and Optical Networks: IS label switching, Forwarding equivalence class (FEC), Types of MPLS nodes, Label distribution and binding, label swapping and traffic forwarding, MPLS support of Virtual Private Networks (VPN), MPLS traffic engineering, Multi protocol Lambda switching (MPIS).

Total Periods: *45*

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Rajiv Ramaswami and Kumar Sivarajan, "*Optical Networks–Practical Perspective*", 3rd Edition, Morgan - Kaufmann Publishers (ELSEVIER), 2010 ISBN: 978-0-12-374092-2.
2. Uyless Black, "*Optical Networks:Third Generation Transport Systems*", Pearson India,2008.

REFERENCE BOOKS:

1. Partha Pratim Sahu, "*Fundamentals of Optical Networks and Components*", CRC Press, July 10, 1st Edition, 2020. ISBN 9780367265458
2. Mukherjee, B., Tomkos, I., Tornatore, M., Winzer, P., Zhao, Y. (Eds.), "*Springer Handbook of Optical Networks*", 1st Edition, 2020. ISBN 978-3-030-16250-4.

ADDITIONAL LEARNING RESOURCES:

1. Mohammad Ilyas and Hussein T. Mouftah, "The Handbook of Optical communication networks", CRC Press.
2. https://onlinecourses.nptel.ac.in/noc20_ee79

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**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	2	-
CO2	3	3	1	1	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	-	3	-	-	-	-	-	-	-	-	3	2	3
CO4	3	2	3	2	-	-	-	-	-	-	-	-	2	2	3
Average	3	2.6	2	2	-	-	-	-	-	-	-	-	2.7	2	3
Course Correlation Level	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**3**

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

IV B. Tech. - I Semester
(19BH70403) **PATTERN RECOGNITION**

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

PRE-REQUISITES: A course on Digital 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 (09 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 (09 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 **(09 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 **(08 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, Second Edition, 2009.

REFERENCE BOOKS:

1. Richard Duda, Peter E Hart, David G Stork, *Pattern Classification*, John Wiley & Sons, Second Edition, 2001.
2. Christopher M.Bishop, *Pattern Recognition and Machine Learning,* Springer Publications, 2006.

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
CO1	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	2	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	3	2	1	-	-	-	-	-	-	-	-
Average	3	3	1	2.6	3	2	1	-	-	-	-	-	-	-	-
Course Correlation Level	3	3	1	3	3	2	1	-	-	-	-	-	-	-	-

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

IV B. Tech. - I Semester

(19BH70404) VLSI SIGNAL PROCESSING

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

PREREQUISITES: Courses on VLSI Design and Digital Signal Processing

COURSE DESCRIPTION:

Introduction to Typical DSP Algorithms, Data Flow graph Representations, Iteration Bound, The Minimum Cycle Mean Algorithm, Pipelining and Parallel Processing techniques, Retiming concepts, Fast Convolution, Arithmetic Strength Reduction techniques for Filter design, Pipelining and Parallel Processing for design of IIR Filters.

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

CO1: Analyze various DSP algorithms to design digital and adaptive Filter Banks to improve performance characteristics of digital systems in multidisciplinary environments such as image processing, wireless communication, biomedical engineering, speech processing, video processing, etc

CO2: Analyze iterative bound, parallel and pipelining processing methods in the frequency analysis of FIR filters.

CO3: Understand convolution methods and arithmetic strength reductions in analyzing Parallel FIR filters.

CO4: Design IIR filters by applying pipelining and parallel processing techniques.

CO5: Analyze scaling and round off noise to evaluate the performance of digital filters.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO DIGITAL SIGNAL PROCESSING (07 Periods)

Typical DSP Algorithms – Convolution, Correlation, Digital Filters, Adaptive Filters. Representation of DSP Algorithms - Block Diagrams, Signal-Flow Graph, Data-Flow Graph.

UNIT-II: ITERATION BOUND, PIPELINING AND PARALLEL PROCESSING OF FIR FILTER (08 Periods)

Iteration Bound - Data-Flow Graph Representations, Loop Bound and Iteration Bound, Algorithms for Computing Iteration Bound-Longest Path Matrix Algorithm, The Minimum Cycle Mean Algorithm.

Pipelining and Parallel Processing - Pipelining of FIR Digital Filters. Parallel Processing, Pipelining and Parallel Processing for Low Power.

Retiming – Definitions and Properties, Solving Systems of Inequalities, Retiming Techniques.

UNIT-III: FAST CONVOLUTION AND ARITHMETIC STRENGTH REDUCTION IN FILTERS (10 Periods)

Fast Convolution - Cook-Toom Algorithm, Modified Cook-Toom Algorithm, Design of Fast Convolution Algorithm by Inspection.

Parallel FIR filters, Fast FIR algorithms - Two parallel and three parallel fast FIR algorithms. Low- Complexity FIR Filters. Parallel architectures for Rank Order filters – Odd-Even Merge-Sort architecture, Rank Order filter architectures, Parallel Rank Order filters, Running Order Merge – Sorter, Low power Rank Order filter.

UNIT-IV: PIPELINED AND PARALLEL RECURSIVE FILTERS (10 Periods)

Pipeline Interleaving in Digital Filters, Pipelining in 1^{st}Order IIR Digital Filters, Pipelining in Higher-Order IIR Digital Filters-Clustered Look-Ahead Pipelining, Stable Clustered Look-Ahead Filter Design. Parallel Processing for IIR Filters.

UNIT-V: SCALING AND ROUNDOFF NOISE (10 Periods)

Scaling and Round off Noise, State Variable Description of Digital Filters, Scaling and Round off Noise Computation, Round off Noise Computation Using State Variable Description, Slow-Down, Retiming and Pipelining.

Total Periods: 45

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOK:

1. K.K Parhi, "*VLSI Digital Signal processing*", John Wiley, 1999.

REFERENCE BOOKS:

1. John G.Proakis, Dimitris G.Manolakis, "*Digital Signal Processing*", Prentice Hall of India, Fourth Edition, 2007.
2. George A. Constantinides, Peter Y.K. Cheung, Wayne Luk, "*Synthesis and Optimization of DSP Algorithms*", Kluwer Academic Publishers, 2004.

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
CO1	3	3	-	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	2	2	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	3	2	3	-	-	-	-	-	-	-	3	-	-
CO5	3	3	-	2	3	-	-	-	-	-	-	-	3	-	-
Average	3	2.6	2.5	2	3	-	-	-	-	-	-	-	3	-	-
Course Correlation Level	**3**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

MINOR DEGREE

(SVEC-19 Regulations)

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			C	Scheme of Examination Max. Marks		
			L	T	P		Int. Marks	Ext. Marks	Total Marks
III B.Tech. I-Sem (2 Theory+ 1 Lab)	19BM50401	Switching Theory and Logic Design	3	-	-	3	40	60	100
	19BM50402	VLSI Design	3	-	-	3	40	60	100
	19BM50403	Microcontrollers	3	-	-	3	40	60	100
	19BM50431	Digital design Lab	-	-	2	1	40	60	100
III B.Tech. II-Sem. (2 Theory+ 1 Lab)	19BM60401	ARM and AVR Microcontrollers	3	-	-	3	40	60	100
	19BM60402	Testing and Testability	3	-	-	3	40	60	100
	19BM60403	Low Power CMOS VLSI Design	3	-	-	3	40	60	100
	19BM60404	Microprocessors and Microcontrollers	3	-	-	3	40	60	100
	19BM60431	VLSI Lab	-	-	2	1	40	60	100
IV B.Tech. I-Sem. (1 Theory+ 1 Lab)	19BM70401	Embedded Systems	3	-	-	3	40	60	100
	19BM70402	Real Time Systems	3	-	-	3	40	60	100
	19BM70403	System-on-Chip Design and verification	3	-	-	3	40	60	100
	19BM70431	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
(19BM50401) 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 (08 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 (09 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 (07 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

CO-PO-PSO Mapping Table

Course outcome	**Program Outcomes**														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	3	1	-	1	1	-	-	-	-	-	3	-	-
CO3	3	2	3	1	-	1	1	-	-	-	-	-	3	-	-
CO4	3	2	3	1	-	1	1	-	-	-	-	-	3	-	-
Average	3	2	3	1	-	1	1	-	-	-	-	-	3	-	-
Course Correlation Level	**3**	**2**	**3**	**1**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

III B. Tech. – I Semester

(19BM50402) **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 (08 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 sholeh Eshraghian, *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 & Practices*, Pearson Education Asia, 4th Edition, 2008.
2. John M. Rabaey, *Digital Integrated Circuits: A Design Perspective*, PHI, 2nd Edition, 2003.

CO-PO-PSO Mapping Table

Course outcome	Program outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	3	2	-	-	-	2	-	-	-	-	3	-	-
CO4	3	2	3	2	-	1	1	2	-	-	-	-	3	-	-
Average	3	2.5	3	2	-	1	1	2	-	-	-	-	3	-	-
Course Correlation Level	**3**	**3**	**3**	**2**	**-**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

III B. Tech. - I semester
(19BM50403) **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 (07 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 (08 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

CO-PO-PSO Mapping Table

Course outcome	Program outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	3	-	-	1	-	-	-	-	-	-	3	-	-
CO4	3	2	3	1	-	1	-	1	-	-	-	-	3	-	-
Average	3	2.5	3	1	-	1	-	1	-	-	-	-	3	-	-
Course Correlation Level	3	3	3	1		1		1	-	-	-	-	3	-	-

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

III B. Tech. – I Semester

(19BM50431) DIGITAL DESIGN LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	-	-	2	1

PRE-REQUISITES: Courses on Switching Theory and Logic Design/Digital Logic Design & Electronic Devices and Circuits.

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, 4^{th}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

CO-PO-PSO Mapping Table

Course outcome	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	-	2	2	2	2	-	-	-	-	3	-	-
CO2	3	2	3	-	2	2	2	2	-	-	-	-	3	-	-
CO3	3	3	2	-	3	2	-	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	3	2.33	2.66	-	2.33	2	2	2	3	3	-	-	3	-	-
Course Correlation Level	**3**	**3**	**3**	**-**	**3**	**2**	**2**	**2**	**3**	**3**	**-**	**-**	**3**	**-**	**-**

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

III B. Tech. – II Semester

(19BM60401) 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 (09 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 (09 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 (09 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 **(08 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, Sarmad Naimi 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

CO-PO-PSO Mapping Table

Course outcome	**Program Outcomes**														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	2	2	1
CO2	3	3	3	2	2	1	-	-	-	-	-	-	2	2	1
CO3	3	3	3	2	1	1	2	3	-	-	-	-	2	1	1
CO4	3	2	3	2	3	1	3	2	-	-	-	-	-	1	1
Average	3	2.7	2.7	2	2	1	2.5	2.5	-	-	-	-	2	1.5	1
Course Correlation Level	**3**	**3**	**3**	**2**	**2**	**1**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**2**	**1**

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

III B. Tech. – II Semester

(19BM60402) 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 (09 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 (06 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 (09 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. Miron Abramovici, 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

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
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	2	2	-	2	3	-	-	-	-	3	-	-
CO4	3	-	-	-	-	-	-	3	-	-	-	-	3	-	-
Average	3	3	2	2	-	-	2	3	-	-	-	-	3	-	-
Course correlation Level	**3**	**3**	**2**	**2**	**-**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

III B. Tech. - II semester

(19BM60403) 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 (9 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/

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
CO1	3	2	2	2	-	-	-	3	-	-	-	-	3	-	-
CO2	3	3	2	2	-	-	-	3	-	-	-	-	3	-	-
CO3	3	2	3	2	1	-	1	3	-	-	-	-	3	-	-
CO4	3	2	2	2	3	-	1	3	-	-	-	-	3	-	-
Average	3	2.2	2.2	2	2	-	1	3	-	-	-	-	3	-	-
Course Correlation Level	**3**	**2**	**2**	**2**	**2**	**-**	**1**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

III B. Tech. - II semester
(19BM60404) 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 Gillispie Mazidi, *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.

CO-PO-PSO Mapping Table

Course outcome	Program outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	2	-	-	-	-	-	-	-	3	1	2
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	3	1	-	1	-	1	-	-	-	-	3	1	2
Average	3	2.5	3	1	2	1	-	1	-	-	-	-	3	1	2
Course Correlation Level	3	3	3	1	2	1		1	-	-	-	-	3	1	2

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

III B. Tech. – II Semester
(19BM60431) **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

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
CO1	3	3	-	2	3	1	-	-	-	-	-	-	3	-	-
CO2	3	1	3	2	3	1	-	-	-	-	-	-	3	-	-
CO3	3	2	3	2	3	1	-	-	-	-	-	-	3	-	-
CO4	3	2	3	2	3	1	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	3	2	2.5	2	3	1	-	-	3	3	-	-	3	-	-
Course Correlation Level	**3**	**2**	**3**	**2**	**3**	**1**	**-**	**-**	**3**	**3**	**-**	**-**	**3**	**-**	**-**

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

IV B. Tech. – I Semester
(19BM70401) **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

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**
CO1	3	3	-	1	-	-	-	-	-	-	-	-	2	1	-
CO2	3	3	2	3	2	2	-	-	-	-	-	-	2	2	-
CO3	3	3	3	2	2	2	-	2	-	-	-	-	1	2	2
CO4	3	3	2	2	2	2	-	2	-	-	-	-	1	1	1
Average	3	3	2.3	2	2	2	-	2	-	-	-	-	1.5	1.5	1.5
Course Correlation Level	**3**	**3**	**3**	**2**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

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

IV B. Tech. – I Semester

(19BM70402) **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 & 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 (09 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 (09 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 (09 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 (09 Periods)

Introduction, Failures- Causes, Types, Detection. Fault and Error Containment, Redundancy- Hardware, Software, Time, Integrated Failure Handling.

UNIT-V: OPERATING SYSTEMS **(09 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.

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
CO1	3	3	2	2	-	-	-	3	-	-	-	-	3	-	-
CO2	3	3	2	2	-	-	-	3	-	-	-	-	3	-	-
CO3	3	2	3	2	1	-	1	3	-	-	-	-	3	-	-
CO4	3	2	3	2	3	-	1	3	-	-	-	-	3	-	-
Average	3	2.5	2.5	2	2	-	1	3	-	-	-	-	3	-	-
Course Correlation Level	**3**	**3**	**3**	**2**	**2**	**-**	**1**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

IV B. Tech. – I Semester

(19BM70403) SYSTEM-ON-CHIP DESIGN AND VERIFICATION

Int.	Ext.	Total	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. Farzed Nekoogar, Faranak Nekoogar, "*From ASICs to SOCs: A Practical Approach*", China Machine Press, 2006.

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**
CO1	3	2	-	1	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-	3	-	-
CO4	3	1	2	2	3	-	-	-	-	-	-	-	3	-	-
Average	3	2.2	2	1.2	3	-	-	-	-	-	-	-	3	-	-
Course Correlation Level	3	2	2	1	3	-	-	-	-	-	-	-	3	-	-

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

IV B. Tech. – I Semester

(19BM70431)**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, 1stEdition, 2008.
2. C P Ravikumar, *MSP430 Microcontrollers in Embedded System Projects*, Elite Publishing House , 1stEdition, 2012.

SOFTWARE/Tools used:

Code Composer Studio Version 6, Energia, MSP430 launch pads, Wi-Fi booster pack.

CO-PO-PSO Mapping Table

Course Outcome	Program Outcomes												Program specific outcomes		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO2**	**PSO 3**
CO1	3	3	1	2	2	-	-	-	-	-	-	-	2	2	-
CO2	3	3	2	3	2	1	1	-	-	-	-	1	2	2	-
CO3	3	3	3	2	1	1	-	-	-	-	-	2	2	3	-
CO4	3	3	3	2	1	1	1	2	-	-	-	2	-	2	3
C05	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Average	3	3	2.2	2.2	1.5	1	1	2	3	3	-	1.6	2	2.2	3
Course Correlation Level	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**2**	**3**	**3**	**-**	**2**	**2**	**2**	**3**

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