ACADEMIC REGULATIONS

COURSE STRUCTURE

AND

DETAILED SYLLABI

OF

ELECTRICAL AND ELECTRONICS ENGINEERING

FOR

B.TECH REGULAR FOUR YEAR DEGREE PROGRAM

(For the batches admitted from 2020-2021)

&

FOR B.TECH LATERAL ENTRY PROGRAM

(For the batches admitted from 2021-2022)

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 ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To become the Nation's premiere centre of excellence in electrical engineering through teaching, training, research and innovation to create competent engineering professionals with values and ethics.

MISSION

- Imparting Knowledge through implementing modern curriculum, academic flexibility and learner centric teaching methods in Electrical Engineering.
- Inspiring students for aptitude to research and innovation by exposing them to industry and societal needs to creating solutions for contemporary problems.
- Honing technical and soft skills for enhanced learning outcomes and employability of students with diverse background through comprehensive training methodologies.
- Inculcate values and ethics among students for a holistic engineering professional practice.

PROGRAM EDUCATIONAL OBJECTIVES

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

1. Enrolled in academic program in the disciplines of electrical engineering, multidisciplinary areas and management studies.
2. Become entrepreneurs or be employed as productive and valued engineers in reputed industries.
3. Engage in lifelong learning, career enhancement and adopt to changing professional and societal needs.

PROGRAM OUTCOMES

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

PSO1: **Plan** to **conserve and harness** electrical energy using electrical and electronic systems for **sustainability**.

PSO2: Use domain specific **tools** to **analyze, design and develop** electrical and electronic systems for feasible operation and control of Electrical and Electronic Systems.

PSO3: Develop **operating strategies** for utilization of energy and **application** of Electrical and Electronics systems in relevance to industry and society.

SREE VIDYANIKETHAN ENGINEERING COLLEGE

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

ACADEMIC REGULATIONS (SVEC-20)
CHOICE BASED CREDIT SYSTEM

B.Tech. Regular Four Year Degree Program
(For the batches admitted from the academic year 2020–21)

and

B.Tech. (Lateral Entry Scheme)
(For the batches admitted from the academic year 2021-22)

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

1. Applicability:

All the rules specified herein, approved by the Academic Council, shall be in force and applicable to students admitted from the academic year 2020-2021 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
9) Computer Science and Business Systems
10) Computer Science and Engineering (Artificial Intelligence)

11) Computer Science and Engineering (Data Science)
12) Computer Science and Engineering (Artificial Intelligence & Machine Learning)
13) Computer Science and Engineering (Internet of Things)
14) Computer Science and Engineering (Cyber Security)
15) Computer Science and Design

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 22 weeks 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/APSCHE 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. Maximum Duration:

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) SO (Skill Oriented) Courses

(viii) Mandatory Courses (MC)

(ix) Audit Courses (AC)

(x) Projects (PR) (Internships, Project Work)

S.No	Course Category	Course Type
1.	HS – Humanities and Social Sciences	Humanities, Social Sciences and Management.
2.	BS – Basic Sciences	Mathematics, Physics and Chemistry Courses, etc.
3.	ES – Engineering Sciences	Fundamental Engineering courses.
4.	PC – Professional Core	Core courses related to the Parent Discipline/ Branch of Engineering.
5.	PE – Professional Electives	Elective courses related to the Parent Discipline/ Branch of Engineering.
6.	OE – Open Electives	Electives from other technical and /or emerging courses
7.	SO (Skill Oriented) Courses	Basic and advanced skills related to the domain courses, soft skills course
8.	PR - Projects	Summer Internships, Internship, Project Work
9.	MC - Mandatory Courses	Induction Program, Environmental Science, Universal Human Values
10.	AC - Audit Courses	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.

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

For Summer Internships, 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 **121** 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, value added, Skill oriented courses etc. 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. Break of Study from a Program (Gap Year)

10.1. 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.

10.2. 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.

10.3. 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.

10.4. 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.

10.5. 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).

10.6. 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.

11. Examination System:

11.1 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>70</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 70 marks.
The question paper shall be of descriptive type with FIVE EITHER/OR type questions, ONE EITHER/OR type question from each unit [totally ten questions from Q. No. 1 to 10)] of which student has to answer one from each EITHER/OR type question and shall be evaluated each for 14 marks.</td></tr>
<tr><td rowspan="2">30</td><td>10</td><td>Assignments (Internal evaluation)</td><td>One Assignment shall be given to the student for 10 marks during the semester.</td></tr>
<tr><td>20</td><td>Mid-term Examination of 2 hours duration (Internal evaluation)</td><td>Two mid-term examinations each for 20 marks shall be conducted. For a total of 20 marks, 80% of better one of the two and 20% of the other one are added and finalized, any fraction shall be rounded off to the higher integer number.
The examination shall be conducted and evaluated for 40 marks and scaled down to 20 marks, any fraction shall be rounded off to the higher integer number.
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 of descriptive type with two parts i.e., Part-A and Part-B. Part-A shall contain 5 short answer questions [Q. No. 1 (a) to (e)] and evaluated each for 2 marks. Part-B shall contain three EITHER/OR type questions [totally six questions from Q. No. 2 to 7)] of which student has to answer one from each EITHER/OR type question and shall be evaluated each for 10 marks. Further, in the case of Part-B of Mid-I, one EITHER/OR type question from each unit and third either or type question from both the units; and for Mid-II, one EITHER/OR type question from each unit.</td></tr>
<tr><td rowspan="3">2.</td><td rowspan="3">Laboratory</td><td>70</td><td colspan="2">Semester-end Lab Examination for 3 hours duration (External evaluation)</td><td>The examination shall be conducted by the faculty member handling the laboratory (Examiner-2) and another faculty member (Examiner-1) appointed by the Chief Controller of Examinations.</td></tr>
<tr><td rowspan="2">30</td><td>20</td><td>Day-to-Day evaluation for Performance in laboratory experiments and Record.
(Internal evaluation)</td><td rowspan="2">Two laboratory examinations each for 30 marks which include Day-to-Day evaluation and Practical examination shall be evaluated by the faculty member. For a total of 30 marks 80% of better one of the two and 20% of the other one are added and finalized, any fraction shall be rounded off to the higher integer number.
Mid-I: Shall be conducted just before FIRST mid-term theory examinations.
Mid-II: Shall be conducted just before SECOND mid-term theory examinations.</td></tr>
<tr><td>10</td><td>Practical Examination
(Internal evaluation)</td></tr>
</table>

Sl. No.	Course	Marks	Examination and Evaluation		Scheme of examination
3.	Mandatory courses	30	Internal Evaluation		Shall be evaluated as given in 11.2.1
4.	Audit Courses	-	-		As detailed in 11.2.2
5.	MOOC	100	-		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 the equivalent Grade Point and Credits will be assigned as given in 11.3.
6.	Summer Internship	100	Semester-end evaluation		The evaluation shall be done by the Internship Evaluation Committee (IEC) at the end of the semester as given in 11.4.
7.	Internship	-	-		At the end of semester the student should submit an internship completion certificate as given in 11.5
8.	Project Work	200	100	Internal evaluation	Continuous evaluation shall be done by the Project Evaluation Committee (PEC) as given in 11.6.1
			100	Semester-end evaluation	Project Work Viva-Voce Examination shall be conducted by a Committee at the end of the semester as given in 11.6.2

11.2 Mandatory Course/ Audit Course Evaluation:

11.2.1. 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 mid-term 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 evaluation.** If the student FAILS, a re-examination shall be conducted for FAILED candidates in the CONSECUTIVE semester. The performance of the student shall be indicated in the grade sheets "**SATISFACTORY" (or) "NOT SATISFACTORY"** as given in 14.1**.** The student should pass all the mandatory courses, for the award of B.Tech degree.

11.2.2. Audit Courses:

Audit courses carry "**ZERO**" credits. There shall be **NO mid-term** 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.

11.3 Massive Open Online Course (MOOC)

MOOC is a web-based learning aimed at unlimited participation and open access.

11.3.1 A Student shall be permitted to pursue **two elective courses** under MOOC during the program of study. The duration of the MOOC shall be for a minimum period of 08 weeks.

11.3.2 The student shall confirm registration by enrolling the course within 10 days prior to the last instructional day of the current Semester of study along with regular courses.

11.3.3 The list of courses along with MOOC service providers shall be identified, approved and notified by the Chairman, BOS and Head of the Department.

11.3.4 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.

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

11.3.6 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.

11.4. Summer Internship

11.4.1 Students shall undergo mandatory two summer internships each with a minimum of Four weeks duration, at the end of second and third year of the Programme. The internship can be done by the students at Govt. Organizations, construction agencies, Industries, Research Centres, MNC, Academic Institutes, etc.

11.4.2 The progress of the Internship is monitored by the supervisor periodically. Evaluation of the summer internships shall be conducted by the Internship Evaluation Committee (IEC) at the end of semester. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the IEC. The report

and the oral presentation shall carry 40% and 60% weightage respectively.

11.4.3 If any student fails to complete summer internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the summer internship.

11.5. Internship

11.5.1 In the final semester of program of study, the student should mandatorily undergo internship for the entire semester and parallelly work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate. A student shall also be permitted to submit project report on the work carried out during the internship.

11.5.2 If any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

11.6 Project Work:

11.6.1 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.

11.6.2 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.

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

11.7.1. A student shall be eligible to appear for semester-end examinations if he acquires a minimum of 40% in each subject and 75% of attendance in aggregate of all the courses in a semester.

11.7.2. 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.

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

11.7.4. 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.

11.7.5. 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.

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

11.7.7. 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.

11.8. Evaluation:

Following procedure governs the evaluation.

11.8.1. 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.

11.8.2. 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.

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

11.9. 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.

11.10. 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.

12. 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:

12.1. A student shall be deemed to have satisfied the minimum academic requirements for each theory course, laboratory course, Internship and project work, if he secures not less than 35% 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.

12.2. A student shall be promoted from second year to third year of Program of study only if he fulfills the academic requirement of securing 40% credits (rounded off to lower integer number) from the following examinations (Irrespective of whether or no 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.

12.3. A student shall be promoted from third year to fourth year of Program of study only if he fulfills the academic requirements of securing 40% credits (rounded off to lower integer number)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 12.2 and 12.3 above, the student may make up the credits through supplementary examinations.

12.4. 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 CLASS based on CGPA.

12.5. 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 2021-2022):

12.6. A student shall be deemed to have satisfied the minimum academic requirements for each theory course, laboratory course, Internship and project work, if he secures not less than 35% 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.

12.7. A student shall be promoted from third year to fourth year of Program of study only if he fulfills the academic requirements of securing 40% credits (rounded off to lower integer number) 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 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.

12.8. A student shall register for all 121 credits and earn all the 121 credits. Marks obtained in all the 121 credits shall be considered for the calculation of the CLASS based on CGPA.

12.9. A student who fails to earn 121 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.

13. NCC/NSS Activities:

All students should register for NCC/NSS activities. A student will be required to participate in an activity for two hours in a week for one semester. Student shall register during Fourth or Fifth semester of the program of study. Grade shall be awarded as Satisfactory or Unsatisfactory in the mark sheet on the basis of participation, attendance, performance and behavior. If a student gets an unsatisfactory Grade, he/she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.

14. Minor Degree in a discipline:

The concept of Minor degree is introduced in the curriculum of all B. Tech. programs offering a Major degree. The main objective of Minor degree in a discipline is to provide additional learning opportunities for academically motivated students and it is an optional feature of the B.Tech. Program. In order to earn a Minor degree in a discipline, a student has to earn **20** extra credits (By studying Six Theory Courses) from the core courses of the minor discipline.

a. Students having a CGPA of 8.0 or above up to II B.Tech I-Semester without any backlogs shall be permitted to register for Minor degree by paying the requisite fee.

b. An SGPA and CGPA of 7.5 has to be maintained in the subsequent semesters without any backlog subjects in order to keep the Minor Degree registration live or else it shall be cancelled.

c. Students aspiring for a Minor degree must register from III B.Tech I-Semester onwards and must opt for a **Minor in a discipline other than the discipline** he is registered in.

d. A Student shall register for a Minor with **Eight** credits in III B.Tech I-Semester (**TWO** theory courses), **Six** credits in III B.Tech II-Semester (**TWO** theory courses- one from the pool of courses offered and other one through MOOC) and **Six** credits in IV B.Tech I-Semester (**TWO** theory courses- one from the pool of courses offered and other one through MOOC).

e. The evaluation pattern of the courses offered (for 16 credits) shall be similar to the regular program courses evaluation. However, the remaining 4 credits must be acquired through two MOOCs, which shall be domain specific each with 2 credits and with minimum duration of 08 weeks each.

f. The list of courses along with MOOC service providers shall be identified, approved and notified by the Chairman, BOS and Head of the Department.

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

h. Minimum strength required for offering a Minor in a discipline is 40 students.

i. 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.

j. The Minor degree shall be mentioned in the degree certificate as Bachelor of Technology in XXX with Minor in YYY. For example, Bachelor of Technology in Computer Science & Engineering with Minor in Title of the Minor Pursued This shall also be reflected in the transcripts, along with the list of courses taken for Minor degree program with CGPA mentioned separately.

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

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

15. Honors Degree in a discipline:

The concept of Honors degree is introduced in the curriculum for all B. Tech. programs. The main objective of Honors degree is to provide additional learning opportunities for academically motivated students in the same or allied discipline and it is an optional feature of the B. Tech. program. In order to earn Honors degree in a discipline, a student has to earn **20** extra credits (By studying SIX Theory Courses).

a. Students having a CGPA of 8.0 and above up to II B.Tech I-Semester without any backlogs shall be permitted to register for Degree with Honors by paying the requisite fee.

b. An SGPA and CGPA of 7.5 has to be maintained in the subsequent semesters without any backlog subjects in order to keep the Honors Degree registration live or else it shall be cancelled.

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

d. A Student shall register for a Honors with **Eight** credits in III B.Tech I-Semester (**TWO** theory courses), **Six** credits in III B.Tech II-Semester (**TWO** theory courses- one from the pool of courses offered and other one through MOOC) and **Six** credits in IV B.Tech I-Semester (**TWO** theory courses- one from the pool of courses offered and other one through MOOC).

e. The evaluation pattern of the courses offered (16 credits) shall be similar to the regular program courses evaluation. However, the remaining 4 credits must be acquired through two MOOCs, which shall be domain specific each with 2 credits and with minimum duration of 8 weeks.

f. The list of courses along with MOOC service providers shall be identified, approved and notified by the Chairman, BOS, and Head of the Department.

g. 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.

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

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

j. 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.

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

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

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

16. Transitory Regulations:

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

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

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

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

% of Marks obtained	Grade	Description of Grade	Grade Points (GP)
≥90	A+	Outstanding	10
≥80 to <90	A	Excellent	9
≥70 to < 80	B	Very Good	8
≥ 60 to < 70	C	Good	7
≥ 50 to < 60	D	Fair	6
≥ 40 to < 50	E	Satisfactory	5
< 40	F	Fail	0
Absent	N	Absent	0
For Mandatory Courses			
≥40	P	Satisfactory	-
<40	I	Not Satisfactory	-
For NCC/NSS Activities			
Participated	P	Satisfactory	-
Not Participated	I	Not Satisfactory	-
For Internship			
Submission of Certificate	P	Completed	
Non-Submission of Certificate	I	Incomplete	

Pass Marks:

A student shall be declared to have passed theory course, laboratory course, and project work if he secures minimum of 35% marks (Rounded off to lower integer number) in external examination, and a minimum of 40% marks in the sum total of internal evaluation and external examination taken together. 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.

For the NCC/NSS Activities, if the student participate in the activities, then his performance shall be indicated as "P" (SATISFACTORY), otherwise the performance shall be indicated as "I" (NOT SATISFACTORY) in the grade sheet.

For the Internship, if the student submit Certificate, then his performance shall be indicated as "P" (COMPLETED), otherwise the performance shall be indicated as "I" (INCOMPLETE) 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 who appeared in the Semester-end examination (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.

Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

As per AICTE regulations, conversion of CGPA into equivalent percentage as follows:

Equivalent Percentage = (CGPA – 0.50) x 10

18. Grade Sheet: A grade sheet (Marks Memorandum) shall be issued to each student indicating the SGPA and CGPA, provided if he passed all the courses registered in the regular semester-end examinations.

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

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

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

- Registered and successfully completed all the components prescribed in the Program of study to which he is admitted.
- Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of study within the stipulated time.
- Obtained CGPA greater than or equal to 4.0 (Minimum requirement for declaring as passed).
- Has NO DUES to the College, Hostel, Library etc. and to any other amenities provided by the College.
- No disciplinary action is pending against him.

20.2. Award of Class: Awarding of Class is based on CGPA.

Awarding of Class

CGPA Secured	Class Awarded
≥7.5	First Class with Distinction
≥6.5 and <7.5	First Class
≥5.5 and <6.5	Second Class
≥5.0 and <5.5	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 Vidyanikethan Engineering College payable at Tirupati along with the requisition through the concerned Head of the Department.

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

24. Amendments to Regulations:

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

25. General:

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

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

ANNEXURE-I

GUIDELINES FOR DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

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

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

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

SVEC-20 CURRICULUM

Course Structure for B.Tech (EEE) Program

(Effective from the Academic year 2020-21 onwards)

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

SVEC-20 B.Tech. EEE Course Structure

I B.Tech I–Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (C)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	20BT1BS01	Differential Equations and Multivariable Calculus	3	-	-	3	3	30	70	100
2.	20BT1BS03	Engineering Physics	3	-	-	3	3	30	70	100
3.	20BT10201	Basic Electrical and Electronics Engineering	3	-	-	3	3	30	70	100
4.	20BT10341	Basic Civil and Mechanical Engineering	3	-	-	3	3	30	70	100
5.	20BT1BS32	Engineering Physics Lab	-	-	3	3	1.5	30	70	100
6.	20BT10231	Basic Electrical and Electronics Engineering Lab	-	-	3	3	1.5	30	70	100
7.	20BT10331	Computer Aided Engineering Drawing	-	1	4	5	3	30	70	100
8.	20BT10332	Engineering Workshop	-	-	3	3	1.5	30	70	100
9.	20BT1HSAC	Spoken English(Audit Course)	2	-	-	2	-	-	-	-
		Total:	**14**	**1**	**13**	**28**	**19.5**	**240**	**560**	**800**

I B.Tech II–Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (C)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	20BT2BS01	Transformation Techniques and Linear Algebra	3	-	-	3	3	30	70	100
2.	20BT1BS02	Engineering Chemistry	3	-	-	3	3	30	70	100
3.	20BT1HS01	Communicative English	3	-	-	3	3	30	70	100
4.	20BT20201	Electrical Circuits	3	-	-	3	3	30	70	100
5.	20BT20541	Programming in C and Data Structures	3	-	-	3	3	30	70	100
6.	20BT1BS31	Engineering Chemistry Lab	-	-	3	3	1.5	30	70	100
7.	20BT1HS31	Communicative English Lab	-	-	3	3	1.5	30	70	100
8.	20BT20551	Programming in C and Data Structures Lab	-	-	3	3	1.5	30	70	100
9.	20BT1MC01	Universal Human Values (Mandatory Course)	2	-	-	2	-	30	-	30
		Total	**17**	**-**	**09**	**26**	**19.5**	**270**	**560**	**830**

II B.Tech I–Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (c)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	20BT3BS02	Special Functions and Complex Analysis	3	0	0	3	3	30	70	100
2.	20BT30402	Electronic Devices and Circuits	3	0	0	3	3	30	70	100
3.	20BT30201	Electromagnetic Fields	3	0	0	3	3	30	70	100
4.	20BT30202	Electrical Machines-I	3	0	0	3	3	30	70	100
5.	20BT30203	Signals and Networks	3	0	0	3	3	30	70	100
6.	20BT3HS31	Soft Skills Lab	0	1	2	3	2	30	70	100
7.	20BT30432	Electronic Devices and Circuits Lab	0	0	3	3	1.5	30	70	100
8.	20BT30231	Electrical Machines-I Lab	0	0	3	3	1.5	30	70	100
9.	20BT30232	Signals and Networks Lab	0	0	3	3	1.5	30	70	100
Total			**15**	**1**	**11**	**27**	**21.5**	**270**	**630**	**900**
10.	20BT3MC01	Environmental Science	2	-	-	2	-	30	-	30

II B.Tech II–Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (C)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	20BT40441	Analog Electronics	3	0	0	3	3	30	70	100
2.	20BT40201	Control Systems	3	0	0	3	3	30	70	100
3.	20BT40202	Digital Electronics	3	0	0	3	3	30	70	100
4.	20BT40203	Electrical Machines-II	3	0	0	3	3	30	70	100
5.	20BT40204	Electrical Measurements	2	0	0	2	2	30	70	100
6.	**Open Elective-1**		3	0	0	3	3	30	70	100
7.	20BT40451	Analog Electronics Lab	0	0	3	3	1.5	30	70	100
8.	20BT40231	Digital Electronics Lab	0	0	3	3	1.5	30	70	100
9.	20BT40232	Electrical Machines-II Lab	0	0	3	3	1.5	30	70	100
Total			**15**	**1**	**11**	**26**	**21.5**	**270**	**630**	**900**
10.	20BT315AC	Design Thinking	2	-	-	2	-	-	-	-

III B.Tech I–Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (C)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	20BT5HS02	Principles of Business Economics and Accountancy	3	0	0	3	3	30	70	100
2.	20BT40403	Linear and Digital IC Applications	3	0	0	3	3	30	70	100
3.	20BT50201	Transmission and Distribution	3	0	0	3	3	30	70	100
4.	**Open Elective-2**		3	0	0	3	3	30	70	100
5.	**Professional Elective-1**									
6.	20BT50202	Energy Audit, Conservation and Management	3	0	0	3	3	30	70	100
7.	20BT50203	Electrical Machine Design								
8.	20BT50204	Energy Systems								
9.	20BT50205	Instrumentation								
10.	20BT50432	Linear and Digital IC Applications Lab	0	0	3	3	1.5	30	70	100
11.	20BT50231	Electrical Workshop Practice	0	0	3	3	1.5	30	70	100
12.	20BT50232	Electrical Auditing and Conservation Practice Lab	0	1	2	3	2	30	70	100
13.	20BT50233	Summer Internship-I	-	-	-	-	1.5	-	100	100
		Total	**15**	**1**	**8**	**24**	**21.5**	**240**	**660**	**900**
14.	20BT503AC	Foundations of Entrepreneurship	2	-	-	2	-	-	-	-
15.	20BT4NS01	NCC/NSS Activities	-	-	-	-	-	-	-	-

III B.Tech II–Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (C)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	20BT5HS01	Organizational Behavior	3	0	0	3	3	30	70	100
2.	20BT60201	Power Electronics	3	0	0	3	3	30	70	100
3.	20BT60202	Power System Operation and Control	3	0	0	3	3	30	70	100
4.	**Professional Elective-2**									
5.	20BT60203	Advanced Control Systems	3	0	0	3	3	30	70	100
6.	20BT60204	High Voltage Engineering								
7.	20BT60205	PIC Microcontrollers and Applications								
8.	20BT60206	Special Electrical Machines								
9.	**Professional Elective-3**									
10.	20BT60442	VLSI Design	3	0	0	3	3	30	70	100
11.	20BT60207	Design and Estimation of Electrical Systems								
12.	20BT60208	Distributed Generation and Microgrid								
13.	20BT60209	Smart Grid Technology								
14.	**Inter Disciplinary Elective-1**									
15.	20BT50441	Principles of Communications	3	0	0	3	3	30	70	100
16.	20BT60410	Microelectromechanical Systems								
17.	20BT61041	Sensors and Signal Conditioning								
18.	20BT60210	Computer Organization and Architecture								
19.	20BT60231	Electrical CAD Lab	0	0	3	3	1.5	30	70	100
20.	20BT60232	Electrical Power Systems Lab	0	0	3	3	1.5	30	70	100
21.	20BT60233	ARM Processor and its Interfacing Lab	0	1	2	3	2	30	70	100
		Total	**18**	**1**	**8**	**27**	**23**	**270**	**630**	**900**
22.	20BT5MC01	Professional Ethics	2	-	-	2	-	30	-	30

IV B.Tech I–Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (C)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	20BT70201	Power System Analysis	3	0	0	3	3	30	70	100
2.	20BT70202	Solid State Drives	3	0	0	3	3	30	70	100
3.	20BT70203	Switchgear and Protection	2	0	0	2	2	30	70	100
4.	**Professional Elective-4**									
5.	20BT70401	Embedded Systems	3	0	0	3	3	30	70	100
6.	20BT70203	Analysis of Power Electronic Converters								
7.	20BT70204	Electric Vehicles								
8.	20BT70205	Flexible AC Transmission System								
9.	**Professional Elective-5**									
10.	20BT70206	Digital Signal Processing for Electrical Engineering	3	0	0	3	3	30	70	100
11.	20BT70207	Power System Automation								
12.	20BT70208	Power Electronics for Renewable Energy Systems								
13.	20BT70209	Soft Computing Techniques								
14.	**Inter Disciplinary Elective-2**									
15.	20BT50403	FPGA Architectures and Applications	3	0	0	3	3	30	70	100
16.	20BT60406	Image Processing								
17.	20BT61003	Industrial Data Communications								
18.	20BT71041	PLC and SCADA								
19.	20BT70231	Power Electronics and Drives Lab	0	0	3	3	1.5	30	70	100
20.	20BT70232	Power System Simulation Lab	0	0	3	3	1.5	30	70	100
21.	20BT70233	Summer Internship-II	-	-	-	-	1.5	-	100	100
		Total	**15**	**1**	**8**	**23**	**21.5**	**240**	**660**	**900**
22.	20BT702AC	Electrical Safety and Safety Management	**2**	**-**	**-**	**2**	-	-	-	-

IV B.Tech II–Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (C)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	20BT80231	Project Work	-	-	-	-	12	100	100	200
2.	20BT80232	Internship	-	-	-	-	-	-	-	-
Total			**-**	**-**	**-**	**-**	**12**	**100**	**100**	**200**

LIST OF COURSES FOR
OPEN ELECTIVE–1 AND OPEN ELECTIVE-2

Course Code	Open Elective -1	Course Code	Open Elective -2
20BT4BS01	Material Science	20BT4HS01	Banking and Insurance
20BT4HS02	Business Communication and Career Skills	20BT4HS03	Cost Accounting and Financial Management
20BT4HS04	Entrepreneurship for Micro, Small and Medium Enterprises	20BT4HS05	Gender and Environment
20BT4HS06	German Language	20BT4HS07	Indian Economy
20BT4HS08	Indian History	20BT4HS09	Life Skills
20BT4HS10	Personality Development	20BT4HS11	Indian Tradition and Culture
20BT4HS12	Women Empowerment	20BT4HS13	Constitution of India
20BT40205	Reliability and Safety Engineering	20BT50106	Disaster Mitigation and Management
20BT40105	Environmental Pollution and Control	20BT50107	Sustainable Engineering
20BT40106	Planning for Sustainable Development	20BT50108	Contract Laws and Regulations
20BT40107	Rural Technology	20BT50310	Global Strategy and Technology
20BT40305	Human Resource Management	20BT50311	Management Science
20BT50506	Ethical Hacking	20BT40502	Cyber Laws and Security
20BT51205	AI in Healthcare	20BT50206	Intellectual Property Rights
20BT51501	Bioinformatics	20BT50406	Green Technologies

I B. Tech. - I Semester

(20BT1BS01) DIFFERENTIAL EQUATIONS AND MULTIVARIABLE CALCULUS

(Common to: All branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE REQUISITE: -

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. Solve the higher order linear differential equations and identify solutions by analytical methods related to various engineering problems involving electrical circuits.
CO2. Formulate and solve partial differential equations for engineering problems.
CO3. Determine maxima and minima of functions of two variables and analyze their behaviour at extreme values.
CO4. Evaluate and apply multiple integrals to determine areas of plane curves.
CO5. Identify solenoidal and irrotational vector fields and apply vector integral theorems in evaluating areas and volumes.

DETAILED SYLLABUS:

UNIT-I: Ordinary Differential Equations (9 Periods)

Ordinary Differential Equation: Order and Degree of Differential Equation; 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 homogeneous and Legendre's linear equations; Applications to L-C-R Circuit problems.

UNIT-II: Partial Differential Equations (9 Periods)

Formation of PDE, solutions of first order 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) (9 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) (9 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 polar coordinates; Areas enclosed by plane curves.

UNIT-V: Multivariable Calculus (Vector Calculus) (9 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 and Volume integral; Vector integral theorems: Theorems of Green, Gauss and Stokes (without proofs)-Problems related to theorems.

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.
3. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 9th Edition, 2006.

I B. Tech. – I Semester

(20BT1BS03) **ENGINEERING PHYSICS**

Common to: ECE, EEE, EIE, CSE(AI) CSE(DS) and CSE(AI&ML)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Wave Optics; Electromagnetic Waves; Fiber Optics; Semiconductors; Optoelectronic Devices; Dielectrics; Magnetic materials; 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 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 (9 Periods)

Interference: Introduction- 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 (qualitative) - Double slit diffraction (qualitative) -Diffraction grating.

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 (9 Periods)

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

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 - 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 and Optoelectronic Devices (10 Periods)

Introduction - 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 Extrinsic semiconductors (qualitative) - Drift and Diffusion currents -Direct and Indirect band gap semiconductors - Hall effect, Hall coefficient and Applications - pn junction.
Optoelectronic devices: Light Emitting Diode (LED), Photodiode and Semiconductor diode laser.

UNIT-IV: Dielectrics and Magnetic Materials (9 Periods)

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

UNIT-V: Superconductors and Nanomaterials (8 Periods)

Introduction – Properties of Superconductors - Critical parameters of Superconductors - Meissner effect - Penetration depth - Types of Superconductors - BCS Theory - Josephson effect (AC & DC) - High T_C Superconductors – Applications of Superconductors.
Basic principles of nanomaterials - Synthesis of nanomaterials by Ball Milling and Pulsed Laser Deposition (PLD) methods - Properties of nanomaterials (Physics, Electrical, Magnetic, Mechanical and Optical) - Applications of nanomaterials.

Total Periods: 45

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

I B. Tech. – I Semester

(20BT10201) **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**

Common to: ME, ECE, EEE, EIE, CSE, CSSE, IT, CSE(AI), CSE(DS), CSE(AI&ML), CSE(IOT), CS&D and CSE(CS)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Principles of Electrical Systems; AC & DC 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 concepts.
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 (9 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 (9 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. Energy Efficiency (Star rating) standards by BEE.

UNIT-III: Transformers and Machines (10 Periods)

Construction and working of a single phase transformer, EMF Equation; Construction, working and applications of Permanent Magnet DC Motor, Brushless DC Motor, three phase induction motor; construction, working and applications of stepper motor, resistor start & capacitor start and run single phase induction motor.

UNIT-IV: Semiconductor Devices (9 Periods)

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

UNIT-V: Op-Amps **(8 Periods)**

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

Total Periods: 45

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

I B.Tech. – I Semester

(20BT10341) **BASIC CIVIL AND MECHANICAL ENGINEERING**

(Common to: ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	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 analysing 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 (8 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 Harbors.

Part – B: Mechanical Engineering

UNIT-III: Internal Combustion Engines, Turbines and Pumps (9 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 (9 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 (9 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 MS, *Basic Civil and Mechanical Engineering*, Tata McGraw Hill PublishingCo.,NewDelhi, 1st Edition 2018.
2. R. Vaishnavi, Prof. M. Prabhakaran & Prof. 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 kumarJain, Building *Construction,* Laxmi publications, 10th Edition, 2008.

REFERENCE BOOKS:

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, 1stEdition, 2013.

I B. Tech. – I Semester

(20BT1BS32) **ENGINEERING PHYSICS LAB**

(Common to: ECE, EEE, EIE, CSE(AI), CSE(DS) and CSE(AI&ML))

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE REQUISITE: -

COURSE DESCRIPTION: Estimation of thickness of the wire using wedge shape method; Wavelength of monochromatic light source by diffraction grating; Newton's ring method; numerical aperture and acceptance angle of optical fiber; Characteristics of p-n junction diode; Photodiode and LED; Experimental determination of carrier concentration and energy gap of a semiconductor material; Determination resistivity of semiconductor by Four probe method and 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, 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 or in teams to solve problems with effective communication.

List of 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 using spectrometer by minimum deviation method
4. Estimation of magnetic field along the axis of a circular coil carrying current.
5. Determination the numerical aperture of a given optical fiber and hence to estimate its acceptance angle.
6. Determination of number of charge carriers and Hall coefficients of a given semiconductor using Hall Effect.
7. Determine the energy gap of a semiconductor.
8. Study the I-V characteristics of pn junction diode.
9. Estimation of threshold voltages of different LED's.
10. Study the characteristics of Photodiode.
11. Determination of wavelength of laser by using diffraction grating.
12. Determine the resistivity of semiconductor by Four probe method.

TEXT BOOK:

1. Engineering Physics Lab Manuel (SVEC-20)

REFERENCE BOOKS:

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

I B. Tech. – I Semester

(20BT10231) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB

(Common to: ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE-REQUISITES: -

COURSE DESCREPTION: 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 or 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. Phasor analysis in R-L-C (Series / Parallel) circuits.
4. Measurement of Power factor and it's improvement.
5. Study of Earthing – Pipe earthing and Plate earthing
6. Load test on 1-Phase Transformer.
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.

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/

I B. Tech. – I Semester

(20BT10331) **COMPUTER AIDED ENGINEERING DRAWING**

(Common to: CE, ME, ECE, EEE, EIE, CSE(IOT) and CS&D)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	1	4	3

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 field.

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 or in teams to solve problems with effective communication.

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

TEXTBOOKS:

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

REFERENCE BOOKS/LABORATORY MANUALS:

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

I B. Tech. – I Semester

(20BT10332) **ENGINEERING WORKSHOP**

(Common to: CE, ME, ECE, EEE, EIE, CSE(IOT) and CS&D)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

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 mould using single piece pattern and split piece pattern in the foundry trade using foundry tools.
CO5. Develop electric circuits for series and stair case connections.
CO6. Demonstrate the knowledge on power tools, plumbing operation, 3D printing technology involved in different engineering applications.
CO7. Work independently or in teams to solve problems with effective communication.

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

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:

3. Prepare a cross lap joint

4. Prepare dovetail / bridle joints

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:

5. Fabricate a rectangular tray as per the dimensions
6. Fabricate square vessel/cylinder 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:

7. Prepare a sand mould, using the given single piece pattern (stepped pulley/cube)
8. Prepare a sand mould, using the given split piece pattern (pipe bent/dumbbell)

Electrical wiring: Prepare electrical wiring with associated devices such as switches, distribution boards, sockets, and light fittings in a structure considering safety standards for design and installation.

List of Exercises:

9. Prepare electrical circuits with Series.
10. Prepare electrical circuits with Stair case connections.

DEMONSTRATION:

11. Demonstrate the usage of power tools.
12. Demonstrate the plumbing operation and identify the essential tool and materials required for plumbing.
13. Demonstrate the working of 3D printer

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

REFERENCE BOOKS/LABORATORY MANUALS:

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

ADDITIONAL LEARNING RESOURCES:

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

I B. Tech. - I Semester

(20BT1HSAC) **SPOKEN ENGLISH**

(Audit Course)

(Common to: CE, ME, ECE, EEE, EIE, CSE(IOT) and CS&D)

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

PRE-REQUISITES: -

COURSE DESCRIPTION: Grammar; Functional English; Paragraph writing; Letter writing and Email writing.

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: Grammar (6 Periods)

Active voice and Passive voice – Auxiliary modals - Question Forms: Wh-word, Embedded, Yes/No - Disjunctive/Tags - Spotting Errors

UNIT-II: Functional English (6 periods)

Vocabulary Building: (Vegetables, groceries, fruits, Parts of human body, relations) Greetings - Introduction - Self and others - Story telling - Speaking Activities

UNIT-III: Paragraph Writing (6 Periods)

Topic sentence - cohesion and coherence - Unity - adequate development - Introduction to types -Compare-Contrast - Problem & Solution, Cause & Effect, Classification & Illustrative.

UNIT-IV: Letter Writing (6 Periods)

Components of an Effective Letter - Communication in everyday life - Personal Correspondence, Internal Communication - Career and Employment Letters

UNIT-V: Email Writing (6 Periods)

Do's & Don'ts - Tips for email effectiveness - Email Jargon - Sample Emails

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/

I B. Tech. - II semester

(20BT2BS01) TRANSFORMATION TECHNIQUES AND LINEAR ALGEBRA

(Common to: All branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITE: -

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. Construct the Fourier series for periodic functions and demonstrate the use of Fourier series and Fourier transform to connect the frequency and time domain systems.
CO2. Solve initial and boundary value problems in engineering fields through Laplace Transform techniques.
CO3. Apply the matrix theory in solving system of linear equations and determine the Eigen values and Eigen vectors.
CO4. Demonstrate the knowledge of Linear Transformations to intelligent systems.

DETAILED SYLLABUS:

UNIT-I: Fourier series and Fourier Transforms (9 Periods)

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

UNIT-II: Laplace Transforms (9 Periods)

Definition of Laplace transforms, existence conditions, Laplace transforms of standard functions, Properties of Laplace transforms (without proofs), Laplace transforms of derivatives, Laplace transforms of integrals, multiplication by t^n, division by t, Laplace transforms of periodic functions, Laplace transforms of unit step function and unit impulse function.

UNIT-III: Inverse Laplace Transforms (9 Periods)

Inverse Laplace transforms 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) (9 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.

Unit- V: Linear Algebra-II (Vector Spaces) (9 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).

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.

I B. Tech. - II Semester

(20BT1BS02) **ENGINEERING CHEMISTRY**

(Common to: ECE, EEE, EIE CSE(AI), CSE(DS) and CSE(AI&ML))

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE REQUISITE: -

COURSE DESCRIPTION: Water Treatment; Atomic Structure and Bonding Theories; 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. Analyze and solve problems associated with hardness of water, boiler troubles and address the societal, health and safety issues related to quality of water.
CO2. Apply the basic knowledge of quantum mechanical approach to atomic structure and bonding theories to identify shapes of different molecules.
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: Water Treatment (10 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; softening of water– Ion exchange process, zeolite process, desalination of brackish water by reverse osmosis, 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-II: Atomic Structure and Bonding Theories (9 Periods)

Quantum-mechanical model of atom, Schrodinger wave equation, significance of Ψ and Ψ^2 , applications to particle in a box; 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-III: Electrochemistry and Applications (9 Periods)

Introduction, Electrode potential, Nernst equation, reference electrode-Calomel electrode, electrochemical cell; Battery– Leclanche cell, lithium ion batteries; Fuel cells- Hydrogen-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 (9 Periods)

Introduction to spectroscopy–types of energy present in molecules, types of spectra, UV-Vis spectroscopy – principle (Beer-lamberts Law), 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 (8 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 and their applications, properties of lubricants – viscosity and viscosity index , flash and fire points, cloud and pour points, Aniline points, neutralization number and mechanical strength.

Total Periods: 45

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

I B. Tech. - II Semester

(20BT1HS01)**COMMUNICATIVE ENGLISH**

(Common to: CE, ME, ECE, EEE, EIE, CSE(IOT) and CS&D)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Introduction to Communication; Active Listening; Effective Speaking; Reading and 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 them 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 in Conferences, Symposia, Seminars and in formal and real time situations by applying appropriate speaking techniques learnt by examining different communication styles used in similar contexts.

DETAILED SYLLABUS:

UNIT-I: Introduction to Communication (9 Periods)

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

UNIT-II: Active Listening (9 Periods)

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

UNIT-III: Effective Speaking (9 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.

UNIT-IV: Reading (9 Periods)

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

UNIT-V: Technical Writing (9 Periods)

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

Total Periods: 45

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

ADDITIONAL LEARNING RESOURCES

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

I B. Tech. – II Semester
(20BT20201) **ELECTRIC CIRCUITS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Basic electrical and Electronics Engineering**.**

COURSE DESCRIPTION: Circuit reduction and analyzing techniques; Analysis of single and poly phase circuits; Circuit theorems; Magnetic and coupled magnetic circuits.

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

CO1. analyze the electrical circuits by applying the principles of network reduction techniques, mesh and nodal analysis.
CO2. analyze the single phase circuits to investigate the response and to determine various electrical quantities.
CO3. analyze various electrical circuits, by applying circuit theorems to determine various electrical quantities.
CO4. analyze 3-phase circuits to investigate the response and to determine various electrical quantities.
CO5. analyze magnetic circuits, coupled circuits by applying the principles of electromagnetism and determine various parameters.

DETAILED SYLLABUS:

UNIT-I: FUNDAMENTALS OF ELECTRIC CIRCUITS (9 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 (11 Periods)
Peak factor and form factor for different wave forms; Analysis of single phase AC circuits: impedance and admittance, impedance triangle; Power triangle; Sinusoidal response of R, L and C elements with different combinations; Resonance, bandwidth and quality factor for series and parallel networks.

UNIT-III: CIRCUIT THEOREMS (10 Periods)
Superposition, Thevenin's, Norton's, Maximum power transfer, Millmann's, Telligen's, Compensation and Reciprocity theorems for DC & AC Excitations (without proof); Concept of dual and duality – Numerical problems.

UNIT-IV: 3-PHASE CIRCUITS (7 Periods)
Analysis of three phase balanced and unbalanced systems; Measurement of active and reactive power in balanced and unbalanced systems-single wattmeter and two wattmeter methods.

UNIT-V: MAGNETIC AND COUPLED CIRCUITS (8 Periods)

Coupled circuits-self and mutual inductance, coefficient of coupling, DOT convention; series and parallel connection of coupled coils, equivalent circuits of coupled coils. Magnetic Circuits – Series and Parallel. Analogy between electrical and magnetic circuits.

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, Shyammohan 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*, 8th Edition, McGraw Hill, New Delhi, 2008.

I B. Tech. – II Semester

(20BT20541) **PROGRAMMING IN C AND DATA STRUCTURES**

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A Course on Basic Mathematics.

COURSE DESCRIPTION: Algorithms; Flowcharts; Introduction to C language; Operators and expressions; Input and output functions; Control statements; Arrays; Strings; Functions; Pointers; User-defined data types; Linked lists; Overview of data structures; Stack; Queue; Searching algorithms; Sorting algorithms.

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

CO1. Develop flowcharts, algorithms for given problems.
CO2. Design algorithmic solutions by analysing programming problems and using appropriate C language constructs.
CO3. Apply linear data structures such as arrays, linked lists, stacks, queues for efficient data organization and manipulation.
CO4. Select appropriate techniques for searching and sorting problems.

DETAILED SYLLABUS:

UNIT-I: Introduction to C Programming (8 Periods)

Introduction to Algorithms and Flowcharts: What is an algorithm, Different ways of stating algorithms, Key features of algorithm, What are variables, Subroutines, Flowcharts, Strategy for designing algorithms, Tracing an algorithm to depict logic, Specification for converting algorithms into programs.

Basis of C Programming: Introduction, Structure of a C program, Concept of a variable, Data types in C, Program statement, Declaration, How does the computer store data in memory, Tokens, Operators and expressions, Expressions revisited, Type conversion in C.

UNIT-II: Input and Output, Control Statements (9 Periods)

Input and Output: Basic screen and keyboard I/O in C, Non-formatted input and output, Formatted input and output functions.

Control Statements: Specifying test condition for selection and iteration, Writing test expression, Conditional execution and selection, Iteration and repetitive execution, goto statement, Special control statements, Nested loops.

UNIT-III: Arrays and Strings, Functions (10 Periods)

Arrays and Strings: One-dimensional array – Declaration, Initialization, Manipulation; Multi-dimensional arrays – Declaration, Initialization, Manipulation; Strings – Declaration, Initialization, String input/output, Character manipulation, String manipulation; Arrays of strings – Declaration, Initialization, Manipulation.

Functions: Concept of function, Using functions, Call by value mechanism, Working with functions, Passing arrays to functions, Scope and extent, Storage classes, Recursion.

UNIT-IV: Pointers, User-Defined Data Types, Linked Lists (10 Periods)

Pointers in C: Understanding memory addresses, Address operator (&), Pointer, Arrays and pointers, Pointers and strings, Pointer arithmetic, Pointers to pointers, Array of pointers, Pointers to an array, Two-dimensional arrays and pointers, Dynamic memory allocation.

User-Defined Data Types: Structures - Declaration, Initialization, Accessing members, Arrays of structures, Arrays within structure, Structures and pointers, Structures and functions; Enumeration types.

Linked Lists: Single linked lists – Definition, Representation, Operations, Inserting a node, Deleting a node; Applications of linked lists, Disadvantages of linked lists, Array versus linked list revisited.

UNIT-V: Data Structures (8 Periods)

Basic Data Structures: Overview of data structures, Stack – Definition, Array representation, Implementation of stack operations using arrays; Queue - Definition, Array representation, Implementation of queue operations using array.

Searching and Sorting: Linear Search, Binary Search, Bubble sort, Selection sort.

Total Periods: 45

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

TEXT BOOKS:

1. Pradip Dey and Manas Ghosh, *Programming in C,* Oxford University Press, 2018.
2. Debasis Samanta, *Classic Data Structures,* 2nd Edition, PHI Learning, 2009.

REFERENCE BOOKS:

1. Byron S Gottfried and Jitender Kumar Chhabra, *Programming with C*, 4thEdition, McGraw Hill Education, 2019.
2. Yashavant Kanetkar, *Let Us C,* 17thEdition, BPB Publications, 2020.

ADDITIONAL LEARNING RESOURCES:

1. E. Balagurusamy, *Programming in C*, 7thEdition, McGraw Hill, 2014.
2. R. G. Dromey, *How to Solve it by Computer*, Pearson Education, 2007.
3. https://nptel.ac.in/courses/106/104/106104128/
4. https://nptel.ac.in/courses/106/103/106103069/

I B. Tech. - II Semester

(20BT1BS31) **ENGINEERING CHEMISTRY LAB**

(Common to: ECE, EEE, EIE CSE(AI), CSE(DS) and CSE(AI&ML))

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE REQUISITE: -

COURSE DESCRIPTION: Estimation of hardness ground water sample, alkalinity, dissolved oxygen of water samples, Iron, residual chlorine in drinking water and Strength of an acid in Pb-Acid battery by volumetric methods; Instrumental methods like conductivity meter, potentiometer, P^H meter and colorimeter; Measurement of viscosity of lubricants; and Determination of the influence of pH on metallic corrosion.

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 or in teams to solve problems with effective communication.

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

1. Determination of hardness of ground water sample
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. Estimation of residual chlorine in drinking water
6. Conductometric titration of strong acid Vs strong base
7. Estimation of Ferrous ion by Potentiometry
8. Determination of percentage of Iron in Cement sample by colorimetry
9. Determination of strength of acid by pHmetric method
10. Determination of Viscosity of liquids by Ostwald's viscometer
11. Determination of Strength of an acid in Pb-Acid battery
12. Determination of the influence of pH on metallic corrosion

TEXT BOOK:

1. Engineering Chemistry lab Manual (SVEC-20)

REFERENCE 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.

I B. Tech. - II Semester

(20BT1HS31) **COMMUNICATIVE ENGLISH LAB**

(Common to: CE, ME, ECE, EEE, EIE, CSE(IOT) and CS&D)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE REQUISITE: -

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

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 through Phonetics.

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

CO3. Apply appropriate listening and reading skills by analyzing the context, and demonstrate through 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 in formal and real time situations.

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, SVEC

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 SOFTWARES:

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.
4. https://goo.glsvMHZ1: information and advice about describing line graphs
5. https://goo.gl/NqFJuc: an informative presentation about using line graphs

I B. Tech. – II Semester
(20BT20551) PROGRAMMING IN C AND DATA STRUCTURES LAB
(Common to: CE, ME, ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE-REQUISITES: A course on Programming in C and Data Structures.

COURSE DESCRIPTION: Hands on practice in developing and executing simple programs using C Programming constructs – Control statements, Arrays, Strings, Functions, Pointers, Structures, Single linked lists, Stack, Queue, Searching and Sorting.

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

CO1. Design algorithmic solutions by analyzing programming problems and using appropriate C language constructs.
CO2. Implement linear data structures such as arrays, linked lists, stacks, queues for efficient data organization and manipulation.
CO3. Select appropriate techniques for searching and sorting problems.
CO4. Work independently or in teams to solve problems with effective communication.

LIST OF EXERCISES:

1. a) Let a and b are two integer variables whose values are 10 and 13 respectively. Write a program to evaluate the following arithmetic expressions.
   i) a + b ii) a–b iii) a * b iv) a/b v) a % b

   b) Write a program to evaluate the following algebraic expressions after reading necessary values from keyword.
   i) (ax + b)/(ax – b)
   ii) 2.5 log x + Cos 32^0+ | $x^2 + y^2$|
   iii) $x^5 + 10\ x^4 + 8$ and $x^3 + 4\ x + 2$
   iv) ae^{kt}

2. a) Mr. Gupta deposited Rs.1000 in a bank. The bank gives simple interest at the rate of 15% per annum. Write a program to determine the amount in Mr. Gupta's account at the end of 5 years. (Use the formula I = PTR / 100)

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

   c) In a town, the percentage of men is 52. The percentage of total literacy is 48. If total percentage of literate men is 35 of the total population; write a program to find the total number of illiterate men and women if the population of the town is 8000.

3. a) Write a program that prints the given three integers in ascending order using if - else.

b) Write a program to calculate commission for the input value of sales amount. Commission is calculated as per the following rules:
   i) Commission is NIL for sales amount Rs. 5000.
   ii) Commission is 2% for sales when sales amount is >Rs. 5000 and <= Rs. 10000.
   iii) Commission is 5% for sales amount >Rs. 10000.

c) If cost price and selling price of an item is input through the keyboard, write a program to determine whether the seller has made profit or incurred loss. Also determine how much profit or loss he incurred in percentage.

4. a) An insurance company calculates premium as follows:
   i) If a person's health is excellent and the person is between 25 and 35 years of age and lives in a city and is a male then premium is Rs.4 per thousand and the policy amount cannot exceed Rs.2 lakhs.
   ii) If a person satisfies all the above conditions and is female then the premium is Rs.3 per thousand and the policy amount cannot exceed Rs.1 lakh.
   iii) If a person's health is poor and the person is between 25 and 35 years of age and lives in a village and is a male then premium is Rs.6 per thousand and the policy cannot exceed Rs. 10000.
   iv) In all other cases the person is not insured.

   Write a program to determine whether the person should be insured or not, his/her premium rate and maximum amount for which he/she can be insured.

   b) Write a program, which takes two integer operands and one operator as input from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, %. Use switch statement)

5. a) Write a program to find the sum of individual digits of a positive integer.

   b) A Fibonacci sequence is defined as follows: The first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a program to generate the first N terms of the sequence.

6. a) Write a program to find the largest and smallest number in a given list of integers.

   b) Write a program to perform addition of two matrices.

   c) Write a program to determine whether the given string is palindrome or not.

7. a) Write a program using functions to perform the following operations:
   i) To convert a given decimal number into binary number
   ii) To convert a given binary number into decimal number

   b) Write a program using functions insert a sub-string in main string at a specified position.

8. a) Write a C program to print the elements of an array in reverse order using pointers.

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

9. A college has N number of students and the following details of all the students are maintained – register number, name, branch, phone number. Write a program to store the details of the students using a singly linked list. Develop functions to perform the following operations on the data.
   i) Insert new student's details
   ii) Display the details of the students
   iii) Delete a given student's information

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

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

11. Store register numbers of students who attended placement training program in a random order in an array. Write a function to search whether a student has attended placement training program or not using
   a) Linear Search
   b) Binary Search

12. Given marks of N number of students in mathematics subject, write a program to display the marks of students in ascending order using
   a) Bubble Sort
   b) Selection Sort

TEXT BOOKS:

1. Pradip Dey and Manas Ghosh, *Programming in C,* Oxford University Press, 2018.
2. DebasisSamanta, *Classic Data Structures,* 2nd Edition, PHI Learning, 2009.

REFERENCE BOOKS:

1. Byron S Gottfried and Jitender Kumar Chhabra, *Programming with C*, 4th Edition, McGraw Hill Education, 2019.
2. YashavantKanetkar, *Let Us C,* 17thEdition, BPB Publications, 2020.

I B. Tech. - II Semester

(20BT1MC01) **UNIVERSAL HUMAN VALUES**

(Mandatory Course)

(Common to: CE, ME, ECE, EEE, EIE, CSE(IOT) and CS&D)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	-	30	2	-	-	-

PRE-REQUISITES: -

COURSE DESCRIPTION: Value education; Human being and self; Family, the society and the nations; Harmony with the nature and Harmony with professional ethics.

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 (6 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 (6 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 (6 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 (6 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 (6 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 BOOKS:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010

REFERENCE BOOKS:

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.

II B. Tech. - I Semester

(20BT3BS02) SPECIAL FUNCTIONS AND COMPLEX ANALYSIS

(Common to ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

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) (7 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) (9 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 (8 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.

II B. Tech. – I Semester

(20BT30402) **ELECTRONIC DEVICES AND CIRCUITS**

(Common to ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	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 (9 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 (9 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 (7 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 Suryaprakash 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 andCircuits*, PHI, 10th Edition, 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

II B. Tech. – I Semester
(20BT30201) **ELECTROMAGNETIC FIELDS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Differential Equations and Multivariable Calculus, and Engineering Physics.

COURSE DESCRIPTION: Static electric fields; Gauss's law and its applications; Potential and Potential Gradient; steady magnetic fields; Ampere's circuital law and its applications; Force in magnetic fields; behavior of various materials in electric and magnetic fields; Inductance and capacitance calculations; Maxwell's equations for time variant and time invariant fields.

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

CO1. analyse the static electric field and determine electric field for various charge configurations by applying the laws of electrostatics.
CO2. analyse the static magnetic field and determine magnetic field due to various current carrying elements by applying the laws of magnetostatics.
CO3. analyse the static magnetic field and determine the force due to various current carrying elements by applying the laws of magnetostatics.
CO4. analyse the time varying electric and magnetic fields by applying the laws of electromagnetics.

DETAILED SYLLABUS:

UNIT-I: ELECTROSTATICS - I (12 Periods)
Introduction to electrostatic fields, coulomb's law in vector form, electric field intensity (EFI), EFI due to various charge distributions, electric flux density, Gauss's law, application of Gauss's law - symmetrical charge distributions, differential volume element, Maxwell's first equation in point and integral form. Energy expended in moving a point charge in an electric field, electric potential, potential for different charge distributions, potential gradient, Maxwell's second equation in point and integral form.

UNIT-II: ELECTROSTATICS - II (10 Periods)
Electric Dipole, dipole moment, Potential and EFI due to an electric dipole. Current density, conduction and convection current density, Ohm's law in point form, current continuity equation, conductors and dielectric materials, properties, boundary conditions between conductor and dielectric material, two perfect dielectric materials, law of refraction, capacitance, capacitance of a parallel plate capacitor (with and without composite dielectric), energy density in electrostatic field.

UNIT-III: MAGNETOSTATICS (09 Periods)
Introduction to Magnetic fields, relation between magnetic flux density and magnetic Field Intensity (MFI), Biot-Savart's law, MFI due to various current carrying elements, Ampere's

Circuital law, Maxwell's third equation in point and integral form, applications of Ampere's Circuital law - infinite line current, infinite sheet of current, solenoid and toroid. Maxwell's fourth equation in point and integral form. Scalar magnetic potential and vector magnetic potential.

UNIT-IV: FORCE IN MAGNETIC FIELDS (08 Periods)

Force due to magnetic fields, Lorentz force equation, force on a straight and long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors. Torque on a current loop placed in a magnetic field, magnetic boundary conditions between different magnetic materials. Self-inductance of a solenoid, toroid and co-axial cable, energy density in magnetic field.

UNIT-V: TIME VARYING FIELDS (06 Periods)

Introduction to time varying fields, Faraday's laws of electromagnetic induction, statically and dynamically induced EMF, concept of displacement current, modifications of Maxwell's equations for time varying fields, Poynting theorem.

Total Periods: 45

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

TEXT BOOKS:

1. William H. Hayt and John A. Buck, *Engineering Electromagnetics,* 8th Edition, McGraw Hill Education (India) Pvt. Ltd. 2014.
2. Matthew N.O. Sadiku, *Principles of Electromagnetics,* 4th Edition, Oxford University Press, New Delhi, 2007.

REFERENCE BOOKS:

1. Joseph A. Edminister, *Theory and Problems of Electromagnetics*, Schaum's Outline Series, Tata McGraw Hill Inc., New Delhi, 2009.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/106/108106073/
2. https://nptel.ac.in/courses/108/104/108104087/

II B. Tech. – I Semester
(20BT30202) **ELECTRICAL MACHINES-I**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Electric Circuits.

COURSE DESCRIPTION: Construction, operation, types, performance characteristics and applications of DC machines and transformers.

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

CO1. analyse the DC generator to evaluate various operating parameters and develop constructional features for sustainability.
CO2. analyse the operational characteristics of various DC generators to assess measures for sustainability.
CO3. analyse the performance characteristics of various types of DC motors to develop accessories and assess the suitability for industrial applications.
CO4. analyse the equivalent circuits of transformers with various configurations to determine their performance and assess sustainability for various load conditions.

DETAILED SYLLABUS:

UNIT-I: DC GENERATORS (9 Periods)

Principle of operation and constructional details of DC generator. Armature windings — lap and wave, simplex and multiplex, single layer and multi-layer, equalizer rings and dummy coils. EMF equation and methods of excitation. Losses — constant, variable and minimization of losses. Calculation of efficiency — condition for maximum efficiency.

UNIT-II: ARMATURE REACTION, COMMUTATION AND CHARACTERISTICS (9 Periods)

Armature reaction — cross magnetizing and de-magnetizing AT/pole; compensating winding. Commutation — reactance voltage and methods of improving commutation. Build-up of EMF in a self-excited DC generator; causes for failure of self-excitation and remedial measures. Internal and external characteristics of DC generators and applications.

UNIT-III: DC MOTORS (9 Periods)

Principle of operation of DC motor; Back EMF & its significance; speed and torque equation. Characteristics and applications of shunt, series and compound motors. Speed control of DC shunt and series motor. Electric braking; Starters for DC Motors (2-, 3- and 4-point) and their design.

UNIT-IV: SINGLE PHASE TRANSFORMERS (10 Periods)

Introduction — classification of transformers, cooling methods, ideal and practical transformers; operation on no-load and on-load, phasor diagrams; losses, equivalent circuit, efficiency and regulation; Effects of variation of frequency and supply voltage on

iron losses. All-day efficiency. Auto transformers — equivalent circuit, comparison with two winding transformers.

UNIT-V: THREE-PHASE TRANSFORMERS (8 Periods)

Three-phase transformers — construction and connections — Y/Y, Y/Δ, Δ/Y, Δ/Δ, open-Δ and Scott connections. Three winding transformers — tertiary windings; determination of ZP, Zs and ZT; OFF-load and ON-load tap changing.

Total Periods: 45

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

TEXT BOOKS:

1. JB Gupta, *Theory and performance of Electrical Machines*(DC machines, Poly phase Circuits & AC machines) in SI Units, S.K. Kataria & Sons, New Delhi, 15th Edition, 2015.
2. R.K. Rajput, *Electrical Machines* in S.I. Units, Laxmi Publications (P) Ltd, 6th Edition, New Delhi, 2017.

REFERENCE BOOKS:

1. P.S. Bimbhra, *Electrical Machinery*, Khanna Publishers, 7th Edition, Delhi, 2011.
2. B.L. Theraja and A.K. Theraja, *A Text Book of Electrical Technology (in S. I. Units)*, Vol.2, S. Chand & Company Ltd, Multicolour illustrative Edition, New Delhi, 2014.

ADDITIONAL LEARNING RESOURCES:

1. http://www.nptelvideos.in/2012/11/electrical-machines-i.html
2. https://nptel.ac.in/courses/108/102/108102146/
3. https://freevideolectures.com/course/3085/electrical-machines-i
4. https://www.youtube.com/playlist?list=PL9RcWoqXmzaJpnkjoNleyFNgGk9-znOji

II B. Tech. – I Semester
(20BT30203) **SIGNALS AND NETWORKS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Transformation Techniques and Linear Algebra, and Electric circuits.

COURSE DESCRIPTION: Discrete and continuous time signals and systems; Signal transformation methods — circuit applications; Analysis of Transients and Two-port networks.

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

CO1. perform various operations on signals, investigate system characteristics and evaluate their features.
CO2. analyze spectral characteristics of signals and circuits using Fourier, Laplace and z-Transforms.
CO3. analyze transient behaviour of DC & AC circuits by using differential equations and Laplace transform methods.
CO4. analyze network parameters of an isolated and interconnected two-port network.

DETAILED SYLLABUS:

UNIT-I: DISCRETE AND CONTINUOUS TIME SIGNALS AND SYSTEMS **(11 Periods)**

Continuous and discrete signals: Test signals — Unit step, ramp, parabolic, unit impulse and exponential signals; Basic operation on signals — Time and Amplitude scaling; Classification of Signals — Periodic and aperiodic signals, Odd and even components, Energy and power signals.
Discrete Systems—Linear and Non-linear, Static and dynamic systems, Time variant and invariant, Causal and non-causal systems.

UNIT-II: TRANSFORMATION OF SIGNALS: Fourier transforms (08 Periods)

Fourier series: Review of Fourier series, Trigonometric Fourier Series, properties of Fourier series (Without proof), Fourier series of common signals — amplitude and phase spectrum, Circuit Applications — Average value, RMS Values, average power and response.
Fourier transforms — Definition, properties of Fourier transforms (Without proof); Fourier transform of periodic signals; Inverse Fourier transform. Applications — Circuit analysis and Parseval's theorem.

UNIT-III: TRANSFORMATION OF SIGNALS: Laplace and z-Transforms **(10 Periods)**

Laplace transforms: Review of Laplace transform, Laplace transform of periodic signals, properties of the Laplace transform(Without proof) — initial and final value theorems (without proof) and convolution, Region of convergence; Applications — Circuit analysis.

Z-Transforms: z-Transform, Region of convergence for the z-Transform, inverse z-Transform; Properties of the z-Transform — Initial and final value theorem (without proof) and convolution; Application: z-Transform solution of linear difference equations.

UNIT-IV: TRANSIENT ANALYSIS (08 Periods)

DC Transients: Initial conditions; Transient response of RL, RC and RLC circuits.

AC Transients: Transient response of RL, RC and RLC circuits; solution methods using differential equation and Laplace transforms.

UNIT-V: TWO-PORT NETWORKS (08 Periods)

Network Functions — Driving point and transfer functions; Network parameters — Impedance, Admittance, Transmission and Hybrid parameters. Symmetry and reciprocity property in two-port networks; Interrelationships of different parameters; Inter-connection of two-port networks.

Total Periods: 45

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

TEXT BOOKS:

1. Lathi & Bhagwandas Pannalal, *Principles of Linear Systems and Signals,* Oxford University Press, 2nd Edition, 2009.
2. Charles K. Alexander & Matthew N. O. Sadiku, *Fundamentals of Electric Circuits,* McGraw-Hill education Private Limited, New Delhi, 5th Edition, 2013.

REFERENCE BOOKS:

1. Matthew N Sadiku, and Warsame Hassan Ali, *Signals and Systems: A Primer with MATLAB,* CRC Press, 2016.
2. A Chakrabarthi, *Network Analysis and Synthesis,* Dhanpat Rai & Co., New Delhi, 2nd revised Edition, 2016.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117/101/117101055/
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/

II B. Tech. – I Semester

(20BT3HS31) **SOFT SKILLS LAB**

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	1	2	2

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 favorable situations by applying the skills of Body Language and demonstrate through Assertiveness, and Interpersonal Skills.
CO3. apply appropriate soft skills by analyzing the problem situations that arise in professional career through demonstrating remedies in Conflict Management.
CO4. demonstrate ability to function effectively as an individual and as a member in diverse teams examining and applying soft skills in Interviews, Group Discussion and Team Building.
CO5. apply appropriate speaking and writing techniques in preparing documents and to communicate effectively by examining and demonstrating knowledge in Technical Report Writing and Résumé Writing.

List of Exercises: *First TEN exercises are mandatory among the following:

1. **Body Language**
   Types of Body Language – Parts of Body – Facial Expressions – Eye Contact Insights – Good Posture
2. **Assertiveness**
   Communications Styles – Benefits – Being Unassertive – Role Playing
3. **Goal Setting**
   Seven Steps of Goal Setting – Self Motivation – Personal Goal Setting – Setting Career Goals
4. **Thinking Skills**
   Positive Thinking – Creative Thinking – Lateral Thinking – Logical Thinking – Institutive 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 BOOKS:

1. Soft Skills Lab Manual, SVEC.

REFERENCE BOOKS:

1. R. C. Sharma & Krishna Mohan, *Business Correspondence and Report Writing*, Tata Mc Graw-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

II B.Tech. – I Semester

(20BT30432) ELECTRONIC DEVICES AND CIRCUITS LAB

(Common to ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

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 or 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.

ADDITIONAL LEARNING RESOURCES:

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

II B. Tech. – I Semester
(20BT30231) **ELECTRICAL MACHINES-I LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE-REQUISITES: A course on Electric circuits.

COURSE DESCRIPTION: Speed control and performance characteristics of DC Machines; Determination of losses and performance evaluation of DC machines and transformers.

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

CO1. evaluate the operating characteristics of DC generators and validate the practical observations with the underlying concepts.
CO2. evaluate the operating characteristics of DC motors and validate the practical observations with the underlying concepts.
CO3. realize the philosophy of testing procedures of various DC machines and transformers by adhering the code of conduct.
CO4. evaluate the operating characteristics of transformers and validate the practical observations with the underlying concepts.
CO5. work independently or in teams to solve problems with effective communication.

Practical Exercises/List of Experiments: Minimum Ten experiments are to be conducted.

1. Draw OCC of DC shunt generator.
2. Performance evaluation by load test on DC shunt generator.
3. Performance evaluation by brake test on DC Shunt and Compound Motors.
4. Speed control of DC shunt motor.
5. Perform Swinburne’s test on DC Shunt motor.
6. Perform Hopkinson's test on two identical DC shunt machines.
7. Perform electric braking of DC motor.
8. Perform OC and SC tests on 1-Phase transformer.
9. Separation of core losses in a 1-Phase transformer.
10. Perform Sumpner's test.
11. Perform parallel operation of 1-Phase transformers.
12. Perform Scott connection on transformers.

TEXT BOOKS:

1. JB Gupta, *Theory and performance of Electrical Machines*(DC machines, Poly phase Circuits & AC machines) in SI Units, S.K. Kataria & Sons, New Delhi, 15th Edition, 2015.
2. R.K. Rajput, *Electrical Machines* in S.I. Units, Laxmi Publications (P) Ltd, 6th Edition, New Delhi, 2017.

REFERENCE BOOKS:

1. P.S. Bimbhra, *Electrical Machinery*, Khanna Publishers, 7th Edition, Delhi, 2011.
2. B.L. Theraja and A.K. Theraja, *A Text Book of Electrical Technology(in S. I. Units)*, Vol.2, S. Chand & Company Ltd, Multicolour illustrative Edition, New Delhi, 2014.

ADDITIONAL LEARNING RESOURCES:

1. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html
2. http://emcoep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical%20Engineering

II B. Tech. – I Semester
(20BT30232) **SIGNALS AND NETWORKS LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE-REQUISITES: Courses on Transformation techniques and linear algebra and Electric circuits.

COURSE DESCRIPTION: Practical investigations through simulation on signals and systems; Spectral analysis of signals, and analysis of Circuits, transients and two-port networks.

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

CO1. evaluate the characteristics/responses of various signals and systems and draw conclusions for validation.
CO2. analyze spectral characteristics of signals/response in frequency domain using Fourier, Laplace and z-Transforms.
CO3. Analyze characteristics of various DC and AC circuits and draw conclusions for validation.
CO4. analyze transient behavior of DC & AC circuits using mathematical methods and design timer circuits for desired specifications.
CO5. analyze network parameters of an isolated and interconnected two-port networks and design impedance and gain matching networks.
CO6. work independently or in teams to solve problems with effective communication.

Practical Exercises/List of Experiments: Minimum **Ten** experiments are to be conducted (Minimum Three experiments are to be conducted from Part-B and Part-C).

PART-A: Signals and Systems

1. Generation of continuous and discrete time signals.
2. Basic operations on continuous and discrete time signals — Time scaling and amplitude scaling.
3. Systems and their properties — Linearity, causality and stability.
4. Response of LTI systems for different excitations.

PART-B: Circuits

5. Current locus diagram of RL and RC circuits.
6. Analysis of Series and Parallel resonance.
7. Verification of Superposition theorem.
8. Verification of Maximum Power transfer theorem for DC & AC excitations.

PART-C: Networks

9. Transient response of RL and RC circuit and design of timer circuit.
10. Transient response of RLC circuit and applications.
11. Determination of two-port network parameters in an isolated networks — Z, Y, ABCD and h-Parameters.

12. Determination of two-port network parameters in an interconnected networks — Series-Series, Parallel-Parallel and cascaded interconnections.

TEXT BOOKS:

1. Lathi & Bhagwandas Pannalal, *Principles of Linear Systems and Signals,* Oxford University Press, 2nd Edition, 2009.
2. Charles K. Alexander & Matthew N. O. Sadiku, *Fundamentals of Electric Circuits,* McGraw-Hill education Private Limited, New Delhi, 5th Edition, 2013.

REFERENCE BOOKS

1. Matthew N Sadiku, and Warsame Hassan Ali, *Signals and Systems: A Primer with MATLAB,* CRC Press, 2016.
2. Alex Palamides Anastasia Veloni, *Signals and Systems Laboratory with MATLAB*, CRC Press Taylor & Francis Group, 2011.

ADDITIONAL LEARNING RESOURCES:

1. http://ssl-iitg.vlabs.ac.in/
2. https://nptel.ac.in/courses/117/101/117101055/
3. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/

II B. Tech. – I Semester

(20BT3MC01) **ENVIRONMENTAL SCIENCE**

(Mandatory Course)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	-	30	2	-	-	-

PRE-REQUISITES:-

COURSE DESCRIPTION: Natural resources; Ecosystems; Biodiversity; Environment pollution and control; Social issues and environment; Human population and environment.

COURSE OUTCOMES: On 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. Anubha Kaushik and Kaushik, C. P., *Perspectives in Environmental Studies*, New Age International (P) Ltd. Publications, 6th Edition, 2018.
2. Erach Barucha, *Environmental Studies,* Orient Blackswan, 3rd Edition, 2021.

REFERENCE BOOKS:

1. Cunningham, W. P. and Cunningham, M. A., *Principles of Environmental Science*, Tata McGraw-Hill Publishing Company, New Delhi, 8th Edition, 2016.
2. Benny Joseph, *Environmental Studies*, Tata McGraw-Hill, 2nd Edition, 2009.
3. Anji Reddy, M., *Text Book of Environmental Science and Technology*, BS Publications, Revised Edition, 2014.
4. Rajagopalan, R., *Environmental Studies*, Oxford University Press, 3rd Edition, 2015.

ADDITIONAL LEARNING RESOURCES:

1. Chauhan, B. S., *Environmental Studies*, University Science Press, 2nd Edition, 2018.
2. Botkin, D. B. and Keller, E. A., *Environmental Science: Earth as a Living Planet*, John Wiley & Sons, 9th International Student Edition, 2014.

II B. Tech. – II Semester
(20BT40441) **ANALOG ELECTRONICS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Electronic Devices and Circuits.

COURSE DESCRIPTION: Demonstrate Single Stage Amplifiers; Multi Stage amplifiers; Frequency Response; Negative Feedback Amplifiers; Oscillators; Multi vibrators; Large Signal 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 the concept of feedback to improve the stability of amplifiers and generate sustained oscillations.
CO3. realize different classes of Power Amplifiers to improve efficiency.
CO4. design filters to find the frequency response and operate IC555 in various modes for different applications.

DETAILED SYLLABUS:

UNIT-I: BJT AMPLIFIERS (11 Periods)
Classification of Amplifiers, Distortion in amplifiers, Analysis of Single Stage Common Emitter Amplifier- Frequency Response, Different coupling schemes used in multistage amplifiers, Effect of coupling and bypass capacitors on frequency response, Multistage Frequency Effects, Analysis of Two stage RC Coupled amplifier, Cascode amplifier, Darlington pair, Bootstrapped Darlington circuit, Hybrid- Pi (π)- Common Emitter model.

UNIT-II: NEGATIVE FEEDBACK AMPLIFIERS (9 Periods)
Classification of Amplifiers, Concepts of feedback – Classification of feedback amplifiers – General characteristics of negative feedback amplifiers – Effect of Feedback on Amplifier characteristics, Method of analysis of Feedback amplifier, Voltage series Feedback, Voltage shunt feedback, Current series feedback and Current shunt Feedback configurations.

UNIT-III: OSCILLATORS (8 Periods)
Conditions for oscillations, Classification, RC phase shift oscillator using BJT and FET, Wien bridge oscillator using BJT, Generalized analysis of LC oscillators, Hartley and Colpitts Oscillators, Crystal Oscillator, Frequency stability.

UNIT-IV: LARGE SIGNAL AMPLIFIERS (8 Periods)
Classification, Series fed Class A Power Amplifier- Power conversion Efficiency, Transformer Coupled class A power Amplifier, Push Pull and Complimentary Symmetry Class B power amplifier, Class AB operation, Principle of operation of class –C Amplifier, Transistor Power Dissipation, Heat Sinks.

UNIT-V: ACTIVE FILTERS AND 555 TIMER (9 Periods)

Analog Filters: Introduction, RC Active Filters- first order and second order all pass, Low pass & high pass, Band pass and Band reject using Op-Amp.

IC 555 Timer: Introduction to 555 Timer, functional diagram, Monostable Operations, Astable operations & their applications.

Total Periods: 45

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

TEXT BOOKS:

1. Jacob Millman, Christos C. Halkias and Satyabrata Jit, *Integrated Electronics,* McGraw-Hill Education, 3rd Edition, 2010.
2. Ramakanth A. Gayakwad, *Op-Amps & Linear ICs*, PHI, 3rd Edition, 1998.

REFERENCE BOOKS:

1. Adel S.Sedra, Kenneth C.Smith, Micro Electronics Circuits Theory and applications, OXFORD international student Edition 5th Edition, 2009.
2. Robert L. Boylestad and Louis Nashelsky, *Electronic Devices and Circuits Theory*, Pearson Education, 10th Edition, 2009.
3. D. Roy Chowdhury, *Linear Integrated Circuits*, New Age International (p) Ltd, 4th Edition, 2011.

II B. Tech. – II Semester
(20BT40201) **CONTROL SYSTEMS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Signals & Networks.

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 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 domain and design a compensator for a system using root locus technique to meet the desired specifications.
CO4. analyze stability of a system in frequency domain and design a compensator for a system to meet the desired specifications using Bode plot technique.
CO5. apply state space method to model the system to investigate controllability and observability.

DETAILED SYLLABUS:

UNIT-I: MATHEMATICAL MODELING OF SYSTEMS (10 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, Signal flow graph.

UNIT-II: TIME RESPONSE ANALYSIS (9 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 (9 Periods)
Introduction to stability, Stability in terms of location of roots, Routh-Hurwitz stability criterion – Relative stability; Root locus — rules to construct root loci, effect of adding pole and zero on root loci; Design of Lag and Lead Compensators using root locus.

UNIT-IV: FREQUENCY RESPONSE ANALYSIS (9 Periods)
Frequency domain specifications, Bode plot, Polar plot and Nyquist Stability Criterion Correlation between time and frequency response; Design of Lag and Lead Compensators using bode plot.

UNIT-V: STATE SPACE ANALYSIS (8 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 – diagonalization 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., 2nd Edition, 2014.
2. Katsuhiko Ogata, *Modern Control Engineering*, Pearson Education Publishers, 5th Edition, 2010.

REFERENCE BOOKS:

1. Nagrath I.J. and Gopal M, *Control Systems Engineering*, New Age International Publications, 5th Edition, 2010.
2. Richard C. Dorf and Robert H. Bishop, *Modern Control Systems*, Prentice Hall, 12th Edition, 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.

II B. Tech – II Semester
(20BT40202) **DIGITAL ELECTRONICS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Electronic Devices and Circuits.

COURSE DESCRIPTION: Boolean algebra; Minimization techniques; Analysis of digital circuits; Asynchronous Sequential Logic, Programmable Memories and Computer arithmetic.

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

CO 1. design logical circuits by analysing various Boolean functions and simplification methods to perform desired logical operations using logical gates.
CO 2. design combinational logical circuits for performing various arithmetic operations and data encoding and decoding in various data lines.
CO 3. analyze various sequential circuits for realizing counters and registers using flip-flops.
CO 4. analyze clocked sequential circuits using various techniques and realize design procedures for optimal circuits.
CO 5. design programmable logic devices for required memory and develop various computer algorithms for arithmetic operations.

DETAILED SYLLABUS

UNIT I: Boolean Algebra & Logic Gates (11 Periods)
Boolean Algebra-Basic definition, Basic theorems and properties, Boolean Functions, Canonical & Standard forms, the map method, four variable, Five variable K-map, POS & SOP Simplification, Don't care conditions.
Logic Gates: logic operations & Logic gates, NAND & NOR Implementation, Other two level Implementation.

UNIT II: Combinational Circuits (08 Periods)
Combinational circuits, Analysis & Design procedure, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude comparator, Decoder, Encoders, Multiplexers, Demultiplexers-1-Line to 4-Line and 1-Line to 8-Line De-multiplexers.

UNIT III: Sequential Circuits-I (09 Periods)
Sequential Circuits, Latches, Flip-Flops, conversions, Clocked sequential circuits, Registers-Shift Registers, Counters- Synchronous counters and Asynchronous counters.

UNIT IV: Sequential Circuits -II (08 Periods)
Analysis of Clocked sequential circuits – Mealy & Moore circuits, design procedure, State Reduction & Assignment- partition technique, merger chart & merger table, Hazards.

UNIT V: Programmable Memories & Computer Arithmetic (09 Periods)
Programmable Memories: ROM, PLA, PAL.

Computer Arithmetic: Addition and Subtraction, Multiplication and Division Algorithms.

Total Periods: 45

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

TEXT BOOKS:

1. A. Anand Kumar, *Switching Theory and Logic Design*, PHI, 2008.
2. M. Morris Mano, *Digital Design*, Pearson, 5th Edition, 2013.

REFERENCE BOOKS:

1. ZviKohavi and NirahK.Jha, *Switching theory and Finite Automata Theory*, Tata McGraw-Hill, 2nd Edition, 1978.
2. Charles H. Roth, *Fundamentals of Logic Design*, Thomson Publications, 5th Edition, 2004.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117/101/117101055/
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/

II B. Tech. – II Semester
(20BT40203) **ELECTRICAL MACHINES-II**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Electrical Machines-I and Electrical Machines-I Lab.

COURSE DESCRIPTION: Construction, types, operation and applications of induction machines and synchronous machines; parallel operation of synchronous generators; Performance evaluation of induction machines and synchronous machines.

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

CO1. analyze the performance of induction machine to evaluate the operating parameters and to asses feasible control strategies.
CO2. analyze the performance of synchronous generator to evaluate the operating parameters and to assess measures for sustainability.
CO3. analyze the synchronized operation of alternators and the effect of influencing factors on synchronization, and to determine feasible operating state for sustainability.
CO4. analyze the performance of synchronous motor to evaluate the operating parameters, and to determine sustainable and feasible operating states for various loadings.

DETAILED SYLLABUS:

UNIT-I: THREE PHASE INDUCTION MOTORS (9 Periods)
Production of rotating magnetic field in 3-phase Induction motor, slip, rotor EMF and rotor frequency, rotor reactance, rotor current and power factor at standstill and running conditions; ratio of full-load torque and maximum torque, ratio of starting torque and maximum torque; losses in 3-phase induction motor, relation between rotor power input, rotor copper loss and mechanical power developed; Induction motor as a generalized transformer. Double-cage and deep bar rotors.

UNIT-II: STARTING AND SPEED CONTROL METHODS (9 Periods)
Methods of starting — starting current and torque calculations for direct online, primary resistors, auto transformer and star-delta starters; Crawling and Cogging; Speed control — change of frequency, voltage and stator poles, rotor rheostat control, cascade connection and injection of EMF into rotor circuit; Induction generator — principle of operation and its applications.

UNIT-III: SYNCHRONOUS GENERATORS (10 Periods)
Armature windings — integral slot and fractional slot, distributed and concentrated, short pitch and full pitch, winding factors; EMF equation, harmonics in generated EMF and suppression of harmonics. Armature reaction and its effect for various operating power

factors. — Phasor diagrams; Power flow equations in synchronous generator; Salient pole alternators —two-reaction theory, phasor diagrams and voltage regulation.

UNIT-IV: PARALLEL OPERATION OF SYNCHRONOUS GENERATORS (10 Periods)
Conditions for parallel operation; methods of synchronization; Synchronizing current, power and torque, rigidity factor; Effect of change of excitation and mechanical power input on parallel operation of two alternators, load sharing between two alternators; Synchronous machines on infinite bus bars; Short Circuit Ratio (SCR) and its significance; Time period of rotor oscillations.

UNIT-V: THREE PHASE SYNCHRONOUS MOTORS (7 Periods)
Principle of operation; starting methods —auxiliary motor, damper winding, synchronous-induction motor. Phasor diagrams; Variation of armature current and power factor with excitation; synchronous condenser; Power flow equations in synchronous motor; Circle diagram —excitation and power circles; Hunting and its suppression.

Total Periods: 45

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

TEXT BOOKS:

1. P.S. Bimbhra, *Electrical Machinery*, 7th Edition, Khanna Publishers, New Delhi, 2011.
2. JB Gupta, *Theory and performance of Electrical Machines (DC machines, Poly phase circuits & AC machines) in SI Units*, 15th Edition, S.K. Kataria & Sons, New Delhi, 2015.

REFERENCE BOOKS:

1. A.E. Fitzgerald, C. Kingsley and S. Umans, *Electric Machinery*, 6th Edition, McGraw-Hill, New Delhi, 2008.
2. B.L. Theraja and A.K. Theraja, *A Text Book of Electrical Technology in S. I. Units*, Vol.2, S. Chand Company Ltd, Multicolour Edition, New Delhi, 2014.

II B. Tech. – II Semester
(20BT40204) **ELECTRICAL MEASUREMENTS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	2	-	-	2

PRE-REQUISITES: A course on Electric Circuits.

COURSE DESCRIPTION: Measurement of electrical quantities; construction, working, design and applications of various electrical measuring instruments; Performance evaluation of various electrical measuring instruments.

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

CO1. understand the constructional and operating principles of various measuring instruments and design an appropriate shunt and multiplier for the extension of instrument range.
CO2. analyze various errors, while measuring the electrical quantities due to interconnection of power, energy and power factor measuring instruments and assess the error compensation techniques.
CO3. analyse the standard producers and calibration methods , while measuring the electrical quantities due to interconnection of instrument transformers and potentiometers.
CO4. analyze the phasor of various electrical bridges used for measuring, to estimate various electrical quantities.
CO5. analyze the patterns of various monitoring instruments to determine the phase and frequency of various electrical signals.

DETAILED SYLLABUS:

UNIT-I: MEASUREMENT OF VOLTAGE AND CURRENT (07 Periods)
Introduction, PMMC, MI instruments — Construction, working, errors, compensations, advantages and disadvantages, extensions.

UNIT-II: MEASUREMENT OF POWER, ENERGY AND POWER FACTOR (06 Periods)
Wattmeter: EDM type wattmeter — construction, working, errors and compensations and LPF wattmeter.

Energy Meter: construction, working, driving and braking torques, errors and compensations.

Power factor meter: single phase and three phase meters.

UNIT-III: INSTRUMENT TRANSFORMERS AND POTENTIOMETERS (06 Periods)
Current and Potential transformers — construction, working, measurement of power using instrument transformers.

DC Crompton's potentiometer — principle, operation, standardization and applications.
AC Potentiometers: Polar type — Principle, operation, standardization and applications.

UNIT-IV: DC AND AC BRIDGES (06 Periods)

Measurement of resistance: Wheatstone bridge, Kelvin's double bridge and loss of charge method.

Measurement of inductance: Maxwell's inductance-capacitance, Anderson's bridges.

Measurement of capacitance & frequency: Schering Bridge and Wien's bridge.

UNIT-V: CRO AND DIGITAL INSTRUMENTS (05 Periods)

Cathode ray oscilloscope: Block diagram of cathode ray tube, measurement of phase and frequency by Lissajous patterns.

Digital instruments: Digital voltmeters—ramp type only, Digital energy meter, Digital storage oscilloscope, Digital frequency meter, Digital multi-meters.

Total Periods: 30

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

TEXT BOOKS:

1. A.K. Sawhney, A course on *Electrical and Electronics Measurements & Instrumentation*, Dhanpat Rai and Co. Publishers, 19th Edition, 2015.
2. J.B. Gupta, A course on *Electrical and Electronics Measurements & Instrumentation*, S.K. Kataria publishers, 14th Edition, 2014.

REFERENCE BOOKS:

1. H. S. Kalsi, *Electronic Instrumentation*, Tata MC Graw Hill Company, 3rd Edition, 2010.
2. E.W. Golding and F.C. Widdis, *Electrical Measurements and measuring Instruments,* Reem Publications, 5th Edition, 2011.

II B. Tech. – II Semester

(20BT4BS01) **MATERIAL SCIENCE**

(Open Elective-1)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Introduction to material science and engineering; properties, processing and applications of composite materials; smart materials; nano and biomimetic materials; emerging materials.

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

CO1. demonstrate the basic knowledge on different materials.
CO2. analyze the structure and properties of various composites used in commercial aircraft, marine grade sandwich and wind turbine blades using different methods.
CO3. demonstrate the basic properties of piezoelectric, magneto-rheostatic, electro-rheostatic, and shape memory alloys used for different applications.
CO4. analyze the properties of nano materials for NEMS & biomimetic materials for dolphin sound wave technology and apply Lithographic technique for deposition of nanomaterials.
CO5. demonstrate the processing and properties of functionally graded materials for nano electronic and optoelectronic applications.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO MATERIAL SCIENCE AND ENGINEERING **(7 Periods)**

Introduction - material science and engineering, engineering materials and advanced materials, modern materials needs, processing and properties of metals, polymers and ceramics (Qualitative).

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

Composite materials – classification based on matrix phase and dispersed phase – functions of matrix phase and dispersed phase – polymer matrix composites and structural composites – applications (commercial aircraft, marine grade sandwich and wind turbine blades), basic composite manufacturing methods: prepeg-up process, wet lay –up (hand lay –up) process - advantages and limitations of composites.

UNIT- III: SMART MATERIALS **(08 Periods)**

Smart materials – piezoelectric, magneto-rheostatic (MR) and electro-rheostatic (ER) materials - shape memory alloys (SMA): characteristics, preparation of SMA, applications in different fields, advances in smart materials.

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

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

Biomimetic materials – Introduction- classification and their applications of biomimetic materials (Lotus effect, Dolphin sound wave technology and viper as a model in its defense).

UNIT- V: EMERGING MATERIALS (10 Periods)

Functionally graded materials (FGM): Types, properties, processing and potential applications, functionally graded fiber cement: mixture design, processing and as structural material, Functionally Graded Nano-electronic, Optoelectronic and Thermoelectric Materials (Qualitative) and its applications.

Total Periods: 45

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

TEXT BOOKS:

1. K M Gupta, *Engineering Materials – Research, Applications and Advances*, CRC press (Taylor & Francis group), 2015.
2. William D Callister, David G Rethwisch, *Materials Science and Engineering*, Wiley, 9th Edition, 2014.

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.

II B. Tech. – II Semester

(20BT4HS02) BUSINESS COMMUNICATION AND CAREER SKILLS

(Open Elective-1)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: –

COURSE DESCRIPTION: Nature and Scope of Communication, Corporate Communication, Writing Business Messages & Documents, Careers & Résumés, and Interviews.

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

CO1: demonstrate knowledge of professional communication by analyzing and applying the styles and strategies of business communication in Communication Networks, Interpersonal, and Informal communication.
CO2: analyze the limitations of communication by applying and demonstrating corporate and cross-cultural communication strategies effectively in a business context and Crisis Management situations.
CO3: apply appropriate strategies and techniques in writing business messages, business letters, and résumé for effective professional communication and career building.
CO4: demonstrate appropriate communication techniques and answering strategies by analyzing the expectations during presentations and interviews.

DETAILED SYLLABUS:

UNIT–I: NATURE AND SCOPE OF COMMUNICATION (9 Periods)

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

UNIT–II: CORPORATE COMMUNICATION (9 Periods)

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

UNIT–III: **WRITING BUSINESS MESSAGES & DOCUMENTS (9 Periods)**

Introduction – Importance of Written Business Communication – Types of Business Messages – Five Main Stages of Writing Business Messages – Business Letter Writing – Kinds of Business Letters – Common Components of Business Letters – Strategies for Writing the Body of a Letter.

UNIT–IV: CAREERS AND RÉSUMÉS (9 Periods)

Introduction – Career Building – Résumé Formats: Traditional, Electronic and Video Résumé – Sending Résumés – Follow-up Letters – Business Presentations and Speeches: Planning –Structuring – Organizing – Delivery.

UNIT–V: INTERVIEWS **(9 Periods)**

Introduction – General Preparation for an Interview – Success in an Interview – Important Non-verbal Aspects – Types of Interviews – Styles of Interviewing – Types of Interviewing –Online Recruitment Process.

Total Periods: 45

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

TEXT BOOKS:

1. Meenakshi Raman, and Prakash Singh, *Business Communication*, Oxford University Press, New Delhi, 2nd Edition, 2012.
2. Neera Jain, and Sharma Mukherji, *Effective Business Communication*, Tata Mc Graw-Hill Education, Pvt. Ltd., New Delhi, 2012.

REFERENCE BOOKS:

1. Courtland L. Bovee et al., *Business Communication Today*, Pearson, New Delhi, 2011
2. Krizan, *Effective Business Communication*, Cengage Learning, New Delhi, 2010.

ADDITIONAL LEARNING RESOURCES

1. http://www.career.vt.edu/interviewing/TelephoneInterviews.html
2. http://job-search-search.com/interviewing/behavioral_interviews
3. https://goo.gl/laEHOY (dealing with complaints)
4. http://www.adm.uwaterloo.ca/infocecs/CRC/manual/resumes.html
5. https://goo.gl/FEMGXS
6. http://www.resumania.com/arcindex.html

II B. Tech. – II Semester

(20BT4HS04) ENTREPRENEURSHIP FOR MICRO, SMALL AND MEDIUM ENTERPRISES

(Open Elective - 1)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE REQUISITE: --

COURSE DESCRIPTION: Introduction to entrepreneurship; Idea generation and formulation of business plans; Micro small and medium enterprises; Institutional finance; Women & rural entrepreneurship.

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

CO1. demonstrate the concepts of Entrepreneurship and Entrepreneur.
CO2. analyze the Ideas and Business Plans for promoting entrepreneurships and start-ups.
CO3. demonstrate the environment of Micro, Small and Medium Enterprises.
CO4. analyze the various sources of Institutional Finance for promoting entrepreneurship.
CO5. demonstrate the encouragement for Women and Rural Entrepreneurship.

DETAILED SYLLABUS:

UNIT – I: INTRODUCTION TO ENTREPRENEURSHIP (9 Periods)

Introduction to Entrepreneurship - Concept of Entrepreneurship – Growth of Entrepreneurship in India **-** Factors affecting entrepreneurship growth - Characteristics of an Entrepreneur – Functions of Entrepreneur – Types of Entrepreneurs – Distinction between an Entrepreneur and a manager.

UNIT – II: IDEA GENERATION AND FORMULATION OF BUSINESS PLANS (9 Periods)

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

UNIT – III: MICRO SMALL AND MEDIUM ENTERPRISES (9 Periods)

Meaning and Definition of Micro, Small and Medium Enterprises – Essential Features – Scope and Objectives of Micro Small and Medium Enterprises – relationship between Micro and Macro Enterprises- Problems of Micro Small and Medium Enterprises.

UNIT–IV: INSTITUTIONAL FINANCE (9 Periods)

Institutional Finance **–** Need – Scope - Services - Various Institutions offering Institutional support: – Small Industries Development of Bank of India (SIDBI), State Industrial

Development Corporations (SIDC) – Small Industries Development Organization (SIDO) – Small Industries Service Institutes (SISIs) – State Financial Corporation (SFC) - National Institute of Entrepreneurship and Small Business Development (NIESBUD) – Micro Units Development and Refinance Agency Bank (MUDRA).

UNIT–V: WOMEN & RURAL ENTREPRENEURSHIP (9 Periods)

Concept of Women entrepreneurs - Functions of Women entrepreneurs - Growth of women entrepreneurship in India - Challenges of Women entrepreneurs - Programmes for 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 & Shikha Sahai, *Entrepreneurship*, Excel Books India, 4th Edition, 2014.

REFERENCE BOOKS:

1. Nandan, H., *Fundamentals of Entrepreneurship*, PHI Learning Pvt. Ltd., New Delhi, 3rd Edition, 2013.
2. Bholanath Dutta, *Entrepreneurship Management* – Text and Cases, Excel Books, 3rd Edition, 2015.

II B. Tech. – II Semester

(20BT4HS06) GERMAN LANGUAGE (Deutsch alsFremdsprache)

(Open Elective - 1)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	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. demonstrate basic knowledge of German language and the verb conjugation.
CO2. comprehend and apply the knowledge of vocabulary and phrases in day-to-day real-life conversation.
CO3. apply the various sentence structures by examining the rules of grammar in speaking and writing.
CO4. analyze and apply the various verb structure of English and German language effectively in professional writing

DETAILED SYLLABUS:

UNIT- I: INTRODUCTION (9 Periods)

Introduction - German alphabets, numbers, days in a week, names of months, seasons. Grammar: Nouns –(i)Nominative case and (ii) Nominative personal pronouns, simple sentence, Verb Conjugation 1st and 2nd type, verb Conjugation 3rd type, 'Wh' questions (simple sentences) Nominative (definite and indefinite) Articles

UNIT-II: CITY AND FOOD (9 Periods)

In the city: naming places and buildings, means of transport, basic directions. Food: drink, groceries and meals. Apartments: rooms, furniture, colours.
Grammar: Nouns-articles negation–(kein and nicht); imperative and the accusative case; Nominative Possessive Pronouns.

UNIT-III: DAY TO DAY CONVERSATIONS (9 Periods)

Everyday life, telling time, making appointments, leisure activities, and celebrations. Different types of professions, Health and the body, Holiday and weather, Clothes and Dresses.

UNIT-IV: BASIC GRAMMAR (9 Periods)

Grammar: Possessive articles, Prepositions (am, um, von. bis); Modal verbs, Separable verbs, the accusative, past tense of 'to have' and 'to be', the imperative sentences, dative case, perfect tense.

UNIT V: BASIC WRITING **(9 Periods)**

Translation from English to German and German to English, Contacts, Writing letters and Email Writing.

Total Periods: 45

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

TEXT BOOKS:

1. Stefanie Dengler, Paul Rusch, Helen Schmitz, Tana Sieber, *NetzwerkDeutsch als Fremdsprache, Kursbuch A1*, Goyal Publishers and Distributors Pvt. Ltd. 2015.
2. Stefanie Dengler, Paul Rusch, Helen Schmitz, Tana Sieber, *Netzwerk Deutsch als Fremdsprache, Arbeitsbuch A1*, Goyal Publishers and Distributors Pvt. Ltd. 2015.

Web link:

1. https://learngerman.dw.com/en/beginners/c-36519789

II B. Tech. – II Semester

(20BT4HS08) **INDIAN HISTORY**

(Open Elective - 1)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-RQUISITES: --

CORSE DESCRIPTION: Introduction; Ancient India; Classical and Medieval era; Modern India; India after independence.

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

CO1. demonstrate contextual knowledge in evolution of ancient and medieval Indian History and acquire awareness on societal and cultural transformation.
CO2. analyze the situations before and after Independence and assess the societal reforms implemented in India after Independence.
CO3. practice culture transformations and appreciate its influence to adapt themselves in global scenario.

DETAILED SYLLABUS:

UNIT- I: INTRODUCTION TO INDIAN HISTORY (8 Periods)

Elements of Indian History; History Sources: Archaeology, Numismatics, Epigraphy & Archival research; Methods used in History; History & historiography; sociological concepts-structure, system, organization, social institutions, Culture and social stratification (caste, class, gender, power), State& Civil Society.

UNIT- II: ANCIENT INDIA (9 Periods)

Mohenjo-Daro civilization; Harappa civilization; Mauryan Empire.

UNIT- III: CLASSICAL & MEDIEVAL ERA (12 Periods)

Classic Era (200 BC - 1200 AD); Hindu - Islamic Era (1200 - 1800 AD).

UNIT- IV: MODERN INDIA (6 Periods)

Age of Colonialism (17th - 19th centuries); First war of Indian Independence; Freedom Struggle (1857-1947)

UNIT-V: INDIA AFTER INDEPENDENCE (1947 -) (10 Periods)

The Evolution of the Constitution and Main Provisions; Consolidation of India as a Nation; Politics in the States; Indian economy; Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and inclusion, 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, 21st Reprint, 2017.

REFERENCE BOOKS:

1. Guha, Ramachandra, *India after Gandhi*, Pan Macmillan, 2007.
2. Romila Thapar, *Early India***,** Penguin India, New Delhi 2002.

II B. Tech. – II Semester

(20BT4HS10) **PERSONALITY DEVELOPMENT**

(Open Elective - 1)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Personalities and Leadership Qualities; Self Esteem and self-Development; Attitude; Communication Relationship; Critical Work Skills and Ethics.

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

CO1. demonstrate knowledge of leadership qualities by examining and applying personality traits.
CO2. analyze and apply the proven techniques to build self-esteem and self-confidence.
CO3. analyze the limitations of attitudes by demonstrating how experiences and circumstances impact attitudes.
CO4. analyze the role of communication in relationships, qualities of a team player and leadership styles.
CO5. apply appropriate techniques in solving problems by examining and demonstrating time management, stress management and anger management.

DETAILED SYLLABUS:

UNIT-I: PERSONALITIES AND LEADERSHIP QUALITIES (9 Periods)

Introduction: Different Personalities -Personality Analysis -Freudian Analysis - Vedantic Concept: Swamy Vivekananda -Personality Begets - Types - Leadership Qualities - Decision Making**-** Case Studies: Personalities.

UNIT-II: SELF ESTEEM AND SELF DEVELOPMENT (9 Periods)

Know Yourself: Self Image - Positive Self-Esteem - Turn Failure into Success - Be Sensitive to Feedback - Build Self-Confidence - Self Actualization - Set Goals - Action Plans - Accountability - Behavior Modification - Mentoring - Learning - Counseling -Challenge yourself with Aptitude Tests and Internships.

UNIT-III: ATTITUDE (9 Periods)

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

UNIT-IV: COMMUNICATIONRELATIONSHIP (9 Periods)

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

UNIT-V: CRITICAL WORK SKILLS AND ETHICS (9 Periods)

Time Management - Balancing Life and Work - Stress Management - Anger Management - Making Decisions and Solving Problems - Developing Creativity - Ethics and Self-Righteousness - Being Judgmental in the Real World - Striving for Integrity.

Total Periods: 45

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

TEXT BOOKS:

1. Barun K. Mitra, *Personality Development and Soft Skills,* Oxford University Press, 2011.
2. Harold R. Wallace and L. Ann Masters, *Personal Development for Life and Work*, Cengage Learning, Delhi, 10th Edition Indian Reprint, 2011. (6th Indian Reprint 2015)

REFERENCE BOOKS:

1. K. Alex, *Soft Skills*, S. Chand & Company Ltd, New Delhi, 2nd Revised Edition 2011.
2. Stephen P. Robbins and Timothy A. Judge*, Organizational Behaviour*, Prentice Hall, Delhi, 16th Edition 2014.

ADDITIONAL LEARNING RESOURCES

- https://www.universalclass.com/.../the-process-of-perso...
- https://www.ncbi.nlm.nih.gov/pubmed/25545842

II B. Tech. – II Semester

(20BT4HS12) **WOMEN EMPOWERMENT**

(Open Elective - 1)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	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 knowledge of the characteristics and achievements of empowered women and women's empowerment techniques by analyzing women's legal and political status.

CO2: apply the knowledge of women's rights by analyzing various societal issues and obstacles in different fields, including science and technology.

CO3: demonstrate the knowledge of significance of women's participation in policy debates, National conferences, and common forums for equality and development by identifying and analyzing issues.

CO4: analyze the concept of women's entrepreneurship, government schemes, and entrepreneurial challenges and opportunities.

DETAILED SYLLABUS:

UNIT- I: CONCEPT & FRAMEWORK (9 Periods)

Introduction– Empowered Women's Characteristics – Achievements of Women's Empowerment **Concept of Empowerment:** Meaning & Concept – Generalizations about Empowerment – Empowerment Propositions – Choices women can make for empowerment – Women's participation in decision making, development process & in Governance. **Framework for Empowerment** – Five levels of equality – Tenets of Empowerment– Elements – Phases and aspects – Techniques – Categories and Models – Approaches.

UNIT- II: STATUS OF WOMEN (9 Periods)

Legal Status: Present Scenario – Call for Social change – Significant trends – Legal & Schemes – Personal Law – Joint Family – Criminal Law – Shift towards Dowry – Deterrent Punishment – Criminal Law (II Amendment) – Discrimination in Employment.

Political Status: Present Scenario – Political Participation & its Nature – Socio–economic Characteristics – Political Mobilization: Mass Media – Campaign Exposure – Group Orientation – Awareness of issues and participation – Progress & Future Thrust.

UNIT - III: WOMEN'S RIGHT TO WORK (9 Periods)

Introduction – Present Scenario – Changes in Policy & Programme – National Plan of Action– Women's Cells and Bureau – Increase in work participation rate – Discrimination in 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 (9 Periods)

Dynamics of social change – conscious participation – Information Explosion – Organized Articulation – National Conference – Common Forums – Participatory Development – New Issues Identified – Role of other Institutions.

UNIT - V: WOMEN ENTREPRENEURSHIP (9 Periods)

Introduction – Definition – Concept – Traits of women Entrepreneurs – Role of women Entrepreneurs in India – Reasons of Women Entrepreneurship – Government schemes & Financial Institutions to develop Women Entrepreneurs – Key policy recommendations – Project Planning – Suggestions and measures to strengthen women entrepreneurship – Growth & Future challenges – Training and Opportunities – **Case Study:** Training Women as Hand–pump Mechanics– **Case Study** : Literacy for Empowering Craftswomen.

Total Periods: 45

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

TEXT BOOKS:

1. Sahay Sushama. *Women and Empowerment.* Discovery Publishing House, New Delhi. 2013.
2. Nayak Sarojini, Jeevan Nair. *Women's Empowerment in India*. Pointer Publishers, Jaipur. 2017.

REFERENCE BOOKS:

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

II B. Tech. – II Semester

(20BT40205) RELIABILITY AND SAFETY ENGINEERING

(Open Elective - 1)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Differential Equations and Multi-Variable Calculus, and Transformation Techniques and Linear Algebra.

COURSE DESCRIPTION: Fundamentals of reliability engineering; Network modelling and reliability evaluation; Markov chain and Markov processes; basics of safety concepts and safety techniques and applications.

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

CO1. develop mathematical model of a network to evaluate the parameters for assessing the reliability of a system.

CO2. analyze the time dependent/independent characteristics of a repairable system and frequency durations techniques to assess reliability.

CO3. understand various safety management, policy, and planning strategies for personal and industrial safety.

CO4. understand various safety and hazard identification techniques and follow appropriate safety measures in industry and society.

DETAILED SYLLABUS:

UNIT-I: FUNDAMENTALS OF RELIABILITY ENGINEERING (9 Periods)

Random variables, probability concepts, rules for probabilities of events. Probability density and distribution functions. Binomial distribution - Expected value and standard deviation for binomial distribution. Reliability functions, f(t), F(t), h(t) - Relationship between these functions, Exponential density and distribution functions, expected value and standard deviation of exponential distribution. Measures of reliability - MTTF, MTTR, MTBF. Bathtub curve.

UNIT-II: NETWORK MODELING AND RELIABILITY EVALUATION (9 Periods)

Basic concepts - Evaluation of network reliability/unreliability, series systems, parallel systems, series - Parallel configuration systems. Redundant systems and its types. Evaluation of network reliability / unreliability using conditional probability method, tie-set and cut-set based approach, complete event tree and reduced event tree methods.

UNIT-III: MARKOV CHAIN AND MARKOV PROCESSES (9 Periods)

Basic concepts, stochastic transitional Probability matrix, time dependent probability evaluation, Limiting State Probability, Absorbing states. Modelling concepts – State space diagrams, time dependent reliability evaluation of single component repairable model, two component repairable model. Frequency and duration techniques.

UNIT-IV: BASICS OF SAFETY CONCEPTS (9 Periods)

Introduction, goals, need for safety, history of safety movement - evolution of modern safety concept, general concepts of safety management. Planning for safety- productivity, quality and safety, line and staff functions, budgeting for safety, safety policy.

UNIT-V: SAFETY TECHNIQUES AND APPLICATIONS (9 Periods)

Introduction to safety techniques, Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, safety sampling, evaluation of performance of supervisors on safety. Hazard identification techniques, components of safety audit, types of audit, audit methodology, process of safety reporting. Applications of industrial Safety, environmental safety, health safety, electrical safety, fire safety.

Total Periods: 45

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

TEXT BOOKS:

1. Roy Billintonand Ronald N Allen, *Reliability Evaluation of Engineering Systems*, 2nd Edition, Springer, New York, 2013.
2. Frank R. Spellman, Nancy E. Whiting, *Safety Engineering: Principles and Practices*, 3rd Edition, Rowman& Littlefield, 2018.

REFERENCE BOOKS:

1. Charles E. Ebeling, *An introduction to reliability and maintainability engineering*, 2nd Edition Tata McGraw-Hill Education, 2010.
2. Dan Petersen, *Techniques of Safety Management: A Systems Approach*, 4th Edition american society of safety engineers, 2003.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/105/108/105108128/
2. https://nptel.ac.in/courses/110/105/110105094/
3. https://www.youtube.com/watch?v=uutg8jKrL9w
4. https://www.youtube.com/watch?v=_c-iZ2BAXPw
5. https://www.youtube.com/watch?v=GeMCF3s5EDk
6. https://www.youtube.com/watch?v=xYWyype7cxE

II B. Tech. – II Semester

(20BT40105)**ENVIRONMENTAL POLLUTION AND CONTROL**

(Open Elective - 1)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	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: On successful completion of this course, the students will be able to:

CO1 Analyze air and noise pollution using appropriate tools and techniques to solve complex environmental issues following relevant standards considering society, environment and sustainability besides communicating effectively in graphical form.

CO2 Analyze air and noise pollution control measures using appropriate tools and techniques to solve complex environmental issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO3 Analyze water pollution and its control measures using appropriate tools and techniques to solve complex environmental issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO4 Analyze soil pollution and its control measures using appropriate tools and techniques to solve complex environmental issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO5 Analyze solid waste and its management measures using appropriate tools and techniques to solve solid waste disposal issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT – I: AIR AND NOISE POLLUTION (08 Periods)

Air Pollution: Scope, Significance, Classification, Sources – Line, Area, Stationary, Mobile; Effects of air pollutants on man, material and vegetation; Global effects of air pollution; Air pollution meteorology - Lapse rate, Inversion, Plume pattern; Dispersion of air pollutants - Dispersion models and applications; Ambient air quality standards.

Noise Pollution: Sound pressure, Power and intensity, Impacts of noise, permissible limits of noise pollution, measurement of noise, Noise standards.

UNIT – II: AIR AND NOISE POLLUTION CONTROL (10 Periods)

Self cleansing properties of the environment, Dilution method, Control at source, Process changes and equipment modifications, Control of particulates – Types of equipment,

Design and operation - Settling chambers, Centrifugal separators, Bag house filters, Wet scrubbers, Electrostatic precipitators; Control of gaseous pollutants – Adsorption, Absorption, Condensation, Combustion; Control of air pollution from automobiles, Control of noise pollution, Case studies, Latest developments in the air and noise pollution control.

UNIT – III: WATER POLLUTION AND CONTROL (10 Periods)

Water pollution – Sources, Causes, Effects; Surface and groundwater quality – Physical, Chemical, Biological; Drinking water quality standards, Water purification – Processes, Engineered systems – Aeration, Solids separation, Settling operations, Coagulation, Softening, Filtration, Disinfection; Wastewater – Sources, Causes, Effects, Treatment process and disposal – Primary, Secondary, Tertiary; Case studies, Latest developments in the water pollution control.

UNIT – IV: SOIL POLLUTION AND CONTROL (08 Periods)

Soil pollutants, Sources of soil pollution, Causes, Effects and control of soil pollution, Diseases caused by soil pollution, Methods to minimize soil pollution, Effective measures to control soil pollution, Soil quality standards, Case studies, Latest developments in the soil pollution control.

UNIT – V: MUNICIPAL SOLID WASTE MANAGEMENT (09 Periods)

Municipal solid waste – Types, Composition and characteristics; Methods of collection and transportation; Methods of disposal – Open dumping, Sanitary landfill, Composting and Incineration; Utilization - 6R Concept, Recovery and recycling and Energy Recovery; Latest developments in solid waste management

Total Periods: 45

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

TEXT BOOKS:

1. Peavy, H. S, Rowe, D. R., and Tchobanoglous, G., *Environmental Engineering*, McGraw Hill Inc., 1985.
2. Rao, C. S. *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. Rao, M. N. and Rao, H. V. N., *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. Khopkar, S. M., *Environmental Pollution Monitoring and Control,* New Age International Pvt. Ltd., 2nd Edition, 2007.
4. Domkundwar, V. M., *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

II B. Tech. – II Semester

(20BT40106) PLANNING FOR SUSTAINABLE DEVELOPMENT

(Open Elective - 1)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PREREQUISITES: -

COURSE DESCRIPTION: Sustainable development; Environmental impact; Sustainable Policies; Governance; Theories and strategies; Media and education for sustainability.

COURSE OUTCOMES: On 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., 3rd Edition, 2018.
2. Jennifer A. Elliot, *An Introduction to Sustainable Development*, Routledge, 4th Edition, 2013.

REFERENCE BOOKS:

1. Peter Rogers, Kazi F Jalal and John A Boyd, *An Introduction to Sustainable Development*, Earth Scan Publications Ltd., 2008.
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

II B. Tech. – II Semester

(20BT40107) **RURAL TECHNOLOGY**

(Open Elective - 1)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Technology for rural development; Non-conventional 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 Saansad Adarsh Gram Yojana (SAGY), Village adoption schemes.

Total Periods: *45*

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

TEXT BOOKS:

1. Prabhath, S. V., and Sita Devi, P. Ch., *Technology and Rural India*, Serials Publications, 1st Edition, 2012.
2. Virdi, M. S., *Sustainable Rural Technologies*, Daya Publishing House, 2nd Edition 2018.
3. Chakravarthy, R., and Murthy, P. R. S., *Information Technology and Rural Development*, Pacific Book International, 1st Edition, 2012.

REFERENCE BOOKS:

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

ADDITIONAL LEARNING RESOURCES:

1. Prasad, L. M., *Principles and Practice of Management*, S. Chand & Sons, 9th Edition, 2019.
2. Venkata Reddy, K., *Agriculture and Rural Development - Gandhian Perspective*, Himalaya Publishing House, 1st Edition, 2017.

II B. Tech. – II Semester

(20BT40305) **HUMAN RESOURCE MANAGEMENT**

(Open Elective - 1)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Introduction to HRM; recruitment, training and Placement, talent management; Basic types of interviews; Components; Compensation and reward administration; Ethics, Employee Relations, and Fair Treatment at Work, Dispute resolution and grievance management, trade unions and their role in collective bargaining;

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

CO1: demonstrate the knowledge of concepts and perspective on HRM.
CO2: demonstrate the knowledge of recruitment, placement and talent management.
CO3: demonstrate the knowledge of training and development.
CO4: demonstrate the knowledge of compensation and reward administration.
CO5: demonstrate the knowledge of ethics, and employee relations.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO HUMAN RESOURCE MANAGEMENT (9 Periods)
Importance of Human Resource Management (HRM), Concepts and perspective on HRM, Role of HRM in a competitive business environment, Environment affecting HRM at the enterprise level, The trends shaping HRM, HR metrics and benchmarking, HR accounting, inventory and information systems.

UNIT-II: RECRUITMENT, PLACEMENT, AND TALENT MANAGEMENT (9 Periods)
HR planning and job analysis, Employee testing and selection, Basic types of interviews, Placement, induction and socialization of the employees, Talent acquisition, talent management.

UNIT-III: TRAINING AND DEVELOPMENT (9 Periods)
Employee Orientation/On boarding, Appraising employee performance and potential evaluation, Techniques for appraising performance, Managing Employee Retention, Engagement, and Careers, Human Resource Development (HRD).

UNIT-IV: COMPENSATION (8 Periods)
Compensation and reward administration, Basic factors in determining pay rates, Job evaluation methods, Pay for Performance and Financial Incentives, Employee benefits and services.

UNIT-V: ENRICHMENT TOPICS IN HRM (10 Periods)
Ethics, Employee Relations, and Fair Treatment at Work, Dispute resolution and grievance management, trade unions and their role in collective bargaining, Employee Safety and

Health, Global Challenges in HRM, Managing Human Resources in Small and Entrepreneurial Firms, Business environment and workforce adjustments, Creating high performance systems, Innovations in HRM.

Total Periods: *45*

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

TEXT BOOKS:

1. Garry Dessler and BijuVarkkey, *Human Resource Management*, Pearson education, 16th Edition, 2020.
2. Aswathappa K, *Human Resource Management*, McGraw Hill Education, 8th Edition, 2017.

REFERENCE BOOKS:

1. V.S.P Rao, *Human Resource Management*, Taxmann Publications Pvt. Ltd, 2nd Edition 2020.
2. Bohlander George W, Snell Scott, *Principles of Human Resource Management*, Cengage Learning, 16th Edition, 2013.

II B. Tech. – II Semester

(20BT50506) **ETHICAL HACKING**

(Open Elective - 1)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	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 (9 Periods)

Introduction to Ethical Hacking: The role of security and penetration testers, Penetration-Testing methodologies, What you can and cannot do legally.

Network and Computer Attacks: Malicious software, Trojans, Backdoors, Viruses, and Worms, Protection against malware attacks, Intruder attacks on networks and computers, Addressing physical security.

UNIT –II:-TCP/IP CONCEPTS AND SOCIAL ENGINEERING (9 Periods)

TCP/IP Concepts: Overview of TCP/IP – Application layer, Transport layer, Internet layer; IP addressing – Planning IP address assignments, IPv6 addressing.

Social Engineering: What is social engineering, What are the common types of attacks, Understand insider attacks, Understand identity theft, Describe phishing attacks, Understand online scams, Understand URL obfuscation, Social engineering countermeasures.

UNIT-III: FOOTPRINTING ANDPORT SCANNING (9 Periods)

Footprinting: Using web tools for footprinting, Conducting competitive intelligence, Using domain name system zone transfers.

Port Scanning: Port scanning, Using port scanning tools, Conducting ping sweeps, Understanding scripting.

UNIT-IV: SYSTEM HACKING (9 Periods)

System hacking -Password cracking techniques, Types of passwords, Key loggers and other spyware technologies, Escalating privileges, Root kits, How to hide files,

Steganography technologies, How to cover your tracks and evidences; Sniffers - Protocols susceptible to sniffing, Active and passive sniffing, ARP poisoning, Ethereal capture and display filters, MAC flooding, DNS spoofing techniques, Sniffing countermeasures; Denial of Service - Types of DoS attacks, How DDoS attacks work, How BOTs/BOTNETs work, Smurf attack, SYN flooding, DoS/DDoS counter measures; Session hijacking - Spoofing vs. hijacking, Types of session hijacking, Sequence prediction, Steps in performing session hijacking, Preventing session hijacking.

UNIT-V: CRYPTOGRAPHY, NETWORK PROTECTION SYSTEMS (9 Periods)

Cryptography: Understanding Cryptography basics, Symmetric and asymmetric algorithms, Public key infrastructure, Cryptography attacks.

Network Protection Systems: Understanding routers, Firewalls, Honeypots.

Total Periods: 45

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

TEXT BOOKS:

1. Michael T. Simpson, Kent Backman, James E. Corley, *Hands-On Ethical Hacking and Network Defense*, 3rd Edition, 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*, 3rd Edition, Pearson, 2019.

II B. Tech. – II Semester

(20BT51205) **AI IN HEALTHCARE**

(Open Elective - 1)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: --

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. analyze the present state and future of AI in Healthcare specialties for different scenarios.
CO3. apply design concepts and metrics for AI in Healthcare.
CO4. demonstrate basic concepts and terminologies of future applications of Healthcare in AI.
CO5. develop AI applications through AI techniques for healthcare.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO ARTIFICIAL INTELLIGENCE IN HEALTHCARE **(8 Periods)**

Introduction to AI in Healthcare, Benefits and Risks, AI in the health sector, AI versus Human Intelligence, The future of AI in health sector, AI and Neural networks.

UNIT-II: THE PRESENT STATE AND FUTURE OF AI IN HEALTHCARE SPECIALTIES **(10 Periods)**

Artificial Intelligence in: preventive healthcare, Radiology, Pathology, Surgery, Anesthesiology, Psychiatry, Cardiology, Pharmacy, Dermatology, Dentistry, Orthopedics, Ophthalmology.

UNIT-III: THE ROLE OF MAJOR CORPORATIONS IN AI IN HEALTHCARE **(8 Periods)**

IBM Watson, The role of Google and Deep mind in AI in Healthcare, Baidu, Facebook and AI in Healthcare, Microsoft and AI in Healthcare.

UNIT-IV: FUTURE OF HEALTHCARE IN AI **(10 Periods)**

Evidence-based medicine, personalized medicine, Connected medicine, Disease and Condition Management , Virtual Assistants, Remote Monitoring, Medication Adherence, Accessible Diagnostic Tests, Smart Implantables, Digital Health and Therapeutics, Education, Incentivized Wellness. Artificial Intelligence, Block chain, Robots, Robot-

Assisted Surgery, Exoskeletons, Inpatient Care, Companions, Drones, Smart Places, Smart Homes, Smart Hospitals, Reductionism, Innovation vs. Deliberation.

UNIT-V: APPLICATIONS OF AI IN HEALTHCARE (9 Periods)

Case Study 1: AI for Imaging of Diabetic Foot Concerns and Prioritization of Referral for Improvements in Morbidity and Mortality.

Case Study2: Outcomes of a Digitally Delivered, Low-Carbohydrate, Type 2 Diabetes Self-Management.

Case Study3: Delivering a Scalable and Engaging Digital Therapy.

Case Study4: Improving Learning Outcomes for Junior Doctors through the Novel Use of Augmented and Virtual Reality for Epilepsy

Case Study5: 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*, 1st Edition 2019.
2. *Arjun Panesar, Machine Learning and AI for Healthcare Big Data for Improved Health*, Apress Publications, 2019.

REFERENCE BOOKS:

1. Michael Matheny, Sonoo Thadaney Israni, Mahnoor Ahmed, and Danielle Whicher, *Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril*, National Academy of Medicine Publication, 1st Edition, 2019.

ADDITIONAL LEARNING RESOURCES:

1. https://www.udacity.com/course/ai-for-healthcare-nanodegree--nd320 (AI for Healthcare).
2. https://builtin.com/artificial-intelligence/artificial-intelligence-healthcare(Surgical robots, new medicines and better care: 32 examples of AI in healthcare).
3. https://healthtechmagazine.net/article/2020/02/future-artificial-intelligence-healthcare (Future of Artificial Intelligence in Healthcare).

II B. Tech. – II Semester

(20BT51501) **BIOINFORMATICS**

(Open Elective - 1)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Biological Data Acquisition, Databases, Data Processing, Methods of Analysis, Applications of Bio-informatics

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

CO1. understand basic biological data acquisition in bioinformatics.
CO2. identify the proper databases for the information search by choosing the biological databases and also submission and retrieval of data from databases.
CO3. analyze the results of bioinformatics data using text and sequence-based searching techniques.
CO4. analyze the secondary and tertiary structures of proteins by applying different alignment programs
CO5. design biological databases and novel drugs by using contextual knowledge on bioinformatics.

DETAILED SYLLABUS:

UNIT-I: BIOLOGICAL DATA ACQUISITION (9 Periods)

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

UNIT-II: DATABASES (9 Periods)

Format and Annotation: Conventions for database indexing and specification of search terms, Common sequence file formats. Annotated sequence databases - primary and secondary sequence databases, protein sequence and structure databases.

UNIT-III: DATA PROCESSING (9 Periods)

Data – Access, Retrieval and Submission: Standard search engines; Data retrieval tools – Entrez, DBGET and SRS; Submission of (new and revised) data; Sequence Similarity Searches: Local and global. Distance metrics. Similarity and homology. Scoring matrices, PAM and BLOSUM

UNIT-IV: METHODS OF ANALYSIS (9 Periods)

Dynamic programming algorithms, Needleman-Wunsch and Smith-waterman. Heuristic Methods of sequence alignment, FASTA and BLAST; Multiple Sequence Alignment and software tools for pair wise and multiple sequence alignment, CLUSTAL program, Prediction of Tertiary structure of proteins.

UNIT-V: APPLICATIONS **(9 Periods)**

Genome Annotation and Gene Prediction; ORF finding; Phylogenetic Analysis, Genomics, Proteomics, Genome analysis – Genome annotation, DNA Microarray, computer aided drug design (CADD).

Total Periods: 45

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

TEXT BOOKS:

1. Lesk, A. K., "*Introduction to Bioinformatics*" 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.

II B. Tech. –II Semester
(20BT40451) **ANALOG ELECTRONICS LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE-REQUISITES: A course on Electronic Devices and Circuits.

COURSE DESCRIPTION: Single Stage Amplifiers; Multi Stage amplifiers; Frequency Response; Negative Feedback Amplifiers; Oscillators; Active Filters, Multi vibrators; Large Signal Amplifiers.

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

CO1. analyze small signal amplifiers, large signal amplifiers, negative feedback amplifiers and Evaluate Gain, Bandwidth, Input and Output Impedances using simulation tool.
CO2. realize small signal amplifiers, negative feedback amplifiers, and oscillators and evaluate Gain, Bandwidth, Input and Output Impedances.
CO3. design and Implement Multi vibrator Circuits and Filters using IC 555 and BJT for Societal Applications.
CO4. work independently or in teams to solve problems with effective communication.

List of Exercises/List of Experiments: Minimum 10 Experiments to be conducted. Conduct a minimum of five experiments form each part.

Part-A: Simulation of the following circuits using simulation software

1. Two stage RC Coupled Amplifier
2. Cascode Amplifier
3. Voltage Series feedback amplifier
4. R C Phase Shift Oscillator
5. Class A Power Amplifier (Transformer less)
6. Class B Complementary Symmetry Amplifier

Part-B: Implementation of the following circuits through hardware

7. Darlington Amplifier
8. Current shunt Feedback Amplifier
9. Hartley and Colpitts Oscillator
10. Design of Bistable Multivibrator using BJT
11. Design of Monostable Multivibrator using IC555
12. Design of Astable Multivibrator using IC555
13. Design of First order and Second Order Low Pass Filter
14. Design of First order and Second Order High Pass Filter

REFERENCE BOOKS/LABORATORY MANUALS:

1. S Poornachandra Rao and B Sasikala ”Handbook of Experiments in Electronics and Communication Engineering” ; Vikas Publishing House Pvt. Ltd, 1st Edition, 2003
2. Adel S. Sedra, Kenneth C. Smith ,Micro Electronic Circuits Theory and applications, OXFORD international student Edition 5th Edition, ,2009

SOFTWARE/Tools used:

OrCAD PSPICE Designer V14.0

II B. Tech. – II Semester
(20BT40231) **DIGITAL ELECTRONICS LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE-REQUISITES: A course on Electronic Devices and Circuits.

COURSE DESCRIPTION: Practical investigations through simulation on logic gates; minimization of circuits; design of various combinational and sequential logic circuits.

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

CO1. perform various arithmetic operations on number systems and analyze simplification methods in logical circuits, to perform desired logical operations optimally using logical gates.
CO2. design combinational logical circuits for performing various arithmetic operations and data encoding and decoding for engineering applications.
CO3. analyze various sequential circuits for realizing counters and registers using flip-flops.
CO4. work independently or in teams to solve problems with effective communication.

Practical Exercises/List of Experiments:

Part-A: Analytical Exercises:

1. Number systems and their conversions.
2. Arithmetic operations on weighted non-weighted numbers.

Part-B: Any EIGHT experiments are to be conducted from the following

1. Verification of logic gates.
2. Minimization of logic circuits using K-Map.
3. Design of half adder & subtractor and full adder & subtractor.
4. Design of 4 bit comparator.
5. Design of 3 to 8 decoder & 8 to 3 encoder for an engineering application.
6. Design of 8 to 1 multiplexer.
7. Design of 4 bit
    a. binary adder and
    b. binary adder-subtractor
8. Design of 4 bit binary incrementer using 4 half adders.
9. Design of 4-bit combinational circuit shifter.
10. Design of BCD to seven segment decoder.
11. Design of 1 stage of logic circuit using logical gates and 4x1 multiplexer.
12. Design SR, JK, T and D Flip flops using logic gates.
13. Design a ring counter using flip flops.

TEXT BOOKS:

1. M. Morris Mano, *Digital Design*, Pearson education, 5th Edition, 2013.

REFERENCE BOOKS

1. Anand Kumar, *Switching Theory and Logic Design*, PHI, 2008

2. ZviKohavi and NirahK.Jha, *Switching theory and Finite Automata Theory*, Tata McGraw-Hill, 2nd Edition, 1978

ADDITIONAL LEARNING RESOURCES:

1. http://cse15-iiith.vlabs.ac.in/
2. http://vlabs.iitb.ac.in/vlabs-dev/labs/dldgates/labs/index.php

II B. Tech. – II Semester
(20BT40232) ELECTRICAL MACHINES -II LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE-REQUISITES: Courses on Electrical Machines-I and Electrical Machines-I Lab

COURSE DESCRIPTION: Practical investigations on asynchronous and synchronous machines; Performance indices analysis, determination of equivalent circuit parameters and speed control methods of induction motor.

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

CO1. analyze the performance of induction machines to evaluate operating parameters and interpret the practical observations for validation.
CO2. analyze the performance of synchronous machines to evaluate operating parameters and interpret the practical observations for validation.
CO3. analyze the performance of universal motor for various loading conditions.
CO4. realize the philosophy of testing procedure of synchronous and asynchronous machines following the code of conduct.
CO5. 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. Brake test on three phase induction motor.
2. Separation of no-load losses of three phase induction motor.
3. Speed control of induction motor.
4. No load and blocked rotor test on three phase induction motor.
5. Determination of voltage regulation of a three phase alternator by E.M.F and M.M.F. methods.
6. Determination of voltage regulation of three phase alternator by Z.P.F. and A.S.A methods.
7. Determination of efficiency of a three phase alternator.
8. Perform slip test on a salient pole synchronous machine.
9. Draw V and inverted V curves of a three phase synchronous motor.
10. Determination of equivalent circuit parameters of single phase induction motor.
11. Performance evaluation of universal motor.
12. Perform parallel operation of 3-phase alternators.

TEXT BOOKS:

1. P.S. Bimbhra, *Electrical Machinery*, 7th Edition, Khanna Publishers, New Delhi, 2011.
2. JB Gupta, *Theory and performance of Electrical Machines (DC machines, Poly phase circuits & AC machines) in SI Units*, 15th Edition, S.K. Kataria & Sons, New Delhi, 2015.

REFERENCE BOOKS:

1. A.E. Fitzgerald, C. Kingsley and S. Umans, *Electric Machinery*, 6th Edition, McGraw-Hill, New Delhi, 2008.
2. B.L. Theraja and A.K. Theraja, *A Text Book of Electrical Technology in S. I. Units*, Vol.2, S. Chand Company Ltd, Multicolour Edition, New Delhi, 2014.

ADDITIONAL LEARNING RESOURCES:

- http://www.vlab.co.in/broad-area-electrical-engineering

II B. Tech. – II Semester

(20BT315AC) **DESIGN THINKING**

(Audit Course)

(Common to CE, ME, ECE, EEE 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 (6 Periods)

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

UNIT-II: EMPATHIZE (6 Periods)

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

UNIT-III: IDEATION (6 Periods)

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

UNIT-IV: PROTOTYPING (6 Periods)

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

UNIT-V: TESTING PROTOTYPES **(6 Periods)**

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

Total Periods: 30

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

TEXTBOOK:

1. S. Salivahanan, S. Suresh Kumar, D. Praveen Sam, "*Introduction to Design Thinking*", Tata McGraw Hill, 1st 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", John Wiley & Sons, 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/

III B. Tech. – I Semester

(20BT5HS02) PRINCIPLES OF BUSINESS ECONOMICS AND ACCOUNTANCY

(Common to ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE REQUISITE: --

COURSE DESCRIPTION: Business economics and demand analysis; theory of production and cost analysis; markets and pricing; principles of accounting and capital; final accounts and tally erp 9.0

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

CO1: demonstrate the principles of Business Economics and theories of Demand.
CO2: apply the theories of Production and Cost for the managerial decision making of an organization.
CO3: determine the Price and Output relation in the different Market structures.
CO4: demonstrate the principles of Accountancy and sources of Capital.
CO5: analyze the profitability and soundness of an organization.

DETAILED SYLLABUS:

UNIT–I: BUSINESS ECONOMICS AND DEMAND ANALYSIS (9 Periods)

Definition - Nature and Scope of Business Economics - Demand: Determinants of demand – Demand function - Law of demand, assumptions and exceptions - Elasticity of demand – Types of elasticity of demand - Demand forecasting and methods of demand forecasting.

UNIT–II: THEORY OF PRODUCTION AND COST ANALYSIS (9 Periods)

Production Function: Input-output relationship - Law of Variable proportion- Isoquants and Iso costs

Cost Concepts: Total, Average and Marginal Cost **-** Fixed vs. Variable costs – Opportunity Costs Vs Outlay Costs– Separable Costs Vs Joint Costs, Urgent Costs Vs Postponable Costs-Avoidable Costs Vs Unavoidable Costs

Break Even Analysis (BEA) – Assumptions, Merits and demerits - Determination of Break Even Point (Simple problems).

UNIT–III: MARKETS AND PRICING (9 Periods)

Market Structure: Types of Markets - Features of perfect competition - Monopoly and monopolistic competition - Price and Output determination in perfect competition, monopoly and monopolistic Markets.

Pricing: Objectives and policies of pricing – Sealed bid pricing - Marginal cost pricing - Cost plus pricing - Going rate pricing – penetration Pricing –skimming Pricing - Block pricing – Peak load pricing - Cross subsidization.

UNIT–IV: PRINCIPLES OF ACCOUNTING & CAPITAL (9 Periods)

Accountancy: Introduction – Concepts – Conventions – Double Entry Book Keeping – Journal – Ledger - Trial Balance (Simple problems).

Capital: Significance - Types of capital – Sources of Capital.

UNIT–V: FINAL ACCOUNTS & TALLY ERP 9.0 (9 Periods)

Introduction to Final Accounts - Trading account - Profit and Loss account and Balance Sheet with simple adjustments (Simple problems).

Tally ERP 9.0: Introduction – Create a company – Create ledger – Posting vouchers – Advantages of Tally.

Total Periods: 45

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

TEXT BOOKS:

1. H L Ahuja, *Business Economics (13th Edition)*, S Chand Publishing, Jan 2016.
2. S.P. Jain and K.L. Narang, *Financial Accounting*, Kalyani Publishers, Ludhiana, 12th Edition, 2018.

REFERENCE BOOKS:

1. Joseph G.Nellis and David Parker, *Principles of Business Economics*, Pearson Education Canada, 2nd Edition, 2016.
2. Larry M. Walther, *Financial Accounting*, Create Space Independent Publishing Platform, July 2017.

III B. Tech. – I Semester
(20BT40403) **LINEAR AND DIGITAL IC APPLICATIONS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Analog Electronics and Digital Electronics.

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 (9 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 (8 Periods)
Introduction, Language Elements, operators, Expressions, Modeling-gate level modeling, data flow modeling, behavioral modeling, structural modeling.

UNIT-IV: COMBINATIONAL LOGIC DESIGN APPLICATIONS (8 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 (9 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, 4th Edition, 2011.
2. John F. Wakerly, *Digital Design Principles & Practices*, Pearson Education Asia, 4th Edition, 2008.

REFERENCE BOOKS:

1. Ramakanth A. Gayakwad, *Op-Amps & Linear ICs*, PHI, 3rd Edition, 1998
2. J. Bhaskar, *A Verilog HDL Primer*, BS Publications, 2nd Edition, 2001

ADDITIONAL LEARNING RESOURCES:

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

III B. Tech. – I Semester
(20BT50201) TRANSMISSION AND DISTRIBUTION

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Electromagnetic Fields, and Signals and Networks.

COURSE DESCRIPTION: Parameters of overhead transmission lines and underground cables; Performance of transmission lines, travelling wave phenomenon; Insulators; Sag and corona; Distribution systems classification, analysis and planning.

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

CO1. analyze the overhead lines and underground cables to evaluate various parameters and their characteristics for different configurations.
CO2. analyze the performance of transmission lines and investigate the behavior of travelling waves for different configurations of transmission lines.
CO3. analyze the mechanical and electrical aspects of overhead transmission lines and realize measures for sustainability.
CO4. analyze various distribution systems, to determine their performance characteristics under various scenarios.
CO5. realize various aspects of substation, and analyze the primary and secondary feeders systems of substation to configure the feeder layout in a service area.

DETAILED SYLLABUS:

UNIT-I: OVERHEAD TRANSMISSION LINE AND UNDERGROUND CABLES (11 Periods)

Overhead Transmission Lines: Overhead line and underground cables and its types, Parameters- resistance, inductance and capacitance calculations in single and three phase transmission lines, single and double circuits, symmetrical and unsymmetrical spacing, concepts of GMR and GMD-Effect of earth on capacitance.
Underground Cables: Construction, types of insulating materials, classification of cables, laying of cables, insulation resistance, capacitance of single and 3-core belted cables, grading of cables - capacitance and inter sheath grading.

UNIT-II: ANALYSIS OF TRANSMISSION LINES (11 Periods)

Modelling and Analysis of Transmission lines: Classification - short line, medium line and long line; equivalent circuits –end condenser, Nominal-T, Nominal-π models, rigorous method; ABCD constants, voltage regulation and efficiency of transmission lines.
Travelling waves on transmission lines: Travelling waves – open end line, short circuited line, Line terminated through a resistor, line connected to a cable, Line connected to a T-junction.

UNIT-III: MECHANICAL ASPECTS OF OVER HEAD LINE AND CORONA (08 Periods)

Insulators— Line supports, overhead line insulators, types of insulators, string efficiency and methods for improvement.

Sag in overhead line: Sag and tension calculations with equal and unequal heights of towers, effect of wind and ice on sag, stringing chart.
Corona: Corona phenomenon - factors affecting corona, critical voltages and power loss, advantages and disadvantages.

UNIT-IV: DISTRIBUTION SYSTEMS (07 Periods)
Classification and Characteristics—residential, commercial, agricultural and industrial loads.
Voltage drop calculations in DC distributors– radial DC distributor fed at one end, at both the ends (equal/unequal voltages) and ring main distributor.
Voltage drop calculations in AC distributors– power factors referred to receiving end voltage and respective load voltages.

UNIT-V: SUBSTATIONS (08 Periods)
Classification of substations — Indoor and outdoor, gas and air insulated substations; Substation layout, different bus bar schemes, location of substations and benefits through optimal location — rating of distribution substations, service area with 'n' primary feeders; Considerations of distribution feeder voltage levels: Radial and loop types of primary feeders and secondary feeders – Feeder loading – Basic design practice of the secondary distribution system.

Total Periods: 45

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

TEXT BOOKS:

1. Wadhwa, C. L. *Electrical power systems*. 7th Edition, New Age International Private limited, 2017.
2. Turan Gonen, *Electric Power Distribution System Engineering,* 3rd Edition CRC Press, Taylors and Francis Group, 2014.

REFERENCE BOOKS:

1. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt Ltd, New Delhi, 2002.
2. U.A. Bakshi and M.V. Bakshi, *Transmission and Distribution of Electrical Power*, Fourth revised Edition, Technical Publications, 2009.
3. J.B. Gupta, *A Course in Electrical Power*, 11th Edition, S.K. Kataria & sons, New Delhi 2013.
4. V.K. Mehta, Rohit Mehta, *Principles of Power System,* revised Edition, S. Chand & Company Ltd, 2013.

ADDITIONAL LEARNING RESOURCES:
1. Travelling Wave: https://www.eeeguide.com/travelling-waves-on-transmission-lines/
2. Travelling Waves Lecture: https://nptel.ac.in/courses/108/102/108102119/
3. Power System: https://nptel.ac.in/courses/108/105/108105104/
4. https://edisontechcenter.org/Transmission.html
5. http://www.minnelectrans.com/transmission-system.html
6. Distribution System: https://nptel.ac.in/courses/108/102/108102047/

III B. Tech. – I Semester

(20BT4HS01) **BANKING AND INSURANCE**

(Open Elective-2)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE REQUISITE: --

COURSE DESCRIPTION: Introduction to Banking; Bank-Customer Relationship; Electronic Payment System and Business Models; Introduction to risk and insurance; Insurance Overview.

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

CO1. demonstrate the importance of Banking and functions of Reserve Bank of India and its role in sustainable development of the country.
CO2. demonstrate the role, relationships and operations between Banker and Customer.
CO3. demonstrate the online Banking system, various types of Electronic Payments and Business models.
CO4. demonstrate concept of risk and principles, functions, types of Insurance companies.

DETAILED SYLLABUS:

UNIT – I: INTRODUCTION TO BANKING (9 Periods)

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

UNIT–II: BANK-CUSTOMER RELATIONSHIP (9 Periods)

Debtor-creditor relationship, deposit products or services, payment and collection of cheques. Accounts – Types of accounts, procedure for opening and closing an account - Loans and Advances- principles of lending.

UNIT–III: ELECTRONIC PAYMENT SYSTEM&BUSINESS MODELS (9 Periods)

Introduction to Online Banking - types of e-payment system, e-cash, NEFT, RTGS, Credit cards, Electronic Wallet and Debit cards. **Business models**- B2B, B2C, C2C, and B2G.

UNIT–IV: INTRODUCTION TO RISK AND INSURANCE (9 Periods)

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

UNIT–V: INSURANCE OVERVIEW (9 Periods)

Principles of insurance - insurance types - LIC & GIC – insurance functions, IRDA - Insurance Players in India.

Total Periods: 45

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

TEXT BOOKS:

1. Ranganadha Chary, 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 Edition, 2016.
2. Jyotsna Sethi and Nishwan Bhatia, *Elements of Banking and Insurance*, PHI Learning Pvt. Ltd., 2nd Edition, 2012.

III B. Tech. – I Semester

(20BT4HS03) COST ACCOUNTING AND FINANCIAL MANAGEMENT

(Open Elective-2)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE REQUISITE: --

COURSE DESCRIPTION: Cost accounting; cost sheet & preparation of cost sheet; standard costing & variance analysis; financial management & ratio analysis; introduction to investment**.**

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

CO1. demonstrate the concepts of Cost Accounting and Management Accounting and the elements of costing.
CO2. determine the Cost of Production for pricing decisions..
CO3. apply the Standard Costing and Variance techniques for the control of cost of production.
CO4. analyze the Profitability and financial condition of an organization using Ratios.
CO5. apply the Capital Budgeting techniques for making investment decisions in an Organization.

DETAILED SYLLABUS:

UNIT-I: COST ACCOUNTING (9 Periods)

Meaning of Cost and Cost Accounting, Objectives, Scope, Advantages and disadvantages – Cost Accounting *Vs* Management Accounting – Elements of Costing – Installation of costing system – Material Control, Labor Control, Overhead Control.

UNIT-II: COST SHEET & PREPARATION OF COST SHEET (9 Periods)

Analysis of Cost – Preparation of cost sheet, estimate, tender and quotation (Simple problems) – Importance of Costing while pricing the products.

UNIT-III: STANDARD COSTING & VARIANCE ANALYSIS (9 Periods)

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

UNIT-IV: FINANCIAL MANAGEMENT & RATIO ANALYSIS (9 Period)

Meaning, Objectives - Nature and Scope, Importance of FM – **Ratio Analysis:** Types of Ratios: Solvency Ratios, Liquidity Ratios, Turnover Ratios and Profitability Ratios - Financial Statement Analysis through Ratios (Simple Problems).

UNIT-V: INTRODUCTION TO INVESTMENT (9 Periods)

Investment - Meaning and Definition- concept of risk and returns - 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 Saravana Prasath, *Cost Accounting and Financial management*, Wolters Kluwer India Pvt. Ltd., New Delhi, 2018 Edition, 2018.

III B. Tech. – I Semester

(20BT4HS05) **GENDER AND ENVIRONMENT**

(Open Elective-2)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	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 & environmental connections by analyzing key issues and topics within global environmental politics in environmental decision-making.
CO2. demonstrate the knowledge of 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 AND ENVIRONMENT RELATIONSHIP (9 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 (9 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 AND SUSTAINABLE DEVELOPMENT (9 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 (9 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 (9 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. *Empowering Indian Women*. Publication Division, Government of India, New Delhi. 2000.
2. Ronnie Vernooy, Ed. *Social and Gender Analysis Natural Resource Management: Learning Studies and Lessons from Asia.* Sage, New Delhi. 2006
3. Swarup Hemlata and Rajput, Pam. "Gender Dimensions of Environmental and Development Debate: The Indian Experience" In Sturat S. Nagel, (ed). *India's Development and Public Policy*. Ashgate, Burlington. 2000.

III B. Tech. – I Semester

(20BT4HS07) **INDIAN ECONOMY**

(Open Elective-2)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Introduction; Elementary Economic Analysis; Economic Planning; Time Value of Money; Value Analysis/Value Engineering.

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 strata.
CO2. demonstrate knowledge in capital budgeting, evaluation of engineering projects, depreciation policy and familiarize with the concepts of value analysis vs value engineering.
CO3. analyze and apply financial information for the evaluation of finance.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION (9 Periods)

Economics-Flow in an Economy, Law of Supply and Demand; Micro and Macro Economics; Relationship between Science, Engineering, Technology and Economic Development; Concept of Engineering Economics-Types of Efficiency, Definition and Scope of Engineering Economics.

UNIT-II: ELEMENTARY ECONOMIC ANALYSIS (9 Periods)

Economic Analysis – Meaning, Significance, Simple Economic Analysis; Material Selection for a Product, Substitution of Raw Material; Design Selection for a Product; Material Selection-Process Planning, Process Modification.

UNIT-III: ECONOMIC PLANNING (9 Periods)

Introduction - Need For Planning in India, Five year plans(1951-2012), NITI Aayog (from 2014 onwards); Inclusive Growth-Meaning, Significance, Need for inclusive growth in India, Strategy for more inclusive growth, Challenges and Prospects; Employment and Inclusive Growth in India, Role of engineers in sustaining inclusive growth.

UNIT-IV: TIME VALUE OF MONEY (12 Periods)

Concepts and Application; Capital Budgeting-Traditional and Modern Methods; Simple and Compound Interest, Cash Flow Diagram, Principle of Economic Equivalence; Evaluation of Engineering Projects - Present Worth Method, Future Worth Method, Annual Worth Method, Internal Rate of Return Method, Cost-benefit Analysis in Public Projects; Depreciation Policy-Depreciation of Capital Assets, Causes of Depreciation, Straight Line Method and Declining Balance Method.

UNIT-V: VALUE ANALYSIS/VALUE ENGINEERING (6 Periods)

Introduction-Value Analysis, Value Engineering, Functions, Aims; Value Analysis vs Value Engineering; Value Engineering Procedure- Advantages, Application Areas.

Total Periods: 45

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

TEXT BOOKS:

1. Panneerselvam. R., *Engineering Economics*, PHI Learning Private Limited, New Delhi, 2nd Edition, 2013.
2. Jain. T. R., V. K. Ohri, O. P. Khanna., *Economics for Engineers*. VK Publication, 1st Edition, 2015.

REFERENCE BOOKS:

1. Dutt Rudar & Sundhram K. P. M., *Indian Economy*, S. Chand, New Delhi, 62nd revised Edition, 2010.
2. Misra, S. K. & V. K. Puri., *Indian Economy*: Its Development Experience, Himalaya Publishing House, Mumbai, 32nd Edition, 2010.

III B. Tech. – I Semester

(20BT4HS09) **LIFE SKILLS**

(Open Elective-2)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Positive attitude; Self-discovery and Interpersonal relationships; Cross-cultural communication; Core thinking, Problem solving and Decision making; Business presentations and Public speaking.

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

CO1. demonstrate knowledge of strategies involved in developing positive attitude, improving self-discovery by SWOT analysis techniques and managing effective inter personal relationships.
CO2. apply appropriate speaking styles and techniques by analysing and demonstrating effective cross-cultural communication in different situations.
CO3. analyse problem solving strategies in decision making by developing core thinking skills.
CO4. analyse and demonstrate presentation and public speaking skills effectively in business and professional arena.

DETAILED SYLLABUS:

UNIT-I: POSITIVE ATTITUDE (9 Periods)

Introduction–Features of attitudes–Formation of attitudes–Ways of changing attitude in a person– Attitude in a work place–Developing positive attitude–Obstacles in developing positive attitude–Measuring attitude.

UNIT-II: SELF DISCOVERY AND INTERPERSONAL RELATIONSHIPS (9 Periods)

Importance of knowing yourself–Process of knowing yourself–SWOT Analysis–Elements of attitude in interpersonal relationships–Methods to deal with different types of interpersonal relationship skills.

UNIT III: CROSS-CULTURAL COMMUNICATION (9 Periods)

Different communication styles – Cultural variables – Communication sensitivity and variables of national culture – Individual cultural variables – Cross-cultural communication Strategies – Potential hot spots in cross-cultural communication – Cross-cultural communication – Basic Tips.

UNIT IV: CORE THINKING, PROBLEM SOLVING AND DECISION MAKING (9 Periods)

Process of developing core thinking skills–Categories of thinking: Critical & Creative - understanding problem solving–Cause of problems–Stages of problem solving–Methods of problem solving–Types of decision making.

UNIT V: BUSINESS PRESENTATIONS AND PUBLIC SPEAKING (9 Periods)

Business presentations and speeches– Structuring the material–Types of delivery–Guidelines for delivery–Effective sales presentation–Controlling nervousness and stage fright.

Total Periods: 45

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

TEXT BOOKS:

1. Dr. K. Alex (2018) *Soft Skills*, S. Chand and Company Limited, New Delhi.
2. Manmohan Joshi (2017) *Soft Skills*, www.bookboon.com, Bangalore.

REFERENCE BOOKS:

1. Meenakshi Raman and Prakash Singh (2015) *Business Communication*, Oxford University Press, New Delhi.
2. Jeff Butterfield (2011) *Soft Skills for Everyone*, Cengage Learning India Private Limited, Delhi.

III B. Tech. – I Semester

(20BT4HS11) INDIAN TRADITION AND CULTURE

(Open Elective-2)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	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 knowledge in Vedic and Upanishadic culture and society to consider human aspirations, values and theories.
CO2. understand the contributions of Buddhism and Jainism to Indian culture.
CO3. examine the cultural conditions and achievements of India under Mouryas and Guptas.
CO4. analyze social religious reforms and reform movements.

DETAILED SYLLABUS:

UNIT-I: BASIC TRAITS OF INDIAN CULTURE (9 Periods)

Meaning and definition and various interpretations of culture - Culture and its features - The Vedic and Upanishad culture and society - Human aspirations and values in these societies - Chaturvidha purushardhas, Chaturashrma and Chaturvarna theory.

UNIT-II: HUMANISTIC REFORMS UNDER JAINISM AND BUDDHISM (9 Periods)

Salient features of Jainism - contributions of Jainism to Indian culture - Contributions of Aachaarya and Mahaapragya - Buddhism as a humanistic culture - The four noble truths of Buddhism - Contributions of Buddhism to Indian culture.

UNIT-III: CULTURE IN THE MEDIEVAL PERIOD (9 Periods)

Unifications of India under Mouryas and Guptas and their cultural achievements - Cultural conditions under satavahanas - Contributions to pallavas and cholas to art and cultural achievements of vijayanagara rulers.

UNIT-IV: SOCIO RELIGIOUS REFORMS IN INDIAN CULTURE (9 Periods)

Western impact on India - 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 (9 Periods)

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

Total Periods: 45

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

TEXT BOOK:

1. Valluru Prabhakaraiah, *Indian Heritage and Culture*, Neelkamal Publications Pvt. Ltd. Delhi, 1/e , reprint 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. The Cultural Heritage of India Vol-I, II, III, IV, V, The Ramakrishna Mission Institute of Culture, Calcutta

III B. Tech. – I Semester

(20BT4HS13) **CONSTITUTION OF INDIA**

(Open Elective-2)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Preamble and its Philosophy; Union Legislature; Federalism in India; Judiciary and Public Services; Nation Building

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

CO1. demonstrate knowledge in the Parliamentary proceedings, Election Commission, Public Services and Foreign Policy of India.
CO2. apply the reasoning informed by the various aspects of the Constitution and its provisions to assess societal issues and the consequent responsibilities relevant to the professional engineering practice.

DETAILED SYLLABUS:

UNIT-I: PREAMBLE AND ITS PHILOSOPHY (9 Periods)

Introduction to Indian Constitution; Evolution of Indian Constitution; preamble and its philosophy

UNIT-II: UNION LEGISLATURE (9 Periods)

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

UNIT-III: FEDERALISM IN INDIA (9 Periods)

Centre-State Administrative Relationship; Governors – Powers and Functions; State Legislature - Composition and powers; Chief Ministers - Powers and Functions; The Election Commission – Powers and Functions.

UNIT-IV: JUDICIARY AND PUBLIC SERVICES (9 Periods)

The Union Judiciary - Supreme Court and High Court; Fundamental Rights and Duties All India Services - Central Civil Services -State Services - Local Services.

UNIT-V: INTERNATIONAL PARTICIPATION (9 Periods)

Foreign Policy of India; International Institutions Influence: UNO, WTO, WHO, SAARC, International Summits: BRICS, NSS, UNEP – India's Role in International Negotiations; Environmentalism in India.

Total Periods: 45

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

TEXT BOOK:

1. Briji Kishore Sharma, *Introduction to the Constitution of India*, Prentice Hall of India, 2005.

REFERENCE BOOKS:

1. Mahendra Pal Singh,V. N. Shukla's, *Constitution of India*, Eastern Book Company, 2011.
2. Pandey J. N., *Constitutional Law of India* - Central Law Agency, 1998.

III B. Tech. – I Semester

(20BT50106) **DISASTER MITIGATION AND MANAGEMENT**

(Open Elective - 2)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Disasters; Earthquakes; Floods; Cyclones; Droughts; Landslides; Disaster management.

COURSE OUTCOMES: On 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. Sharma, V. K., *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. Singh, R. B., *Natural Hazards and Disaster Management*, Rawat Publications, 2009.

ADDITIONAL LEARNING RESOURCES:

1. Tushar Bhattacharya, *Disaster Science and Management*, McGraw Hill, 2014.

III B. Tech. – I Semester

(20BT50107) **SUSTAINABLE ENGINEERING**

(Open Elective - 2)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Principles of sustainability; Sustainability metrics and assessment tools; Sustainable engineering practices; Sustainable engineering applications; Sustainable urbanization and industrialization.

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

CO1: Analyze the principles of sustainability to solve complex environmental problems following relevant standards/protocols considering society, health, safety and environment.

CO2: Analyze sustainability metrics and assessment tools to solve complex environmental problems following relevant standards and emerging trends considering society, health, safety, environment and economics besides communicating effectively in graphical form.

CO3: Analyze sustainable engineering practices to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

CO4: Design sustainable engineering applications to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

CO5: Analyze sustainable urbanization and industrialization principles to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT – I: PRINCIPLES OF SUSTAINABILITY (09 Periods)

Emerging challenges, Sustainability and sustainable engineering; Environmental concerns; Social, economic and legal issues; Availability and depletion of natural resources, Disaster resiliency; Multilateral environmental agreements – Basel convention, Clean development mechanism (CDM), Montreal and Kyoto protocols.

UNIT – II: SUSTAINABILITY METRICS AND ASSESSMENT TOOLS (09 Periods)

Sustainability indicators, metrics and assessment tools; Material flow analysis and material budget, Carbon footprint analysis, Life cycle assessment, Streamlined life-cycle

assessment (SLCA), Economic input output-life cycle analysis, Environmental health risk assessment, Other emerging assessment tools.

UNIT – III: SUSTAINABLE ENGINEERING PRACTICES (09 Periods)

Sustainable energy engineering, Sustainable waste management, Green and sustainable buildings and infrastructure, Sustainable civil infrastructure, Sustainable remediation of contaminated sites, Climate geoengineering.

UNIT – IV: SUSTAINABLE ENGINEERING APPLICATIONS (09 Periods)

Environmental and chemical engineering projects, Materials engineering projects, Infrastructure engineering projects – Background, Methodology, Goal and Scope, Study area, Technical design, Environmental sustainability, Life cycle assessment, Economic sustainability, Social sustainability, Rating systems – ENVISION, LEED, GRIHA, IGBC; Conclusions.

UNIT – V: SUSTAINABLE URBANIZATION AND INDUSTRIALIZATION (09 Periods)

Sustainable urbanization and industrialization, United Nations sustainable development goals – Right to education, Poverty eradication, Social and technological changes; Industrial Processes - Material selection, Energy efficiency, Pollution prevention and control techniques, Industrial Ecology, Industrial symbiosis.

Total Periods: *45*

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

TEXT BOOKS:

1. Reddy, K.R., Cameselle, C., and Adams, J.A., *Sustainable Engineering: Drivers, Metrics, Tools, and Applications*, John Wiley & Sons, Inc., Hoboken, New Jersey, 2019.
2. Allen, D. T. and Shonnard, D. R., *Sustainability Engineering: Concepts, Design and Case Studies*, Pearson Education, 1st Edition, 2012.

REFERENCE BOOKS:

1. Bradley. A.S; Adebayo, A. O., Maria, P., *Engineering Applications in Sustainable Design and Developmen*t, Cengage Learning, 1st Edition, 2016.
2. Purohit, S. S., *Green Technology: An Approach for Sustainable Environment*, Agrobios Publication, 1st Edition, 2016.
3. *Energy Conservation Building Code (ECBC) 2007*, Bureau of Energy Efficiency, Govt. of India, New Delhi.
4. Twidell, J. W. and Weir, A. D., *Renewable Energy Resources*, Routledge, Taylor & Francis Group, 3rd Edition, 2015.

ADDITIONAL LEARNING RESOURCES:

1. Daniel A. Vallero and Chris Brasier, *Sustainable Design: The Science of Sustainability and Green Engineering*, Wiley-Blackwell, 1st Edition, 2008.
2. Jorge A. Vanegas, *Sustainable Engineering Practice: An Introduction*, Committee on Sustainability, American Society of Civil Engineers, https://doi.org/10.1061/9780784407509, 2004.

3. Bell, S. and Morse, S, *Sustainability Indicators: Measuring the Immeasurable?*, Earthscan Publications, London, 2nd Edition, 2008.
4. Mackenthun, K.M., *Basic Concepts in Environmental Management*, CRC Press, Taylor & Francis Group, 1st Edition, 1999.
5. *Environment Impact Assessment Guidelines*, Notification of Government of India, 2006.

III B. Tech. – I Semester

(20BT50108) CONTRACT LAWS AND REGULATIONS

(Open Elective - 2)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	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.

REFERENCE 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., 4th Edition, 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. Markanda, P.C., Naresh Markanda, Rajesh Markanda, *Building and Engineering Contracts- Law and Practice*, Vol-I and II, LexisNexis Publication. 5th Edition, 2017.

III B. Tech. – I Semester

(20BT50310) GLOBAL STRATEGY AND TECHNOLOGY

(Open Elective-2)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	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 (9 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 (9 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 (9 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 (9 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 (9 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, 2nd 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.

III B. Tech. – I Semester

(20BT50311) **MANAGEMENT SCIENCE**

(Open Elective-2)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	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 (8 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 (8 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 (9 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. Mart and T.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.

III B. Tech. – I Semester

(20BT40502) **CYBER LAWS AND SECURITY**

(Open Elective-2)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Evolution of Cyberspace, Jurisdiction in the borderless Cyberspace, E-Contracting, Models of E-Commerce, Modes of Electronic signatures, E-Money, Intellectual Property Rights, Cybercrimes, Privacy and data security.

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

CO1. demonstrate knowledge on jurisdiction in cyberspace and the impact of cybercrime to protect privacy on the Internet.

CO2. analyze the Indian cyber laws on E-Contracting, E-Commerce, E-signatures and E-money to promote digital law enforcement.

CO3. apply the knowledge of digital rights in Indian context to protect intellectual properties in electronic world.

CO4. practice ethics and cyber law regulations for leading electronic transactions on the Internet.

DETAILED SYLLABUS:

UNIT-I: EVOLUTION OF CYBERSPACE AND JURISDICTION IN BORDERLESS CYBERSPACE (9 Periods)

The Evolution of Cyberspace: Significance of information technology, Drawbacks in information technology, the digital divide, E-governance, Origin of cyberspace, Legal issues in cyberspace, regulating the Internet.

Jurisdiction in the Borderless Cyberspace: Meaning of jurisdiction, Three pre-requisites of jurisdiction, Jurisdictional theories in jurisdiction to prescribe, Tests to determine jurisdiction in Internet law cases, Indian laws to determine personal jurisdiction, Jurisdiction clauses in click wrap agreement.

UNIT-II: ELECTRONIC CONTRACTING AND ELECTRONIC COMMERCE (9 Periods)

Electronic Contracting: Formation of offline contracts under English common law, Fundamental requirements of an offline contract, Forming an E-contract through website, E-mail contracting, The Indian approach of E-contracts, Contract formation on the Internet and Information Technology Act 2000, B2C E-contracts.

Electronic Commerce: Models, Advantages, Restricted activities, Laws, India's information Technology Act2000, Online customer protection in India(B2B, B2C).

UNIT-III: ELECTRONIC SIGNATURES AND ELECTRONIC MONEY (9 Periods)

Electronic Signatures: The role of signatures, Significance of electronic signatures, Modes of electronic signatures, UNCITRAL model law on electronic signatures 2001,

Cryptography, Role of certifying authority in PKI, The Indian Information Technology Act and electronic signatures- Electronic signatures, Prescribed authentication mechanisms, Secure electronic record.

Electronic Money: E-Money, RBI's guidelines on mobile banking and payments, The current E-payment systems, Earlier E-payment systems, Credit cards, Use of SET in online payment system.

UNIT- IV: INTELLECTUAL PROPERTY RIGHTS AND THE INTERNET WORLD (9 Periods)

Protecting copyright in the E-world, International organizations protecting Intellectual Property, Copyright issues on the Internet, Digital rights management, Patent protection and computer software, India and copyright protection for computer software, Business method patents- Position of Business methods patents in India, Trademark protection on the Internet, Cyber squatting, The Indian trademark law and legal remedies, Hyper linking and framing.

UNIT - V: CYBERCRIMES AND PROTECTING PRIVACY ON INTERNET (9 Periods)

Cybercrimes: What is cybercrime, Categories, Different kinds of cybercrime, Cybercrimes and Information Technology Act, 2000 - Territorial scope and applicability, India's national cyber security policy.

Protecting Privacy on the Internet: Meaning of privacy, Threat to privacy on the Internet, Use of cookies and web bugs, Terms of use and privacy policy, Government right to interception, Employee privacy rights, Indian legal framework for data protection and privacy, Challenges to right of privacy in India.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOK(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:

1. https://swayam.gov.in/nd2_cec20_cs09/preview
2. https://swayam.gov.in/nd2_nou19_cs08/preview

III B. Tech. – I Semester

(20BT50206) **INTELLECTUAL PROPERTY RIGHTS**

(Open Elective – 2)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	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 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. Prabuddha Ganguli, *Intellectual property right - Unleashing the knowledge economy*, Tata McGraw Hill Publishing Company Ltd.

REFERENCE BOOKS:

1. Neeraj P., & 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

USEFUL WEBSITES:

1. Cell for IPR Promotion and Management (http://cipam.gov.in/)
2. World Intellectual Property Organisation (https://www.wipo.int/about-ip/en/)
3. Office of the Controller General of Patents, Designs & Trademarks (http://www.ipindia.nic.in/)

III B. Tech. – I Semester

(20BT50406) **GREEN TECHNOLOGIES**

(Open Elective-2)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Principles of green engineering; Green communications; Green energy; Green computing; Green construction; Green manufacturing.

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

CO1. analyze energy efficient communication systems such as Telecommunication systems, ICT, Wireless networks and cellular networks by understanding the principles of green communications.

CO2. understand the impact of conventional energy sources on environment and realize the significance and principles of green energy sources for sustainability.

CO3. understand the environmental impacts of IT and approaches for Green IT.

CO4. analyze concepts of sustainable green construction using appropriate tools and techniques following latest developments and considering safety and environment besides communicating effectively in graphical form

CO5. demonstrate the environmental impact of traditional manufacturing and explore the need for green manufacturing process promoting sustainability.

DETAILED SYLLABUS:

UNIT –I: PRINCIPLES OF GREEN ENGINEERING AND GREEN COMMUNICATIONS (9 Periods)

Principles of Green Engineering: Introduction, Definition of green engineering, Principles of green engineering

Green Communications: Introduction, Origin of Green Communications, Energy Efficiency in Telecommunication systems, Telecommunication system model and energy Efficiency, Energy saving concepts, Quantifying energy efficiency in ICT, Energy efficiency metrics of green wireless networks, Embodied energy of communication devices- Introduction, The extended energy model, Embodied/Operating Energy of a BS in Cellular network- A Case study; Energy efficient standards for wireline communications.

UNIT- II: GREEN ENERGY (9 Periods)

Introduction, green energy systems - composition, adverse impacts, Green energy and sustainability, the target and solution. Diversification and localization of energy systems, green energy and sustainable development. Energy sources and their availability. Green energy sources - solar energy, wind energy, geothermal energy, ocean energy, biomass and biogas.

UNIT- III: GREEN IT (9 Periods)

Introduction, Awareness to Implementation: Green IT Trends, Green Engineering, Greening by IT: Using RFID for Environmental Sustainability, Smart Grids, Smart Buildings

and Homes, Green Supply Chain and Logistics, Enterprise-Wide Environmental Sustainability, A Seven-Step Approach to Creating Green IT Strategy: Balancing the Costs and Benefits of Going Green, Research and Development Directions.

UNIT-IV: GREEN CONSTRUCTION (9 Periods)

Green Building: Concept, Necessity, Characteristics, Benefits, Requisites for green building construction, Sustainability, Concept of REDUCE, REUSE, RECYCLE, RETHINK, REPLENISH AND REFUSE (6 R's), Sustainable construction focus point – Site selection, Planning, Water, Energy, Material, Indoor air quality, Construction procedures, case studies of residential and commercial green buildings.

Vastu: Concept, History, scientific approach, elements of vastu for selecting a plot.

Indian Green Building Council: Introduction to IGBC green homes, Benefits of IGBC, IGBC green home rating system, Introduction to USGBC, LEED rating system, Procedure to get IGBC certification, GRIHA Rating.

UNIT-V: GREEN MANUFACTURING (9 Periods)

Green Manufacturing - Introduction, Background and Definition; Impact of traditional manufacturing in environmental ecology, Need for green manufacturing, Motivation and barriers to green manufacturing, Advantages and Limitations of green manufacturing, Green manufacturing strategies, Green manufacturing and sustainability, Green manufacturing through clean energy supply, Green packaging and Supply chain.

Total Periods: 45

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

TEXT BOOKS:

1. 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.

III B. Tech. – I Semester

(20BT50202) ENERGY AUDIT, CONSERVATION AND MANAGEMENT

(Professional Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Basic Electrical and Electronic Engineering.

COURSE DESCRIPTION: Principles of energy audit, management and conservation; Energy efficient motors, lighting schemes; Energy measuring instruments and significance of energy economics.

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

CO1. apply the relevant rules, regulations and procedures of energy audit in industries and realize the energy management principles and protocols for effective conservation of energy.

CO2. analyze performance of energy efficient motors and propose appropriate illumination system by applying the protocols of energy auditing.

CO3. apply appropriate energy auditing instruments for energy auditing in industries and assess the economic benefits of auditing.

CO4. apply the demand side management techniques and relevant standards for organization of energy conservation awareness programs.

DETAILED SYLLABUS:

UNIT-I: ENERGY AUDIT AND MANAGEMENT PRINCIPLES (10 Periods)

Energy audit — definitions, concept, types of audit, energy index-cost index, pie charts, Sankey diagrams, load profiles, energy audit in industries, energy saving potential, energy audit of process industry, thermal power station, building energy audit, case study. IE rules and regulations for energy audit.

Energy management — Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting.

UNIT-II: ENERGY CONSERVATION PRINCIPLES (08 Periods)

Energy scenario in India and world. Rules for efficient energy conservation; technologies for energy conservation. Principles of energy conservation, current energy consumption in India, roles and responsibilities of energy managers in industries.

UNIT-III: ENERGY EFFICIENT MOTORS AND LIGHTING (09 Periods)

Energy efficient motors - factors affecting efficiency, loss distribution, constructional details, characteristics, variable speed, variable duty cycle systems, motor energy audit.

Lighting -Good lighting system design and practice, lighting control, lighting energy audit.

UNIT-IV: ENERGY INSTRUMENTS AND ECONOMIC ANALYSIS (09 Periods)

Energy Instruments— Infrared thermometer, data loggers, thermo-couples, pyrometers, Lux meters, tongue testers, power quality analyzer, and PLC and pic applications.

Energy Economic Analysis— The time value of money concept. Cash flow models, payback analysis, depreciation, taxes and tax credit - numerical problems.

UNIT-V: DEMAND SIDE MANAGEMENT (09 Periods)

Introduction to DSM, concept of DSM, benefits of DSM, different techniques of DSM – time of day pricing, multi-utility power exchange model, and time of day models for planning, load management, load priority technique. Management and organization of energy conservation awareness programs.

Total Periods: 45

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

REFERENCE BOOKS:

1. W.R. Murphy & G. Mckay Butter worth, *Energy management*, Butter worth-Heinemann publications, 2nd Edition, 2016.
2. Albert Thumann, William J. Younger, *Handbook of energy audits*, Taylor & Francis Ltd, 7th Edition, 2008.
3. Umesh Rathore, *Energy management*, S.K. Kataria & Sons, 2nd Edition, 2014.
4. W.C.Turner, Stevedoty, *Energy management hand boo*k, CRC press, 6th Edition, 2006.
5. D.P. Sen, K.R. Padiyar, Indrane Sen, M.A. Pai, *Recent Advances in Control and Management of Energy Systems*, Interline Publisher, Bangalore, 1993.
6. Ashok V. Desai, Wiley Eastern, *Energy Demand - Analysis, Management and Conservation Hand book on energy auditing - TERI (Tata Energy Research Institute)*, 2005.
7. Craig B. Smith, Kelly E. Parmenter, *Energy management principles Applications*, benefits, Savings, Elsevier Inc(Pergamon Press), 1st Edition, 2016.

ADDITIONAL LEARNING RESOURCES:

1. https://beeindia.gov.in/sites/default/files/1Ch3.pdf
2. https://www.youtube.com/watch?v=M1zijCmeXJg
3. https://www.youtube.com/watch?v=FTpMWXMBSyM
4. https://www.youtube.com/watch?v= T1Au P5bnQ
5. https://www.youtube.com/watch?v=ENLzwTVjxms
6. https://www.youtube.com/watch?v=7hDyLuFJ0c8
7. https://www.youtube.com/watch?v=lkNIuFkzxBk

USEFUL WEBSITES:

1. https://beeindia.gov.in/news-events/energy-conservation-building-code-rules-2018
2. https://beeindia.gov.in/content/energy-auditors
3. https://nayaenergy.com/difference-between-energy-audit-and-energy-management/
4. https://www.sgsgroup.in/en-gb/sustainability/environment/energy-services/energy-audits-and-management/energy-audit
5. https://www.consultivo.in/environment-energy/energy-audit-and-management/
6. https://www.teriin.org/energy
7. http://jnujprdistance.com/assets/lms/LMS%20JNU/Dual%20Degree%20Courses/PGD+MBA%20%20Energy%20Management/Sem%20III/General%20Aspects%20of%20Energy%20Management%20and%20Energy%20Audit.pdf

III B. Tech. – I Semester

(20BT50203) **ELECTRICAL MACHINE DESIGN**

(Professional Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Electrical Machines-II.

COURSE DESCRIPTION: Electrical machine design concepts; Design of transformers, DC machines, Induction machines and alternators.

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

CO1. analyze the specific electrical and magnetic loadings on various machines and determine the thermal aspects.
CO2. design the armature and field systems of DC motor and validate the performance of designed machine.
CO3. design the core, yoke, windings and cooling systems of a static device and determine its operational parameters.
CO4. design the stator and various types of rotors for induction motor and synchronous machines to validate the given specifications.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION (09 Periods)

Major considerations in electrical machine design, classification of design problems, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings. Thermal considerations, heat flow, temperature rise, rating of machines and standard specifications.

UNIT-II: DC MACHINES (10 Periods)

Output equation, main dimensions, magnetic circuit calculations, carter's coefficient, net length of iron, real & apparent flux densities, selection of number of poles, design of armature, design of commutator and brushes, Design of interpoles, performance prediction using design values.

UNIT-III: TRANSFORMERS (09 Periods)

Output equations, main dimensions for single and three phase transformers, Design of cores, window space factor, overall dimensions, Design of windings, estimation of no load current, temperature rise in transformers, design of tank, methods of cooling of transformers.

UNIT-IV: INDUCTION MOTORS (09 Periods)

Output equation, choice of loadings, main dimensions, length of air gap, stator core and windings, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor. Dispersion coefficient.

UNIT-V: SYNCHRONOUS MACHINES (08 Periods)

Output equation, choice of loadings, design of salient pole machines, short circuit ratio (SCR), estimation of length of air gap using SCR, armature design, armature parameters,

design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators.

Total Periods: 45

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

TEXT BOOKS:

1. A.K. Sawhney, A. Chakrabarthi , *A Course in Electrical Machine Design*, 6th Edition, Dhanpat Rai & Co, Delhi, 2016.
2. M.V. Deshpande, *Design and Testing of Electrical Machines*, PHI learning Pvt. Ltd, New Delhi, 3rd Edition, May 2010.

REFERENCE BOOKS:

1. R.K. Agarwal, *Principles of Electrical Machine Design,* 5th Edition, S.K. Kataria & Sons, New Delhi, 2014
2. V.N. Mittle, Arvind Mittal, *Design of Electrical Machines,* 5th Edition, Standard publications, New Delhi, 2013
3. A. Nagoor Kani, A simplified text Electrical Machine Design, 2nd Edition, RBA Publications, Chennai, 2009.

ADDITIONAL LEARNING RESOURCES:

1. http://s3.mentor.com/mechanical/MagNet-BLDC-tutorial.pdf
2. https://www.mentor.com/products/mechanical/motorsolve/dcm/motor-analysis

III B. Tech. – I Semester

(20BT50204) **ENERGY SYSTEMS**

(Professional Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	--	--	3

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

COURSE DESCRIPTION: Concepts of conventional, non-conventional and hybrid energy systems; Operational modes of Co-generation and their economic benefits.

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

CO1. understand the operational aspects of hydro, thermal and nuclear power plants and determine the efficiency of thermal power plant.

CO2. understand the generating principles and operational aspects of diverse peak load power plants and impact of conventional sources on environment.

CO3. understand the generating principles and operational aspects of solar, wind and geothermal generation technologies.

CO4. understand the generating principles and operational aspects of ocean, biomass and fuel cell power conversion technologies.

CO5. asses the energy harnessing methods and understand the principle of hybrid energy systems and energy storage systems for sustainability.

DETAILED SYLLABUS:

UNIT-I: CONVENTIONAL ENERGY SOURCES-1 (07 Periods)

Hydro and Thermal power plants: Selection of site for hydro and thermal power plants; Concept of pumped storage plants; Efficiency of a thermal power plant.

Nuclear power stations: Introduction, site selection, working and operation of nuclear power station, classification nuclear reactors— PWR, BWR, Breeder reactors and merits & demerits.

UNIT-II: CONVENTIONAL ENERGY SOURCES-2 (09 Periods)

Diesel engine power plant: Introduction, working and operation of diesel power plant with layout; Applications.

Gas turbine power plant: Introduction, working and operation of gas turbine power plant; Applications.

Environmental aspects of electric power generation from conventional sources: Limitation of fossil fuels - effects of hydro-electric projects; GHG emission from various energy sources and its effects— Atmospheric pollution; disposal of nuclear waste; Need for renewable energy sources.

UNIT-III: RENEWABLE ENERGY SOURCES-1 (12 Periods)

Solar energy —Introduction, solar radiation, measurement of solar radiation— pyranometers; PV cell— types, configuration of solar panel; Mathematical modeling of PV cell, I-V and P-V curves, Block diagram approach of solar PV system.

Wind Energy- Introduction, power extraction form the wind, Wind turbines— propeller type horizontal axis and vertical axis-darrieus rotor wind turbines; Basic components of wind energy conversion systems; Environmental impacts.
Geothermal energy: Introduction, Geothermal resources, geothermal power plants— vapor dominated and liquid dominated; environmental issues.

UNIT-IV: RENEWABLE ENERGY SOURCES-2 (10 Periods)
Energy from ocean: Introduction, ocean thermal energy conversion (OTEC): Open and closed cycle systems power plants; tidal energy: schematic diagram of tidal power plant and its classification-single basin and double basin arrangements.
Energy from Biomass: Introduction, biomass conversion technologies-direct, thermochemical and biochemical conversions; biogas generation.
Fuel cell: Fuel cells-working, classification.

UNIT-V: COGENERATION AND HYBRID ENERGY SYSTEMS (07 Periods)
Cogeneration- Electricity generating systems, Economic and Environmental benefits. Operational modes of co-generation.
Hybrid energy systems: Need for hybrid systems, configuration and coordination, Block diagram approach of Stand-alone PV-wind system, PV-Diesel and Wind-diesel; energy storage systems — ultra capacitors, SMES, Batteries.

Total Periods: 45

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

TEXT BOOKS:

1. Rai, G.D., *Non-conventional Energy Sources*, Khanna Publishers, New Delhi, 2017.
2. R. K. Rajput, *A textbook of power system engineering*, Laxmi publications (P) Ltd, 2016.

REFERENCE BOOKS:

1. C.L. Wadhwa, *Generation Distribution and Utilisation of Electrical Energy*, New Age, International publishers, 3rd Edition, 2015.
2. J K Kaldellis, *Stand-alone and Hybrid Wind Energy Systems*, Wood head publishing, 1st Edition 2010.
3. David Flin, Cogeneration: *A User's Guide. Renewable energy series*, Vol. 11. IET, 2010.
4. *S.Rao, Dr.B.B. Parulekar, Energy Technology, 3rd* Edition, Khanna publications, 2013.
5. D P Kothari, K C Singal and Rakesh Ranjan, '*Renewable Energy Sources and Emerging Technologies*', 2nd Edition, 2012.

III B. Tech. – I Semester

(20BT50205) **INSTRUMENTATION**

(Professional Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Analog Electronic Circuits and Electrical Measurements.

COURSE DESCRIPTION: Principle of operation, advantages and limitations of various types of electronic and digital instruments for measurement of electrical quantities; Signal Analyzers, Data acquisition, display devices and recorders.

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

CO1. understand the construction and working principle of various electronic instruments and apply them to measure various electrical parameters.
CO2. apply various transducers for the measurement of various non-electrical quantities.
CO3. understand the principle of operation of various spectral analysers and their applications for various signals.
CO4. understand the principle of data acquisition systems and apply these principles for recording/storing the data.
CO5. apply monitoring instruments for recording various electrical and non-electrical quantities and determine the required precision.

DETAILED SYLLABUS:

UNIT – I: ELECTRONIC INSTRUMENTS (10 Periods)

Electronic voltmeter using rectifiers; AC voltmeter — Average, Peak and true RMS voltmeters; Vector impedance meter, Vector voltmeter, Digital phase meter, Capacitance meter, Digital LCR meter; Q meter— measurement of low, high impedance, band width and errors.

UNIT – II: NON-ELECTRIC QUANTITIES MEASUREMENT (9 Periods)

Measurement of Torque — Torque transducers, Inductive torque transducer and Digital methods. Measurement of Low Pressure — Thermocouple vacuum gauge and Pirani Gauges.

Measurement of Flow — Turbine meters, Hotwire Anemometers and Electromagnetic flow transducer.

UNIT – III: SIGNAL ANALYZERS (10 Periods)

Analyzers — Resonant wave analyzer, Frequency selective analyzer, Heterodyne analyzer, Harmonic distortion analyzer, Total Harmonic distortion analyzer, logic analyzer and Power analyzer; Application of wave analyzer; Spectrum analyzer — basic spectrum analyzer, spectra of different signals.

UNIT – IV: DATA ACQUISITION SYSTEMS (09 Periods)

Generalized data acquisition system and its components, Types of multiplexing systems — time division and frequency division multiplexing; Digital data acquisition system, use of data acquisition systems and recorders in digital systems; Digital recording systems — block diagram and its working; Modern digital DAS — Analog multiplexer operation and operation of Sample-Hold circuits.

UNIT – V: DISPLAY DEVICES AND RECORDERS (07 Periods)

Display devices — LED, LCD, LVD and VDU; Recorders — graphic, ultraviolet, magnetic tape recorders, digital tape recorders, biomedical recorders.

Total Periods: 45

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

TEXT BOOKS:

1. A.K. Sawhney, A course in *Electrical and Electronics Measurements & Instrumentation*, Dhanpat Rai and Co. Publishers, 19th Edition, 2015.
2. J.B. Gupta, A course in *Electrical and Electronics Measurements & Instrumentation*, S.K. Kataria publishers, 14th Edition, 2015.

REFERENCE BOOKS:

1. H. S. Kalsi, *Electronic Instrumentation*-by Tata MC Graw Hill Company, 3rd Edition, 2010.
2. D.V.S Murthy, *Transducers and Instrumentation*, Prentice Hall of India, New Delhi, 2nd Edition, 2010.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/105/108105064/
2. https://nptel.ac.in/courses/108/105/108105153/

III B. Tech. – I Semester

(20BT50432) LINEAR AND DIGITAL IC APPLICATIONS LAB

(Common to ECE and EEE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE-REQUISITES: A course on Digital Electronics.

COURSE DESCRIPTION: Design, simulation 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 and simulate various op-amp applications and timers' circuits using any analog simulation tool 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 or in teams to solve problems with effective communication.

LIST OF EXPERIMENTS:

PART: A (Minimum **Five experiments** to be to be conducted using **hardware)**

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

PART B:(Minimum **FIVE experiments** to be conducted using **Verilog HDL**)

8. Arithmetic and Logic Unit using IC 74x181
9. Barrel Shifter using 74x151 multiplexer
10. Floating Point Encoder
11. Dual Priority Encoder

12. Self-Correcting Ring Counter
13. Universal Shift Register using IC 74x194
14. 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:

. Multisim tool (multisim live)

. XILINX tool

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

III B.Tech. – I Semester

(20BT50231) **ELECTRICAL WORKSHOP PRACTICE**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE-REQUISITES: Courses on Electric Circuits, Electrical Machines-I and Electrical Machines-II Lab.

COURSE DESCRIPTION: Exercises on assessing of electrical parameters and functionality of electrical apparatus; Design and estimation of electrical systems, and protection system for electrical devices and systems; Troubleshooting of electrical appliances and Calibration of measuring instruments.

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

CO1 evaluate various electrical quantities using modern utilities, assess the functionality of various devices and analyze the practical observations for calibration.

CO2 design operating equipment for the various electrical appliances for sustainable operation, and estimate typical house wiring system following the code of conduct and realize the technological developments in design of operating equipment.

CO3 analyze various electrical appliances for troubleshooting and maintenance, and protection schemes for safety of personals and apparatus, and realize the technological developments in protection.

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. Measurement of electrical quantities using MFM.
2. Operation and testing of Fuse, MCB and Relays.
3. Calibration of measuring instruments.
4. Practice bridges for measurement of circuit element parameters.
5. Design of starter for DC Motors.
6. Practicing and testing of DOL starter for Induction Motors.
7. Design of Timers for operation of electrical appliances.
8. Design and estimation of wiring for a typical house.
9. Troubleshooting of electrical appliances — Fan, Mixer/grinder, Water heater/Iron box.
10. Practicing plate and pipe earthing system.
11. Protection scheme for a 3-Phase Induction Motor. (Single Phasing, OL, Dry Run)
12. Installation and maintenance of UPS.

REFERENCE BOOKS/LABORATORY MANUALS:

1. http://www.srisaiuniversity.org/downloads/files/n59b79d6117211.pdf
2. https://www.gtu.ac.in/syllabus/NEW_Diploma/sem-1/Pdf%20Content%20detailing/3312401Electrical%20&%20Electronic%20Workshop.pdf

ADDITIONAL LEARNING RESOURCES:

1. https://www.youtube.com/watch?v=ax-KUL17YJ4
2. https://www.youtube.com/watch?v=TJpQ3fZIt20
3. https://www.youtube.com/watch?v=6RJnsa83xTA
4. https://www.youtube.com/watch?v=w2M4tS2OMsU
5. https://www.youtube.com/watch?v=DzVJiSQNbew

III B. Tech. – I Semester
(20BT50232) ELECTRICAL AUDITING AND CONSERVATION PRACTICE LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	1	2	2

PRE-REQUISITES: A course on Electrical measurements.

COURSE DESCRIPTION: Experimental investigations on behavior of insulators, performance of synchronous and asynchronous machines, relay testing and fault analysis.

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

CO1. demonstrate skill in identifying an appropriate auditing tool for measuring appropriate electrical and non-electrical preliminary quantities for auditing.
CO2. demonstrate skills to apply the auditing principles for illumination, house hold utilities and suggest a suitable conservation methods for economic benefits.
CO3. demonstrate skills to audit various industrial drives and suggest suitable methods for energy conservation adhering the protocols of auditing.
CO4. perform auditing by following the auditing protocols in various commercial, agricultural and domestic class of customers and suggest an appropriate energy conservation practices for economic benefits.
CO5. work independently or in teams to solve problems with effective communication.

Practical Exercises/List of Experiments: Conduct any **TEN** Experiments from the following:

1. Demonstration of auditing instruments for measuring electrical and non-electrical quantities for auditing purpose.
2. Measurement of active, reactive power and energy for auditing purpose.
3. Assess power quality problems using power quality analyser and suggest a suitable conservative measures to mitigate.
4. Testing of an electric motor drive for energy conservation.
5. Analyze star labelled electrical apparatus and compare the data sheet of various star ratings.
6. Determine energy consumption by fluorescent/incandescent lamp and evaluate net energy savings and payback period by replacing with energy efficient lamp.
7. Evaluate energy conservation in a ceiling fan with and without an electronic regulator.
8. Conserve the energy consumption in a three phase induction motor by applying an appropriate energy conservation method.
9. Determine the energy conservation in an induction motor operating in star and delta mode of operation.
10. Estimate energy and economic savings by improving power factor for a given class of consumer.
11. Estimate the economic benefits of improving load factor for a domestic consumer.
12. Audit the energy of a commercial consumer and suggest an appropriate energy conservation practice to reduce energy bill.

ADDITIONAL LEARNING RESOURCES:

1. https://sites.google.com/a/venusict.org/energy-conservation-and-management/ntpl-video-links
2. https://nptel.ac.in/courses/108/105/108105058/
3. https://www.youtube.com/watch?v=Nd_EL_B3JBQ
4. https://www.youtube.com/watch?v=lkNIuFkzxBk
5. https://www.youtube.com/watch?v=730netBSZKY
6. https://www.youtube.com/watch?v=R_FdTPbgzTs

III B.Tech. - I semester

(20BT50233) **SUMMER INTERNSHIP-I**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	100	100	-	-	-	1.5

PREREQUISITES: -

COURSE DESCRIPTION: Expose students to the industrial environment; Create competent professionals for the industry; sharpen the real time technical / managerial skills required at the job; Gain professional experience and understand engineer's responsibilities and ethics; Familiarize with latest equipment, materials and technologies; Gain exposure to technical report writing; Gain exposure to corporate working culture.

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

CO1. analyze latest equipment, 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.

III B. Tech. – I Semester

(20BT503AC) FOUNDATIONS OF ENTREPRENEURSHIP

(Audit course)

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

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

PRE-REQUISITES: -

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 (6 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 (6 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 (6 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 (6 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 (6 Periods)

Start-Ups: Definition to start-up, Start-up activities, Promising start-ups, Venture-backed start-ups, Corporate-supported start-ups.

Social Entrepreneurship: Social enterprise-Need - Types - Characteristics and benefits of social enterprises, Rural entrepreneurship.

Total Periods: 30

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

TEXT BOOKS:

1. Robert D. Hisrich, Mathew J. Manimala, Michael P. Peters, Dean A. Shepherd, *Entrepreneurship*, McGraw Hill Education (India) Private Limited, 8th Edition, 2013.
2. Marc J Dollinger, Entrepreneurship: Strategies and Resources, Pearson, 3rd Edition, 2003.

REFERENCE BOOKS:

1. Vasant Desai, *Dynamics of Entrepreneurial Development and Management,* Himalaya 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.

III B. Tech. – II Semester

(20BT5HS01) **ORGANIZATIONAL BEHAVIOR**

(Common to CE, ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE REQUISITE:-

COURSE DESCRIPTION: Introduction to organizational behaviour; Individual behaviour and Personality; Interpersonal and group behaviour; 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 behaviour to understand the behaviour of people in the organization.
CO3. analyze the complexities associated with management of the individual, group behaviour in the organization.
CO4. develop leadership qualities.
CO5. improve individual behaviour, skill and life-long learning in a group.

DETAILED SYLLABUS:

UNIT – I: INTRODUCTION TO ORGANIZATIONAL BEHAVIOUR (9 Periods)

Meaning and Definition, Nature, Scope, Features, Significance of Organizational Behavior – Levels and Contributing disciples to OB – Emerging Issues and Challenges of OB

UNIT – II: INDIVIDUAL BEHAVIOR AND PERSONALITY (9 Periods)

INDIVIDUAL: Introduction – Role of Brain and Mind in Individual Behavior – Similarities and Dissimilarities in Individuals – Reasons for individual differences – Nature of Man – Models of man – Values, Attitudes, emotions, Moods and Job satisfaction.

PERSONALITY: Introduction – Personality Traits – Determinants of Personality – Personality Theories**.**

UNIT – III: INTERPERSONAL AND GROUP BEHAVIOUR (9 Periods)

INTRODUCTION TO INTERPERSONAL: Process of perception – Inter personal perception

GROUP BEHAVIOUR: Meaning and Definition of a Group – Classification of Groups – Stages of Group development.

UNIT – IV: LEADERSHIP (9 Periods)

Meaning and Definition of Leadership – Leadership Theories: Behavioral Theories and Modern theories – Leadership Styles – New directions for leadership

UNIT – V: ORGANIZATIONAL CHANGE AND DEVELOPMENT (9 Periods)

Meaning – Nature of work change – Pressure for change – Change Process – Types of change – Factors influencing change – Organizational development process – 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.

III B. Tech. – II Semester
(20BT60201) **POWER ELECTRONICS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	--	--	3

PRE-REQUISITES: A course on Analog Electronics.

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.

COURSE OUTCOMES: 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 120^0 conduction 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,* Tata McGraw - 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/

III B. Tech. – II Semester
(20BT60202) **POWER SYSTEM OPERATION AND CONTROL**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Transmission & Distribution and Control Systems.

COURSE DESCRIPTION: Load forecasting; Optimal operation of generators in thermal power station; Optimal scheduling of hydrothermal system; Unit commitment; Modeling of Power system components; Reactive power and Voltage control; Load frequency control.

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

CO1. estimate the load profile using statistical methods for planning and scheduling of thermal plants in power system.
CO2. determine the optimal schedule of hydro-thermal plants for sustainable operation of the plant.
CO3. solve the unit-commitment problem using dynamic programming to allocate the load among the committed generators.
CO4. model the power system components appropriate for automatic generation control of power system.
CO5. assess the load frequency dynamics in single area and two-area system, and design a suitable controller to control the LFC dynamics.

DETAILED SYLLABUS:

UNIT-I: PLANNING AND ECONOMIC OPERATION OF THERMAL POWER SYSTEM (12 Periods)

Planning: Load curves, Load curve parameters – Connected load, Maximum Demand, Average Load, Load Factor, Demand Factor, Diversity Factor; Load forecasting: Simple regression – Linear and quadratic.

Economic Operation of thermal plants: Characteristics of thermal plants, cost function: fuel cost and incremental fuel cost; Optimum allocation with and without transmission losses, loss coefficients, general transmission line loss formula.

UNIT-II: HYDROTHERMAL SCHEDULING (08 Periods)

Introduction, classification of hydro plants, scheduling of hydro plants - long-term, short-term, scheduling energy. Hydrothermal scheduling - problem formulation, objective function, operational constraints. Short term scheduling - Lagrange function, penalty factor; iteration method.

UNIT-III: UNIT COMMITMENT (08 Periods)

Introduction, Constraints in unit commitment—Start-up and shutdown costs, up time and downtime, and reserves; Unit commitment solution methods - priority list method,

dynamic Programming method (maximum of three plants for three operating hours only); Unit commitment Vs Economic dispatch.

UNIT-IV: MODELLING OF POWER SYSTEM COMPONENTS FOR AGC

(07 Periods)

Load Frequency Problem; LFC Model - speed governor, turbine, generator-load model; Components and block diagram representation of IEEE type-1 excitation system; AVR model.

UNIT-V: LOAD FREQUENCY CONTROL IN POWER SYSTEM (10 Periods)

Load frequency control of single area system: Necessity of keeping frequency constant; Steady state response - uncontrolled and controlled case, dynamic response.

Load frequency control of two area system: Concept of control area, Block diagram representation, Steady state response - uncontrolled and controlled case, dynamic response, tie-line bias control.

Total Periods: 45

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

TEXT BOOKS:

1. K. Uma Rao, *Power system operation and control*, Wiley India Pvt. Ltd, 1st Edition, 2013.
2. C. L. Wadhwa, *Electrical Power Systems*, New age International, New Delhi, 5th Edition, 2009.

REFERENCE BOOKS:

1. Sivanagaraju, S. *Power system operation and control*. Pearson Education India, 2009.
2. A. Chakravarthi and S. Halder, *Power System Analysis Operation and Control*, Prentice Hall India, 3rd Edition, 2006.

ADDITIONAL LEARNING RESOURCES

1. https://nptel.ac.in/courses/108/104/108104052/
2. https://www.digimat.in/nptel/courses/video/108105104/L53.html

III B. Tech. – II Semester

(20BT60203) **ADVANCED CONTROL SYSTEMS**

(Professional Elective-2)

(Common to EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Control systems.

COURSE DESCRIPTION: State space analysis; design of compensators and controllers; describing function for non-linear systems, phase-plane analysis; Lyapunov's stability analysis.

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

CO1. design state feedback controller and observer by applying knowledge on controllability and observability.
CO2. design the compensators and controllers to enhance the performance of the system using root locus technique.
CO3. analyze the non-linear control system stability using describing function and phase-plane analysis.
CO4. investigate the stability of non-linear system by applying Liapunov stability.

DETAILED SYLLABUS:

UNIT-I: STATE SPACE ANALYSIS AND STATE FEEDBACK CONTROL (12 Periods)

Review of state space analysis, Canonical forms —controllable canonical form, observable canonical form and Jordan canonical form; Test for controllability and observability for continuous time invariant systems and principle of duality; Design of state feedback control through pole placement technique — direct substitution method and Ackermann's formula. full-order observer and reduced-order observer.

UNIT-II: COMPENSATORS AND CONTROLLERS (10 Periods)

Introduction to preliminary design considerations, Lag, lead and lag-lead compensator; Compensator design based on root locus. Types of controllers, tuning rules for PID controller, design of PI, PD and PID controllers using frequency domain and root locus techniques.

UNIT-III: NON-LINEAR SYSTEMS (09 Periods)

Introduction to non-linear systems, common non-linearities in control systems; study of nonlinear systems — describing function method, derivation of describing function for saturation, ideal relay, relay with dead-zone, backlash, stability analysis with describing function.

UNIT-IV: PHASE PLANE ANALYSIS (7 Periods)

Concept of phase plane analysis — singular-points, concept of limit cycle construction of phase trajectory by analytical method, isocline and delta methods.

UNIT-V: LYAPUNOV STABILITY **(7 Periods)**

Introduction — Stability in the sense of Lyapunov; Lyapunov's stability and Lypanov's instability theorems; Lyapunov function for linear system, Lyapunov function for non-linear systems — Krasooviski's and variable gradient methods.

Total Periods: 45

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

TEXT BOOKS:

1. Katsuhiko Ogata, *Modern Control Engineering*, 5th Edition, Pearson, 2010.
2. M. Gopal, *Control Systems Principles and Design*, 4th Edition, McGraw Hill Education (India) Private Limited, NewDelhi, 11th reprint 2016.

REFERENCE BOOKS:

1. A. Nagoorkani, *Advanced Control Theory,* 3nd Edition, CBS Publishers and Distributors Pvt Ltd, March 2020.
2. I.J Nagarth, M.Gopal, *Control systems Engineering,* 6th Edition, New Age International Publishers, September 2018.

ADDITIONAL LEARNING RESOURCES:

1. http://www.nptelvideos.in/2012/11/advanced-control-system-design_27.html
2. https://swayam.gov.in/nd1_noc19_de04/preview

III B. Tech. – II Semester

(20BT60204) **HIGH VOLTAGE ENGINEERING**

(Professional Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Electromagnetic fields and Electrical circuits.

COURSE DESCRIPTION: Electrostatic fields; Breakdown phenomena of insulation; Generation of high voltages; Measurement of HV and Testing of high voltage apparatus.

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

CO1. analyze the behaviour of dielectrics in the presence of high voltages using the principles of electric fields.
CO2. analyze the generating circuits for generation of high voltages and currents.
CO3. analyze the measuring circuits and techniques for the measurement of high Voltages and currents.
CO4. realize the philosophy of sustainable testing and develop procedures for testing of various high voltage equipment by adhering relevant standards.

DETAILED SYLLABUS:

UNIT-I: ELECTROSTATIC FIELDS (6 Periods)

Introduction to high voltage engineering — electrical field distribution; breakdown strength of insulating materials; field distortions by conducting particles; fields in multi-dielectric materials.

Over voltages — causes and protection against over voltages.

UNIT-II: BREAKDOWN PHENOMENA (11 Periods)

Breakdown in gases — Townsend's theory, Streamer's theory, breakdown in electro negative gases, Paschen's law, time lags of breakdown; insulation co-ordination.

Breakdown in solid dielectrics — Thermal breakdown and electro mechanical breakdown, treeing and tracking, Internal discharges.

Breakdown in liquid dielectrics — Suspended particle theory and stressed oil volume theory.

UNIT-III: GENERATION OF HVAC, HVDC, IMPULSE VOLTAGE AND CURREN (12 Periods)

Generation of HVAC and HVDC — cascade connection of transformers; series resonant circuit; tesla coil; voltage doubler circuit; Cock Croft Walton circuit — calculation of regulation, ripple and optimum number of stages for minimum voltage drop.

Generation of impulse voltage and current — introduction to standard lightning and switching impulse voltages; analysis of single stage impulse generator — expression for output impulse voltage; multi stage impulse generator — working principle, rating and components of impulse generator; triggering of impulse generator; generation of high impulse current.

UNIT-IV: MEASUREMENT OF HIGH VOLTAGE AND CURRENT (8 Periods)

HVAC measurement — Chubb and Fortescue method; HVDC measurements — generating voltmeter principle, construction; potential dividers — resistance dividers, capacitance dividers, mixed RC potential dividers; Standard sphere gap measurements of HVAC, HVDC and impulse voltages; factors affecting the measurements; Measurement of high impulse currents — Rogowsky coil and magnetic links.

UNIT-V: TESTING OF HIGH VOLTAGE APPARATUS (8 Periods)

Non-destructive testing — measurement of DC resistivity — Galvanometer method, loss of charge method; Dielectric loss and loss angle measurements using Schering bridge; Partial discharge measurements – straight discharge detection circuit.

Testing of high voltage apparatus — testing of insulators, bushings, power transformers, cables, surge arresters and circuit breaker.

Total Periods: 45

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

TEXT BOOKS:

1. E. Kuffel, W.S. Zaengl and J. Kuffel, *High Voltage Engineering: Fundamentals*, 2nd Edition, Newnes, Elsevier Press, 2000.
2. M. S. Naidu and V. Kamaraju, *High Voltage Engineering*, 4th Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2008.

REFERENCE BOOKS:

1. C.L. Wadhwa, *High Voltage Engineering*, 3rd revised Edition New Age Science, 2010.
2. Mazen Abdel-Salam, Hussein Anis, Ahdab El-Morshedy, Roshdy Radwan, *High Voltage Engineering Theory and Practice*, 2nd Edition, Revised & Expanded, Marcel-Dekker Publishers (Special Indian Edn.), 2000.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/104/108104048/#
2. http://vlabs.iitkgp.ernet.in/vhv/

III B. Tech. – II Semester

(20BT60205) PIC MICROCONTROLLERS AND APPLICATIONS

(Professional Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Computer Architecture & Organization.

COURSE DESCRIPTION: Embedded systems concept, PIC Microcontroller Architecture, Peripherals, Programming, Interfacing and their applications.

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

CO1. develop optimized programs using PIC18 assembly instructions by applying the concepts of internal architecture and operation of PIC18 processor.
CO2. develop programs for specific applications using internal Timers, Serial port and I/O ports of PIC18 microcontroller.
CO3. develop programs for specific applications using Interrupts, CCP and ECCP of PIC18 microcontroller.
CO4. develop programs for interface and control of peripherals using PIC18 Microcontroller.

DETAILED SYLLABUS:

UNIT–I: INTRODUCTION TO EMBEDDED SYSTEMS (9 Periods)

Introduction – Characteristics - Von Neumann and Harvard Architecture - CISC and RISC - Instruction pipelining, Microcontrollers and Embedded processors: Microcontroller versus general-purpose microprocessor – History of the PIC microcontroller – PIC18 features, PIC18 Family.

UNIT-II: PIC18 ARCHITECTURE & BASIC PROGRAMMING (9 Periods)

PIC18 architecture and features - PIC18 Memory organization – program memory - data memory - PIC Register file – General Purpose registers - Special Function registers. PIC18 Data Format and Directives - Introduction to PIC18 Assembly Programming – PIC18 programming tools, Instruction set: Data transfer – Arithmetic – logical - bit manipulation - branch Instructions, Addressing modes: Immediate – Direct - Register Indirect Addressing Modes, Macros and Modules, PIC18 programming using MPLAB and PIC 'C' Compile.

UNNIT-III: TIMERS, SERIAL PORT AND I/O PORTS PROGRAMMING (9 Periods)

Timers: Programming Timers 0 and 1 in Assembly language - Programming Timers 2 and 3 in Assembly language, Serial Port: Basics of Serial Communication and PIC Serial Port programming in Assembly language, I/O Ports: Port A TRISA - Port B TRISB - Port C TRISC.

UNIT–IV: INTERRUPTS, CCP AND ECCP PROGRAMMING (9 Periods)

PIC18 Interrupts - Programming Timer Interrupts - Programming the Serial Communication Interrupts - Port-B Change Interrupt, Interrupt Priority in the PIC.

Standard and Enhanced CCP Modules - Compare Mode programming - Capture Mode programming - PWM Programming - ECCP Programming.

UNIT–V: PIC18 INTERFACING (9 Periods)

ADC Characteristics - ADC Programming in the PIC18 - DAC Interfacing - Sensor Interfacing and Signal Conditioning - Relays and Opto-isolators - Stepper Motor Interfacing - DC Motor Interfacing and PWM - PWM Motor Control with CCP - DC Motor Control with ECCP.

Total Periods: 45

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

TEXT BOOKS:

1. Muhammad Ali Mazidi, Rolin D. McKinlay, Danny Causey, PIC Microcontroller and Embedded Systems using assembly and C for PIC 18, Pearson Education, 2008.
2. John B. Peatman, Design with PIC Microcontrollers, Pearson Education, 2007.

REFERENCE BOOKS:

1. PIC18FXXX data sheet.
2. John B. Peatman, Embedded design with the PIC18F452 Microcontroller, Printice Hall, 2003.

ADDITIONAL LEARNING RESOURCES:

1. UDEMY:https://www.udemy.com/course/master-pic-microcontroller-using-mikroc-protuesprofessional/.
2. https://pic-microcontroller.com/online-courses-learn-pic-microcontroller-programming/
3. Coursera: https://www.coursera.org/learn/comparch
4. EDX : https://www.edx.org/learn/computer-architecture

IV B. Tech. – I Semester

(20BT60206) **SPECIAL ELECTRICAL MACHINES**

(Professional Elective – 2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Electrical Machines–II and Power Electronics.

COURSE DESCRIPTION: Construction, Working, Types, control operation, characteristics and applications of Stepper Motors, Switched Reluctance Motors, Synchronous Reluctance Motors, Permanent Magnet Motors and Linear Induction Motors.

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

CO1. analyze the open and closed loop operational characteristics of stepper motor and assess its performance under various scenarios.
CO2. analyze the operational aspects of switched reluctance motor to assess the performance and design the constructional features for sustainability.
CO3. analyze the operational aspects of synchronous reluctance motor to assess its performance, sustainability and applications.
CO4. analyze the sensorless and sensor based operation and control aspects of permanent magnet brushless DC motor and assess the performance under diverse scenarios.
CO5. analyze the operational and control aspects of linear induction motor and assess their performance for special applications.

DETAILED SYLLABUS:

UNIT-I: STEPPER MOTORS (8 Periods)

Types of construction and working principle of stepping motor. Various configurations for switching the phase windings, torque equation and characteristics. Open loop and closed loop control of stepper motor, applications.

UNIT-II: SWITCHED RELUCTANCE MOTORS (9 Periods)

Construction details, Principle of operation – Design of stator and rotor pole arcs – torque equation and characteristics, power converter for switched reluctance motor, control of switched reluctance motor, rotor position sensing mechanism.

UNIT-III: SYNCHRONOUS RELUCTANCE MOTORS (8 Periods)

Constructional features, Types – Axial and Radial flux motors. Principle of operation, torque-speed characteristics, Phasor diagram, Characteristics, control of SyRM, advantages and applications.

UNIT-IV: PERMANENT MAGNET MOTORS (12 Periods)

Permanent magnet materials–hysteresis loop, analysis of magnetic circuits.
Permanent Magnet DC Motors (PMDCM): Constructional details, principle of operation, types of BLDC motor, sensorless and sensor based control of BLDC motors, Torque/speed characteristics and Applications.

Permanent Magnet AC Motors (PMACM): Principle of operation - Ideal PMSM– EMF and Torque – Synchronous Reactance – Sine wave motor with practical windings - Torque/speed characteristics – Applications.

UNIT-V: AC SERIES AND LINEAR MOTORS (8 Periods)

AC Series Motors: Construction, principle, characteristics and applications.

Linear Induction Motor(LIM): Construction, principle of operation– single sided and double-sided LIM, thrust equations and performance equations based on current sheet concept, equivalent circuit of LIM, applications.

Linear Synchronous Motor (LSM): Construction, types, principle of operation, thrust equation, control and applications.

Total Periods: 45

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

TEXT BOOKS:

1. K. VenkataRatnam, *Special Electrical Machines*, University press, New Delhi, 2009.
2. E.G. Janardhanan, *Special Electrical Machines*, PHI learning private limited, 2014.

REFERENCE BOOKS:

1. Takashi Kenjo, *Stepping Motors and their Microprocessor controls*, Clarenden press, Oxford, 1984.
2. T. Kenjo and S. Nagamori, *Permanent-Magnet and Brushless DC Motors*, Clarenden press, Oxford, 1984.
3. T.J.E. Miller, *Brushless Permanent Magnet and Reluctance Motor Drives*, Clarenden press, Oxford 1989.
4. R. Krishnan, *Switched Reluctance Motor Drives – Modeling, Simulation, analysis, Design and Applications*, CRC press, Special Indian Edition, 2015.
5. JB Gupta, *Theory and Performance of Electrical Machines (DC Machines, Polyphase circuits and AC Machines) in SI Units*, 15th Edition, S.K. Kataria & Sons, New Delhi, 2015.

ADDITIONAL LEARNING RESOURCES:

1. A Video with Animation on Stepper Motor: https://www.youtube.com/watch?v=eyqwLiowZiU
2. A Video Lecture on Switched Reluctance Motor: https://www.youtube.com/watch?v=31hUDWjzLjY
3. A Video Lecture on Synchronous Reluctance Motor: https://www.youtube.com/watch?v=qDon7Nrj1Tk&t=82s
4. Lecture - 35 Step Motor Drives BLDC Drives https://www.youtube.com/watch?v=Qy6mA4TEpyI
5. A Video Lecture on Linear Motor: https://www.youtube.com/watch?v=CZbXaNWGAkM

III B. Tech. – II Semester

(20BT60442) **VLSI DESIGN**

(Professional Elective – 3)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A Course on Digital Electronics.

COURSE DESCRIPTION: Logic Families; CMOS Technology; Stick Diagrams and Layouts; Subsystem design; Programmable Interconnect structures; Memories.

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

CO1. analyze logic families, steady state and dynamic characteristics of CMOS, to improve performance characteristics of digital ICs.
CO2. analyze electrical properties of MOS circuits for VLSI/ULSI chip fabrication.
CO3. develop stick diagrams and layouts of CMOS circuits for miniaturization by analyzing gate delays and scaling effects.
CO4. design subsystems for High speed digital electronics to compensate tradeoff among area, speed and power requirements.

DETAILED SYLLABUS:

UNIT-I: DIGITAL LOGIC FAMILIES (8 Periods)

Introduction to logic families, RTL, DTL, Transistor-Transistor logic, Emitter Coupled Logic, I^2L, CMOS logic, CMOS steady state and dynamic electrical behavior.

UNIT-II: FABRICATION AND ELECTRICAL PROPERTIES OF MOS (10 Periods)

Fabrication Process for NMOS and CMOS technology, Basic Electrical Properties of MOS: I_{ds} – V_{ds} relationships, Second order effects of MOSFETs-Latch up, Hot carrier Effects, channel length modulation, Threshold Voltage V_T, g_m, g_{ds} and ω_0; Pass Transistor, NMOS inverter, Pull up to pull down ratio for an NMOS inverter, CMOS Inverter

UNIT-III: CMOS CIRCUIT DESIGN PROCESS (10 Periods)

VLSI design flow, MOS layers, stick diagrams, NMOS design style, CMOS design style, lambda based design rules, layouts for inverters, sheet resistance, capacitances of layers, Gate delays, Delay estimation, Scaling, Limitations of Scaling.

UNIT-IV: SUBSYSTEM DESIGN - I (08 Periods)

Adders – Transmission based Adder, Carry look-ahead adder, Manchester carry chain adder, Carry Skip Adder, Carry Select Adder; Barrel Shifter, Multipliers – Array Multiplier, Booth Multiplier; ALUs.

UNIT-V: SUBSYSTEM DESIGN - II (09 Periods)

Counters- Synchronous and Asynchronous Counter; High Density Memory Elements - Design Approach, FPGAs, Programmable Interconnect structures - Fusible links, Antifuse via link, UV Erasable, Electrically Erasable; CPLDs, Cell based Design Methodology.

Total Periods: 45

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

TEXT BOOKS:

1. Kamran Eshraghian, Douglas A. Pucknell and 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.

III B. Tech. – II Semester

(20BT60207) DESIGN AND ESTIMATION OF ELECTRICAL SYSTEMS

(Professional Elective-3)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Basic Electrical and Electronics Engineering Lab, and Transmission and Distribution.

COURSE DESCRIPTION: Design and estimation of residential & commercial buildings, overhead transmission & distribution lines and industrial buildings; Light sources, principals of light & design, types of lamps; electric heating, welding and their applications.

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

CO1. design and estimate the requirements of electrical wiring in residential & commercial buildings adhering Indian electricity rules and standards.
CO2. design and estimate the requirements of overhead transmission and distribution lines adhering Indian electricity rules and standards.
CO3. design and estimate the requirements of electrical wiring for industrial buildings adhering Indian electricity rules and standards.
CO4. design the lighting system for various industrial and domestic applications following the design procedures and laws of illumination.
CO5. understand various methods of heating and welding process and their applications.

DETAILED SYLLABUS:

UNIT-I: DESIGN AND ESTIMATION OF RESIDENTIAL AND COMMERCIAL BUILDINGS (11 Periods)

Introduction to residential wiring system, systems of distribution of electric energy, methods of wiring, systems of wiring, choice of wiring, rating of wires and cables, load calculations and selection of size of conductor. Estimation & costing for residential and commercial buildings. Indian Electricity Act and major applicable Indian Electricity (I.E) rules.

UNIT-II: DESIGN AND ESTIMATION OF OVERHEAD TRANSMISSION & DISTRIBUTION LINES (09 Periods)

Introduction, components of overhead lines, conductor materials, determination of size of conductor for overhead transmission line, conductors' configuration, spacing and clearances, span lengths. Preparation of detailed estimates and costing of overhead transmission and distribution lines.

UNIT-III: DESIGN AND ESTIMATION OF INDUSTRIAL NETWORK INSTALLATIONS (09 Periods)

Introduction and classification of industrial buildings, design process, Industries with less than or equal to 1MVA and above 1MVA load, selection of distribution architecture, selection of transformer substations, selection of drives, selection of switch gears.

UNIT-IV: PRINCIPLES OF LIGHT AND DESIGN (10 Periods)

Light sources, colour characteristics, terms used in illumination, laws of illumination, polar curves, photometry - integrating sphere. Types of lamps, LED lights, photometric analysis,

lighting calculations, average lumen method, light loss factor, quality of lighting, design procedures, arrangement of fixtures, factory lighting, street lighting and flood lighting.

UNIT-V: ELECTRIC HEATING AND ELECTRIC WELDING (06 Periods)

Electric heating: Design of heating element, advantages, methods and applications - resistance, induction and dielectric heating.

Electric welding: Classification, resistance and arc welding, electric welding, comparison between AC and DC welding.

Total Periods: 45

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

TEXT BOOKS:

1. J.B. Gupta, *A Course in Electrical Installation Estimating and Costing*, Reprint Edition, S.K. Kataria and Sons, 2013.
2. M. K. Giridharan, *Electrical Systems Design*, 3rd Edition, I K International Publishing House Pvt. Ltd, 2015.

REFERENCE BOOKS:

1. Hemant Joshi, *Residential - Commercial and Industrial Electrical Systems: Network and Installation (Volume 1)*, 21st Edition, McGraw Hill Education, 2007.
2. Hemant Joshi, *Residential - Commercial and Industrial Electrical Systems: Network and Installation (Volume 2)*, 21st Edition, McGraw Hill Education, 2007.
3. J.B. Gupta, *Utilization of Electric Power and Electric Traction*, 10th Edition, S.K. Kataria and Sons, 2013.

ADDITIONAL LEARNING RESOURCES:

1. https://bis.gov.in/index.php/standards/technical-department/national-building-code/

III B. Tech. – II Semester

(20BT60208) DISTRIBUTED GENERATION AND MICROGRID

(Professional Elective-3)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A Course on Transmission and Distribution.

COURSE DESCRIPTION: The course concerns with the significance of distributed generation with centralized grid and microgrid, also the protection systems on various generation equipment and communication systems for the distribution generation and microgrids.

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

CO 1. understand the technical and economic aspects of distributed generations, and their impact on environment.
CO 2. understand various energy resource appropriate for distribution generation and their interfacing issues.
CO 3. plan the generation capacity to meet the thermal generation adequacy and appropriate protection system for distributed generation and networks.
CO 4. develop models of microgrid to assess energy management and coordination of protection system of the grid operating in different modes.
CO 5. understand the operational challenges and communication protocols of microgrid, and its impact on environment and society.

DETAILED SYLLABUS:

UNIT-I: OVER VIEW OF DISTRIBUTED GENERATION (9 Periods)

Distribution Generation - Introduction, Necessity, Benefits of integration. Distributed Generation – Technical aspects, Impacts on Environmental, Economics aspects, transmission system and central generation.

UNIT-2: ENERGY RESOURCES FOR DISTRIBUTED GENERATION (9 Periods)

Combined heat and power systems; Wind energy conversion systems; Solar photovoltaic systems; Small-scale hydroelectric power generation; Other renewable energy sources; Storage devices and Inverter interfaces.

UNIT-3: DG PLANNING AND PROTECTION (9 Periods)

Generation capacity, adequacy in conventional thermal generation systems; Impact of distributed generation on network design; Protection of distributed generation and distribution network.

UNIT-4: CONCEPT OF MICROGRID (9 Periods)

Microgrid - introduction and configuration; Functions of Micro source controller and central controller; Energy Management and Protection Co-ordination Module; Modes

of Operation: Grid connected and islanded modes; Modelling of Microgrid : Micro-turbine Model, PV Solar Cell Model, Wind Turbine Model; Role of Microgrid in power market competition.

UNIT-5: IMPACTS OF MICROGRID (9 Periods)

Technical and economical aspects of Microgrid ; Challenges of Microgrid development; Management and operational issues of a Microgrid ; Impacts of Microgrids on heat utilization, process optimization, energy market, environment, communication standards and protocols.

Total Periods: 45

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

TEXT BOOKS:

1. Nick Jenkins, Janaka Ekanayake, Goran Strbac, *Distributed Generation*, Institution of Engineering and Technology, London, UK, 2010.
2. S. Chowdhury, S.P. Chowdhury and P. Crossley, *Microgrids and Active Distribution Networks*; The Institution of Engineering and Technology, London, United Kingdom, 2009.

REFERENCES:

1. Math H. Bollen, Fainan Hassan, *Integration of Distributed Generation in the Power System*, John Wiley &Sons, New Jersey, 2011.
2. Magdi S. Mahmoud, Fouad M. AL-Sunni, *Control and Optimization of Distributed Generation Systems*, Springer International Publishing, Switzerland, 2015.
3. Nadarajah Mithulananthan, Duong Quoc Hung, Kwang Y. Lee, *Intelligent Network Integration of Distributed Renewable Generation*, Springer International Publishing, Switzerland, 2017.

ADDITIONAL LEARNING RESOURCES:

1. NPTEL Videos : https://nptel.ac.in/courses/108/108/108108034/
2. IEEE Distributed generation and its impact on power grids and microgrids protection : https://ieeexplore.ieee.org/document/6201229

III B. Tech. – II Semester
(20BT60209) SMART GRID TECHNOLOGY
(Professional Elective–3)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Power System Operation and Control.

COURSE DESCRIPTION: Smart grid functions and components; Smart meters and its classification; Demand side management, Communication technology and Cyber security.

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

CO 1. understand the operational and functional aspects of smart grid, architecture and technical challenges.
CO 2. analyze the communication signals from various measuring units and sub-networks for monitoring secured operation adhering relevant standards.
CO 3. assess the various energy options and apply them for the sustainability of Smart grid.
CO 4. develop strategies for demand side management using various communication protocols.
CO 5. understand the challenges and relevant standards in interoperability and cyber security of Smart grid.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO SMART GRID (9 Periods)

Introduction to smart grid as per National Institute Standards and Technology (NIST), smart grid architecture, functions of smart grid components, smart grid initiatives in India, technology drivers and challenges. Overview of the technologies required for smart grid and architecture of smart substation.

NIT-II: SMART GRID MEASUREMENT TECHNOLOGY (9 Periods)

Introduction, standards for information exchange, monitoring, smart meters and measurement technologies, WAMS, PMUs, GIS and google mapping tools and Multi-agent systems technology.

UNIT-III: SUSTAINABLE ENERGY OPTIONS FOR THE SMART GRID (9 Periods)

Renewable Energy Resources, Penetration and Variability Issues Associated with Sustainable
Energy Technology, Demand Response Issues, Electric Vehicles and Plug-in Hybrids, Storage Technologies.

UNIT-IV: DEMAND SIDE MANAGEMENT AND COMMUNICATION TECHNOLOGY (9 Periods)

Introduction, Demand Side Management objectives and its classification. Communication technologies: IEEE 802X series. Layouts of Sub-networks: LAN, WAN, NAN, HAN and FAN and its comparison.

UNIT-V: INTEROPERABILITY, STANDARDS AND CYBER SECURITY (9 Periods)

Introduction, State-of-the-Art-Interoperability, Benefits and Challenges of Interoperability, Model for Interoperability in the Smart Grid Environment, Smart Grid Network Interoperability, Interoperability and Control of the Power Grid, Standards, Approach to Smart Grid Interoperability Standards, Smart Grid Cyber Security, Cyber Security State of the Art, Cyber Security Risks, cyber security concerns associated with Advanced Metering Infrastructure, Mitigation approach to cyber security risks.

Total Periods: 45

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

TEXT BOOKS:

1. James Momoh, *Smart Grid: Fundamentals of design and analysis*, by, John Wiley & sons Inc, IEEE press 2012.
2. Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama *Smart Grid: Technology and Applications*, John Wiley & sons inc, 2012.

REFERENCE BOOKS:

1. Fereidoon P. Sioshansi, *Smart Grid: Integrating Renewable, Distributed & Efficient Energy*, Academic Press, 2012.
2. Clark W.Gellings, *The smart grid: Enabling energy efficiency and demand response*, Fairmont Press Inc, 2009.

ADDITIONAL LEARNING RESOURCES:

1. NPTEL course: https://nptel.ac.in/courses/108/107/108107113/
2. IEEE Smart grid website : https://smartgrid.ieee.org/resources/webinars

III B. Tech. – I Semester

(20BT50441) **PRINCIPLES OF COMMUNICATIONS**

(Inter Disciplinary Elective-1)

(Common to EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Signals and Networks.

COURSE DESCRIPTION: Fundamentals of Communications; Analog and digital communications - modulation and Demodulation Techniques; Information theory and coding.

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 pulse-analog modulations.
CO3. understand the concepts of pulse-code modulation and delta modulations.
CO4. understand various digital carrier modulation schemes.
CO5. analyze various error detection and correction codes for reliable transmission.

DETAILED SYLLABUS:

UNIT-I: ANALOG MODULATION (13 Periods)

Block diagram of Electrical Communication System, Types of Communications, Need for Modulation, Types of Amplitude Modulation: AM, DSBSC, SSBSC, Power and BW requirements, Generation of AM, DSBSC, SSBSC, Demodulation of AM: Diode detector, Product demodulation for DSBSC & SSBSC, Frequency & Phase Modulations.

UNIT-II: PULSE MODULATION (07 Periods)

Elements & Advantages of Digital communication systems, PAM, Regeneration of Base band Signal, PWM and PPM, Time Division Multiplexing, Frequency Division Multiplexing.

UNIT-III: BASE BAND DIGITAL TRANSMISSION (07 Periods)

Pulse Code Modulation: Advantages, Block diagram of PCM, Quantization, effect of Quantization, Quantization error, DM, ADM and Comparison.

UNIT - IV: PASS BAND DIGITAL TRANSMISSION (10 Periods)

ASK, FSK, PSK, DPSK, QPSK, Modulation and Demodulation—Coherent and Non-coherent techniques

UNIT-V: INFORMATION THEORY AND CODING (08 Periods)

Concept of Information, Entropy and Rate of Information, Coding efficiency, Shannon-Fano and Huffman Coding.

Error Correction and Detection Codes: Block Codes, Convolution Codes, Cyclic Codes.

Total Periods: 45

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

TEXT BOOKS:

1. R.P. Singh and S D Sapre, *Communication Systems* - Analog and Digital, TMH, 3rd Edition, 2017.
2. Simon Haykin, *Communication Systems*, John Wiley, 2nd Edition, 2007.

REFERENCE BOOKS:

1. Herbert Taub, Donald L Schilling & Goutam Sana *"Principles of Communication Systems"*, Tata McGraw-Hill, 4th Edition, 2012.
2. Sham Shanmugam, *"Digital and Analog Communication Systems",* Wiley-India Edition, 2019.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/104/108104091/
2. http://ocw.ump.edu.my/course/view.php?id=266

III B. Tech. – II Semester

(20BT60410) MICROELECTROMECHANICAL SYSTEMS

(Inter Disciplinary Elective-1)

(Common to ECE and EEE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	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, 1st Edition, 2011 Education (India) Pvt. Ltd.
2. Nitaigour Premchand Mahalik, *MEMS*, McGraw Hill Education (India) Pvt. Ltd., 11th Reprint, 2016.

III B.Tech. I Semester

(20BT61041) SENSORS AND SIGNAL CONDITIONING

(Inter Disciplinary Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Electrical Measurements.

Course Description: Principle of operation, construction, advantages, limitations and applications of resistive, inductive, capacitive, self-generating, digital and other sensors. Signal conditioning circuits and their operations.

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

CO1. identify and apply suitable passive sensor to measure physical parameters such as displacement, temperature based on principle and characteristics.
CO2. identify and apply suitable self-generating sensor to measure physical parameters based in principle of operation.
CO3. identify and apply suitable digital sensor to measure physical parameters based on principle of operation.
CO4. design signal conditioning circuit for various sensors based on applications.

DETAILED SYLLABUS:

UNIT – I: RESISTIVE SENSORS (09 Periods)

Principle of transducers, classification, Factors influencing the choice of transducers. Potentiometers, Metal and semiconductor strain gauges— principle of operation, gauge factor, gauge sensitivity; Resistance temperature detectors, Thermistors, Light dependent resistors, resistive hygrometer.

UNIT – II: CAPACITIVE AND INDUCTIVE SENSORS (09 Periods)

Capacitive sensors— Variation in overlapping area, variation in dielectric constant, variation in distance between the plates of variable and differential capacitor, Frequency response of capacitive sensors.

Inductive sensors— Variable reluctance sensors, Eddy current sensors, Linear variable differential transformers, Synchro's, Resolvers, Electromagnetic sensors based on Faraday's law, Hall effect sensors.

UNIT – III: SELF-GENERATING SENSORS (09 Periods)

Thermoelectric sensors— Thermoelectric effects, Thermocouple laws, Cold junction compensation, common thermocouples. Piezoelectric sensors— Piezoelectric effect, deformation modes, equivalent circuit, materials. Pyroelectric Sensors— Pyroelectric effect, materials; Photoelectric sensors— photovoltaic effect, materials; Magnetostrictive sensors.

UNIT – IV: DIGITAL AND OTHER SENSORS (09 Periods)

Digital transducers: Tachometer encoder, incremental encoder, absolute encoder. Semiconductor sensors — principle of operation and techniques; Fiber optic sensors—

principle of operation, sensor technology; Ultrasonic sensors— principle of operation, sensing methods; Basics of SMART sensors.

UNIT – V: SIGNAL CONDITIONING (09 Periods)

Block diagram of signal conditioning, balance and deflection measurement in Wheatstone bridge, measurement of reactance; Push-pull bridge and Blumein bridge; Carrier amplifier, chopper amplifier, low drift amplifier and charge amplifier, Instrumentation amplifier.

Total: 45 Periods

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

TEXT BOOKS:

1. Ramon Pallas-Areny and John G. Webster, *Sensors and Signal Conditioning*, John Wiley & Sons, Inc., 2nd Edition, 2001.
2. A.K.Sawhney, *A Course in Electrical and Electronic Measurements and Instrumentation*, Dhanpat Rai & Co., 19th Edition, 2015.

REFERENCE BOOKS:

1. D. V. S Murty, *Transducers and Instrumentation*, PHI Learning Private Limited, 2nd Edition, 2010.
2. D. Patranabis, *Sensors and Transducers*, PHI Learning Private Limited, 2nd Edition, 2003.
3. John P. Bentley, *Principles of Measurement Systems*, Pearson Education, 4th Edition, 2005.
4. Ernest O. Doebelin, Dhanesh N Manik, *Measurement Systems,* 6th Edition, 2011.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/108/108108147/
2. https://nptel.ac.in/courses/112/103/112103174/

III B. Tech. – II Semester

(20BT60210) COMPUTER ORGANIZATION AND ARCHITECTURE

(Inter Disciplinary Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	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, the students 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 (7 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, Programmable peripheral interface IC 8255: Internal architecture and Modes of operation.

UNIT-IV: COMPUTER ORGANISATION (8 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

(9 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, Zvonks Vranesic, Safea Zaky, *Computer Organization*, Mc Graw Hill, 5th Edition, 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

III B. Tech. – II Semester
(20BT60231) **ELECTRICAL CAD LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE-REQUISITES: A course on Computer Aided Engineering Drawing.

COURSE DESCRIPTION: Drafting standards for electrical engineering applications; Drafting of residential electrical layouts and electrical sub-station.

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

CO1. demonstrate preliminary design aspects of electrical design using CAD.
CO2. develop preliminary and detailed single line diagrams of complete electrical load distribution in a residential building.
CO3. develop wiring layouts for lighting, power and Air conditioning applications in residential accommodations.
CO4. develop a typical electrical layout of industrial blue prints and control appliances for industrial applications.
CO5. work independently or in teams to solve problems with effective communication.

Practical Exercises/List of Experiments: Minimum Eight experiments are to be conducted.

PART-A: Electrical Design Concepts (Compulsory)

1. Review of preliminary electrical designing
2. Exercise on three phase load balancing

PART-B: Drafting Exercises (Minimum Six)

3. Typical residential floor plan
4. Lighting load wiring layouts for a residential accommodation
5. Power load wiring layouts for a residential accommodation.
6. AC load wiring layouts for a residential accommodation.
7. Typical house electrical wiring schematic circuit.
8. Preliminary single line diagram for a residential electrical system.
9. Detailed single line diagram for a residential electrical system.
10. Typical electrical wiring diagram for an industrial workshop.
11. Single line diagram of a typical electrical substation.
12. Schematic diagram of a motor control center.

TEXT BOOKS:

1. National Building Code of India 2005.
2. Gaurav Verma and Matt Weber, AUTOCAD Electrical 2016 Black Book, CADCAMCAE works, USA, 2015 (http://1.droppdf.com/files/YooGv/autocad-electrical-2016-black-book-by-gaurav-verma-2015.pdf)

ADDITIONAL LEARNING RESOURCES:

1. https://www.youtube.com/watch?v=zTo8QL7A-wg

2. https://www.youtube.com/watch?v=6VXybp4g4vU
3. https://www.youtube.com/watch?v=fCJtarn6Jvg
4. https://www.youtube.com/watch?v=B0x-OHR-1Pk

SOFTWARE/Tools used:

1. Electrical CAD (AutoCAD for Electrical and Electronics Engineers)

III B. Tech. – II Semester
(20BT60232) **ELECTRICAL POWER SYSTEMS LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE-REQUISITES: A course on Electrical Machines-II

COURSE DESCRIPTION: Experimental investigations on behavior of insulators, performance of synchronous and asynchronous machines, relay testing and fault analysis.

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

CO1. analyze the behavior of various dielectric materials/insulators in the presence of high voltage and determine their withstand limits.
CO2. evaluate the operational parameters and characteristics of the transformers operating under different scenarios.
CO3. analyze the performance of synchronous and asynchronous machines operating under different scenarios.
CO4. evaluate various electrical parameters and interpret the experimental observations with underlying concepts.
CO5. work independently or in teams to solve problems with effective communication.

Practical Exercises/List of Experiments: Minimum **Ten** experiments are to be conducted.

1. Determination of Corona inception characteristics.
2. Determination of efficiency of string insulator.
3. Determination of dielectric strength of liquid insulating material.
4. Determination of dielectric strength of gaseous dielectrics under uniform and non uniform electric fields.
5. Determination of equivalent circuit of a 3-winding transformer.
6. Determination of positive, negative and zero sequences of a three phase transformer.
7. Determination of sequence impedances of a Synchronous Machine.
8. Determination of sub-transient reactance of salient pole alternator.
9. Power Angle Characteristic of Three-Phase Salient Pole Synchronous Machine.
10. Performance of three phase induction motor under two phase supply.
11. Ascertain I-V and P-V Characteristics of PV module.
12. Three phase active power and energy measurement using two instrument transformers.

TEXT BOOKS:

1. C. L. Wadhwa, Electrical Power systems, New Age International (P) Limited, Publishers, New Delhi, 5th Edition, 2009.

2. JB Gupta, *Theory and performance of Electrical Machines*(DC machines, Poly phase Circuits & AC machines) in SI Units, S.K. Kataria & Sons, New Delhi, 15th Edition, 2015.

REFERENCE BOOKS:

1. John J. Grainger and William D. Stevenson, Jr., *Power System Analysis*, McGraw-Hill, 2003.
2. P.S. Bimbhra, *Electrical Machinery*, Khanna Publishers, 7th Edition, Delhi, 2011.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/101/108101039/
2. http://www.ee.iitkgp.ac.in/faci_ps.php
3. https://www.youtube.com/watch?v=tgjayvDVW28
4. https://www.youtube.com/watch?v=_0T2Osgxdxs

III B. Tech. – II Semester
(20BT60233) **ARM PROCESSOR AND ITS INTERFACING LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	1	2	2

PRE-REQUISITES: A course on Computer Organization and Architecture.

COURSE DESCRIPTION: Study of ARM development board and its pin configuration, Installing and usage of Keil IDE, ARM processor programming using Keil, Interfacing and building basic applications using ARM processor and external peripherals.

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

CO1. design an interface for an embedded systems using real time sensors and ARM Processor.
CO2. develop applications to capture the data generated by sensors.
CO3. develop real time applications using Keil IDE.
CO4. design applications to store and visualize sensor data.
CO5. work independently or in teams to solve problems with effective communication.

Hardware and software requirements:

1. ARM processor-based development board.
2. Open-source ARM development platform, KEIL IDE.
3. Proteus for simulation.

Practical Exercises/List of Experiments: Conduct any **TEN** Experiments from the following:

Study Experiment:

1. Introduction to ARM Board: Brief overview of ARM Architecture, ARM Operating modes, System Initialization (Runtime Environment), ARM board description.
2. KEIL IDE tool Cross Compiler/Assembler, ARM tools, writing program, Project structure, Making Utility and make file, building applications, downloading the Hex file onto ARM microcontroller/onto target.

Simulation Experiments:

3. To write and simulate ARM assembly language programs for data transfer, arithmetic and logical operations.
4. To write and simulate C Programs for ARM microprocessor using KEIL.

Hardware Experiments:

5. Design and develop an assembly program to display messages "FIRE" and "HELP" alternately with flickering effects on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages.
6. Design an multitasking system using interrupts in ARM Processor.
7. Design and develop an assembly program to drive a Stepper Motor interface and rotate the motor in specified direction (clockwise or counter-clockwise) by N steps and introduce suitable delay between successive steps. (Any arbitrary value for the delay).
8. Generation of PWM wave with different duty cycles using ARM development board.

9. Interfacing DC Motor with ARM processor and write program to control speed using PWM technique.
10. To interface LCD with ARM processor and execute programs in C language for displaying text messages and numbers on LCD.
11. To interface Accelerometer with ARM processor and write a program to find the angle of tilt.
12. Interfacing of temperature sensor with ARM board and display temperature on LCD.
13. Design a real time clock using internal peripherals of ARM Processor.

III B. Tech. – II Semester

(20BT5MC01) **PROFESSIONAL ETHICS**

(Mandatory course)

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

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	-	-	2	-	-	-

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 of Engineering Ethics, Senses of engineering ethics, Moral dilemmas and theories in professional engineering practice

CO2: analyze the concepts of Professional ideals to assess and to address societal, health, safety, legal and cultural issues in discharging the professional responsibilities

CO3: apply the reasoning informed by the various aspects of Code of Ethics and its provisions to assess societal issues and carry out Professional responsibilities effectively

CO4: practice Collegiality considering conflict of interests to safeguard professional rights in professional engineering practice.

CO5: provide professional engineering solutions considering distinct ethics to address global issues.

DETAILED SYLLABUS:

UNIT –I: ENGINEERING ETHICS (9 Periods)

Scope and aim of engineering ethics, Senses of engineering ethics, Variety of moral issues, Types of inquiry, Moral dilemmas, Moral autonomy-Kohlberg's theory, Gilligan's theory, Consensus and controversy.

UNIT-II: PROFESSIONAL IDEALS AND VIRTUES (8 Periods)

Theories about virtues, Professions, Professionalism, Characteristics, Expectations, Professional responsibility, Integrity, Self-respect, Sense of responsibility, Self-interest, Customs and religion, Self-interest and ethical egoism, Customs and ethical relativism, Religion and divine command ethics, Use of ethical theories, Resolving moral dilemmas and moral leadership.

UNIT- III: ENGINEERING AS SOCIAL EXPERIMENTATION (10 Periods)

Engineering as experimentation, Similarities to standard experiments, Learning from the past and knowledge gained, Engineers as responsible experimenters, Conscientiousness,

Moral autonomy and accountability, The challenger case, Codes of ethics and limitations, Industrial standards, Problems with the law of engineering.

UNIT- IV: RESPONSIBILITIES AND RIGHTS (9 Periods)

Collegiality and loyalty, Respect for authority, Collective bargaining, Confidentiality, Conflict of interests, Occupational crime, Rights of engineers, Professional rights, Whistle-blowing, The BART case, Employee rights and discrimination.

UNIT-V: GLOBAL ISSUES (9 Periods)

Multinational corporations, Professional ethics, Environmental ethics, Computer ethics, Engineers as consultants, Witnesses, Advisors and Leaders, Engineers as Managers, Managerial ethics applied to Engineering Profession, moral leadership.

Total Periods: 45

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

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, *Ethics in Engineering*, Tata McGraw-Hill, 3rd Edition, 2007.
2. Govindarajan, M., 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.

IV B. Tech. – I Semester
(20BT70201) **POWER SYSTEM ANALYSIS**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Power System Operation and Control.

COURSE DESCRIPTION: Per Unit analysis; Formulation of network matrices; Computation of power flow using various iterative techniques; Symmetrical components and Sequence Networks; Analysis of various balanced and unbalanced faults, and stability analysis of power system.

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

CO1. apply the concepts of per-unit system to represent the power system network, and algorithms to model the power system network in terms of bus matrices.
CO2. analyze the power system network to investigate the power flow in various lines of a power system network using numerical methods.
CO3. analyze the power system networks to determine the fault level for various faults in a power system and prefer the current limiter reactors to sustain circuit breakers.
CO4. investigate stability of a power system network under various operating conditions using conventional and numerical methods to sustain stability.

DETAILED SYLLABUS:

UNIT-I: PER UNIT REPRESENTATION AND NETWORK MATRICES (08 Periods)
Per unit **—** advantages, change of base, per unit equivalent reactance representation of power system networks; Construction of Y-bus using inspection methods; Formation of Z_{Bus} using Z_{Bus} building algorithm — Modification of Z_{Bus} due to change in network impedance (without mutual coupling).

UNIT-II: POWERFLOW STUDIES (12 Periods)
Necessary and importance of power flow; Static load flow equations — Formulation of power flow problem— Iterative solution using Gauss-Seidel, Newton-Raphson method (polar coordinates only), Decoupled method and Fast Decoupled methods (with and without PV and for a maximum 3 bus system only); Algorithm; Comparison of different load flow methods.

UNIT-III: BALANCED FAULT ANALYSIS (06 Periods)
Three phase short circuit on unloaded synchronous generator; Effect of Load Current or Pre-fault Current — analysis using Thevenin's theorem and bus impedance matrix; Short circuit capacity; Current limiting reactors.

UNIT-IV: UNBALANCED FAULT ANALYSIS (09 Periods)
Symmetrical component theory — Sequence voltages, currents, impedances; Sequence representation of power system components — Sequence networks; Importance of short

circuit analysis; Unsymmetrical faults—LG, LL, LLG on an un-loaded generator and power system networks.

UNIT-V: POWER SYSTEM STABILITY (10 Periods)

Basic concepts, definitions and classification; Steady state stability — power limit and transfer reactance; Swing equation; Equal area criterion, Applications — Determination of critical clearing angle and time; Solution of swing equation — Point-by-point method; Methods to improve transient and steady state stability.

Total Periods: 45

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

TEXT BOOKS:

1. C. L. Wadhwa, *Electrical Power systems*, 7th Edition, New Age International (P) Limited, Publishers, New Delhi, 2017.
2. Hadi Saadat, *Power System Analysis*, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st Reprint, 2010.

REFERENCE BOOKS:

1. John J. Grainger and William D. Stevenson, Jr., *Power System Analysis*, McGraw-Hill, 2003.
2. T.K.Nagsarkar and M.S.Sukhija, *Power System Analysis*, Oxford University Press, New Delhi, 2007.
3. K. Uma Rao, *Computer Techniques and Models in Power Systems*, I.K. International Publishing House Pvt. Ltd., 2010.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108107112/
2. https://nptel.ac.in/courses/117105140/

IV B. Tech. – I Semester
(20BT70202) **SOLID STATE DRIVES**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Electrical Machines–II, Control Systems and Power Electronics.

COURSE DESCRIPTION: DC drives — Controlled rectifier and chopper fed DC motors; AC drives — Inverter fed induction motor; Special motor fed drives — Synchronous and stepper motors.

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

CO1. evaluate the characteristics and operational aspects of drives operating in different modes.

CO2. analyze the operational aspects of various DC drives operating in different sustainable modes of operation.

CO3. analyze the operational aspects of various asynchronous motor drives operating in different sustainable modes of operation.

CO4. analyze the operational aspects of synchronous motor and stepper motor drives operating in different sustainable modes of operation.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO ELECTRIC DRIVES (10 Periods)

Electrical drives — block diagram, advantages of electric drive, parts of electric drives, choice of electrical drives, status of DC and AC drives. Dynamics of electrical drives — fundamental torque equations, speed-torque conventions and multi-quadrant operation; Equivalent values of drive parameters — loads with rotational and translational motion; Load torques — components, nature and classification. Concept of steady state stability. Electric braking methods — regenerative, dynamic and plugging. Modes of operation of electrical drives — steady state, acceleration including starting and deceleration including stopping. Speed control and drive classifications, closed loop control of drives — current limit control, torque control, speed control and position control (Block diagram only).

UNIT-II: SINGLE PHASE AND THREE PHASE CONVERTER FED DC DRIVES (10 Periods)

Control of DC separately excited motor by single-phase and three-phase half and full bridged converters — voltage and current waveforms for continuous and discontinuous conduction, speed-torque expressions and characteristics. Single phase half controlled rectifier fed DC series motor — voltage and current waveforms for continuous and discontinuous conduction, speed-torque expressions and characteristics. Multi-quadrant operation of DC separately excited DC motor fed from fully controlled rectifier — mechanical reversible switch in armature, dual converter and field current reversal.

UNIT-III: DC CHOPPER FED DRIVES (07 Periods)

Control of DC separately excited motor by one, two and four quadrant choppers — voltage and current waveforms for continuous conduction (motoring, regenerative and dynamic

braking), speed-torque expressions and characteristics. Chopper control of DC series motor — operation, speed-torque expressions and characteristics. Closed loop chopper control of separately excited DC motor (Block diagram only).

UNIT-IV: INDUCTION MOTOR DRIVES (12 Periods)

Three phase induction motors — Introduction, Stator variable voltage control — speed-torque characteristics, AC voltage controllers and efficiency of induction motor under voltage control. Stator variable voltage and variable frequency control — slip speed control, torque-power limitations and modes of operation. Voltage Source Inverters (VSIs) and Current Source Inverters (CSIs) fed induction motor and closed loop operation of induction motor drives (Block diagram only). Comparison of VSI and CSI fed drives. Static rotor resistance control, slip power recovery schemes — static scherbius and kramer drive, speed-torque characteristics.

UNIT-V: SYNCHRONOUS AND STEPPER MOTOR DRIVES (06 Periods)

Synchronous Motor Drives: Separate control and self-control of synchronous motors — operations of self-controlled synchronous motors by VSI and CSI. Load commutated CSI fed Synchronous motor — operation and speed torque characteristics. Closed loop control operation of synchronous motor drives (Block diagram only).

Stepper Motor Drives: Variable reluctance and permanent magnet operation — features of stepper motor — torques Vs stepping rate characteristics and drive circuits.

Total Periods: 45

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

TEXT BOOKS:

1. Gopal K. Dubey, *Fundamentals of Electric Drives*, Narosa Publications, Alpha Science International Ltd, 2nd Edition, 2002.
2. Krishnan, Ramu. *Electric motor drives: modeling, analysis, and control*, 1st Edition, Pearson, 2015.

REFERENCE BOOKS:

1. Gopal K. Dubey, *Power Semiconductor Controlled Drives*, Prentice-Hall International, 1989.
2. P. C. Sen, *Principles of Electrical Machines and Power Electronics*, Wiley, 3rd Edition, 2013.
3. M.D. Singh, K.B. Khanchandani, *Power Electronics*, Tata McGraw-Hill, 2nd Edition, 2013.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/104/108104140/
2. https://nptel.ac.in/courses/108/102/108102046/
3. https://swayam.gov.in/nd1_noc19_ee65/preview

IV B. Tech. – I Semester
(20BT70203) **SWITCHGEAR AND PROTECTION**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	2	-	-	2

PRE-REQUISITES: A course on Transmission and Distribution.

COURSE DESCRIPTION: Overview of protection schemes; Circuit breakers; electromagnetic, static and microprocessor based relays; Protection schemes for various components under various operating conditions; Various grounding schemes.

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

CO1. apply the conceptual knowledge of various circuit breakers for secured operation of power system network.
CO2. apply the conceptual knowledge of various relays for secured operation of power system network.
CO3. analyze various abnormalities in power system equipment and develop an appropriate protection strategies for the protection of generators, transformers and bus bars.
CO4. analyze various protection schemes for the protection of transmission lines and feeders.
CO5. apply various neutral grounding methods and determine the system parameters for protection in power system.

DETAILED SYLLABUS:

UNIT-I: CIRCUIT BREAKER (6 Periods)
Circuit breakers — elementary principles of arc interruption, recovery voltage, restriking voltage, RRV, average and maximum RRRV; Current chopping and resistance switching; Construction and principle of operation — minimum oil circuit breaker, air blast circuit breaker, vacuum circuit breaker and SF_6 circuit breaker.

UNIT-II: RELAYS (8 Periods)
Electromagnetic relays: Types of relays, construction, operation of induction type relays, differential relays and biased differential relays. Universal torque equation — Characteristics of various relays, characteristics of overcurrent relays.
Static relays: Advantages and disadvantages, block diagram of a basic static relay; Definite time, inverse and inverse definite minimum time (IDMT).
Microprocessor based relays: Advantages and disadvantages, block diagram with flow charts — distance relays and over current relays — definite, inverse & IDMT.

UNIT-III: PROTECTION OF GENERATORS AND TRANSFORMERS (6 Periods)
Protection of generators: Rotor protection; Stator protection — restricted earth fault protection and internal fault protection; Other faults — unbalanced loading, overloading

protection, over-speed protection, over-voltage protection, failure of prime mover, loss of excitation; Calculation of percentage winding unprotected.
Transformer protection: Percentage differential protection, design of CT's ratio.
Protection of bus bars: Differential protection.

UNIT-IV: PROTECTION OF FEEDERS AND TRANSMISSION LINES (6 Periods)
Protection of transmission lines: Protection through directional and distance relays (R-X); Three-zone distance protection using distance relays; Carrier current protection using over current relays.
Protection of feeders: Protection of radial and ring main feeders using over current relays.
Protection against over-voltages: Surge diverters and absorbers.

UNIT-V: NEUTRAL GROUNDING (4 Periods)
Grounded and ungrounded systems. Effects of ungrounded neutral on system performance. Methods of neutral grounding — solid, resistance, reactance, arc suppression coil (Peterson coil), grounding practices.

Total Periods: 30

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

TEXT BOOKS:

1. Sunil S. Rao, *Switchgear Protection and Power Systems (Theory, practice and Solved Problems)*, 13th Edition, Khanna Publishers, New Delhi, 2013.
2. Badri Ram, D. N. Viswakarma, *Power System Protection and Switchgear*, 2nd Edition, McGraw Hill education (India) Private Limited, New Delhi, 2011.

REFERENCE BOOKS:

1. C. L. Wadhwa, *Electrical Power systems*, 7th Edition, New Age International (P) Limited, Publishers, New Delhi, 2017.
2. T. S. Madhava Rao, *Power System Protection: Static Relays with Microprocessor Applications*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2nd Edition, 2004.

IV B. Tech.– I Semester

(20BT70401) **EMBEDDED SYSTEMS**

(Professional Elective–4)

(Common to ECE, EEE, EIE, CSE, CSSE, IT, CSE(AI) and CSE(DS))

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Digital Electronics, 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, 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. Jorgeon Staunstrup, Wayne Wolf, *Hardware/Software Co-design Principles and Practice*, Springer 2009.
3. Patrick R Schamont, *A Practical Introduction to Hardware/Software Co-design, Springer publications*, January 2010.

IV B. Tech. – I Semester

(20BT70203) **ANALYSIS OF POWER ELECTRONIC CONVERTERS**

(Professional Elective–4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Power Electronics.

COURSE DESCRIPTION: Advanced Power Semiconductor devices; MOSFET and IGBT-Gate and base drive circuits; 3, 6 and 12-pulse converters; Switching regulators; Advanced PWM Techniques.

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

CO1. understand the operational principle of switching phenomenon/characteristics of various special power switching devices.

CO2. analyze the operational characteristics of various transistor and thyristor gate driver circuits.

CO3. analyze various multi-pulse converters operating in different modes and determine their operational parameters.

CO4. design various switching regulators and analyze their performance in different modes of operation.

CO5. analyze the performance and application of advanced PWM techniques in inverter configurations.

DETAILED SYLLABUS:

UNIT-I: ADVANCED POWER SEMICONDUCTOR DEVICES (10 Periods)

Thyristors: GTOs—Construction, operation, steady state characteristics and switching characteristics; Construction and operation of BCTs, FET — CTHs, ETOs, IGCTs, MCTs, SITHs, ASCR, RCT, SCS and light activated thyristor; Comparison of various thyristors; Transistors: Construction and operation of COOLMOS and SITs.

UNIT-II: GATE & BASE DRIVE CIRCUITS (10 Periods)

MOSFET and BJT gate drive circuits; Isolation of gate and base drives — pulse transformer, opto-couplers; Thyristor firing circuits — R, RC firing circuits, photo-SCR isolator, pulse transformer isolation for inverter gate bias circuits and thyristor converter gating circuits; Gate drive ICs — MOSFETs and IGBTs; Drive ICs for converters — MOS Gated Driver.

UNIT-III: ANALYSIS OF MULTIPULSE CONVERTERS (09 Periods)

Operation of 3-, 6-, and 12- pulse converters; Performance analysis of 3-, 6-, and 12-pulse converters — Low Order Harmonics (LOH), Total Harmonic Distortion (THD), Power Factor, Ripple Factor, Form Factor, Distortion Factor.

UNIT-IV: SWITCHING REGULATORS (08 Periods)

Design and analysis of buck, boost, buck-boost, Cuk and SEPIC Converters. Resonant Converters — Zero Voltage Switching (ZVS) and Zero Current Switching (ZCS) converters — M and L Type.

UNIT-V: ADVANCED PWM TECHNIQUES (08 Periods)

Modified Sinusoidal Pulse Width Modulation; Phase Displacement Control; Trapezoidal Modulation Technique; Staircase Modulation; Stepped Modulation; Harmonic Injection Modulation; Delta Modulation; Selective Harmonics Elimination (SHE) Technique, Space Vector PWM.

Total Periods: 45

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

TEXT BOOKS:

1. Muhammad H. Rashid, *Power Electronics – Devices, Circuits and Applications*, 4th Edition, Pearson, 2017.
2. Ned Mohan, T. M. Undeland, W.P. Robbins, *Power Electronics: Converters, Applications and Design*, Wiley, 3rd Edition, 2007.

REFERENCE BOOKS:

1. P C Sen, *Modern Power Electronics*, Wheeler publishing Co, 1st Edition, New Delhi, 1998.
2. Bimal K Bose, *Modern Power Electronics and Drives*, Pearson Education, 2nd Edition, 2003.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/107/108107128/
2. https://nptel.ac.in/courses/108/105/108105066/
3. https://nptel.ac.in/courses/108/102/108102145/

IV B. Tech. – I Semester

(20BT70204) **ELECTRIC VEHICLES**

(Professional Elective–4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Electrical Machines-II and Power Electronics.

COURSE DESCRIPTION: Transportation vehicles and their impact in society; Concept, configurations, principle, types and operation of Electric Vehicles (EV); Power Electronic converters in EVs; Different motor drives & energy storage technologies in EVs.

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

CO1. understand the principle of operation of electric, hybrid-electric vehicles and various emerging technological challenges while confronting the issues during transportation.

CO2. analyze the performance characteristics of various power converters operating in different modes, and assess a suitable convertor and its control strategies for sustainability of electric vehicle.

CO3. analyze various propulsion motor drives operating in different modes for sustainability and determine the performance/operational parameters of electric vehicle.

CO4. analyze various battery energy storage systems and assess their adaptability for sustainable performance of electric vehicle.

CO5. understand the various types of magnetic gears for electric vehicles and apply them for sustainable mobility of vehicles.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO EVS AND HEVS (08 Periods)

Environmental impact and history of modern transportation, history of transportation electrification, Electric Vehicles (EVs) — introduction, configurations and traction motor characteristics; Hybrid Electric Vehicles (HEVs) — concept and architectures; series and parallel HEVs — configuration, operation, advantages and disadvantages; HEVs — interdisciplinary nature, challenges and key technologies.

UNIT-II: POWER CONVERTERS IN EVS (10 Periods)

Introduction, isolated DC-DC converter — advantages, forward converter, CCM currents in forward converter, CCM voltages in forward converter and sizing the transformer. Isolated full-bridge converter, operation, CCM currents in full-bridge converter and CCM voltages in the full-bridge converter. Resonant power conversion — LCLC series-parallel resonant converter, desirable converter characteristics for inductive charging and fly-back converter. Bi-directional battery chargers and contactless charging.

UNIT-III: ELECTRIC PROPULSION SYSTEMS (09 Periods)

Stator-PM versus rotor-PM, system configurations, doubly salient PM motor drives, flux-reversal PM motor drives, flux-switching PM motor drives, hybrid-excited PM motor drives, flux-mnemonic PM motor drives, magnet less flux switching motor drives and design criteria for EVs.

UNIT-IV: ENERGY STORAGE TECHNOLOGIES (09 Periods)

Battery — basic theory and characterization, battery technologies, types — lead acid batteries, nickel-based batteries and lithium-based batteries. Ultra-capacitors — features, basic principles, performance, battery modeling based on electric equivalent circuit, modeling of ultra-capacitors, battery charging control and flywheel energy storage system. Fuel cells — modeling and block diagrams of hybrid fuel cell energy storage systems.

UNIT-V: MAGNETIC GEAR FOR EV TRANSMISSION SYSTEMS (09 Periods)

Introduction, system configurations, types, Magnetic Gear (MG) machines — principle, modelling, control and design criteria for MG motor drives. Magnetic Gear Electric Variable Transmission (MG EVT) systems — multiport magnetic gears, magnetic planetary-geared EVT system, magnetic concentric-geared EVT system and applications.

Total Periods: 45

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

TEXT BOOKS:

1. K. T. Chau, *Electric Vehicle Machines and Drives, Design, Analysis and Application,* Wiley, 2015.
2. John G. Hayes*, Electric Powertrain*, Wiley, 2018.

REFERENCE BOOKS:

1. Iqbal Husain, *Electric and Hybrid Vehicles Design Fundamentals,* 2nd Edition, CRC Press, 2011.
2. Jack Erjavec, *Hybrid, Electric & Fuel-Cell Vehicles*, 2nd Edition, Delmar Cengage learning, 2013.
3. Mehrdad Ehsani, Yimin Gao and Ali Emadi, Modern Electric, *Hybrid Electric and Fuel Cell Vehicles*, 2nd Edition, CRC Press, 2015.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/102/108102121/
2. https://swayam.gov.in/nd1_noc20_ee18/preview
3. https://www.coursera.org/learn/electric-vehicles-mobility?#syllabus

IV B.Tech. – I Semester

(20BT70205) **FLEXIBLE AC TRANSMISSION SYSTEM**

(Program Elective – 4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Power Electronics and Power System Analysis.

Course Description: Need for flexible AC transmission systems; objectives of shunt and series compensations, phase angle regulators; FACTS controllers: shunt, series and combined; coordination of various FACTS controllers.

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

CO1. understand the power flow aspects in AC transmission system and realize the need of compensation and philosophy of FACTS controllers.
CO2. realize the principle of static shunt compensation techniques and apply an appropriate shunt controller for sustainable operation of AC transmission system.
CO3. realize the principle of static series compensation techniques and apply an appropriate series controller for sustainable operation of AC transmission system.
CO4. realize the philosophy of various power flow controllers operating in various modes to control the active and reactive power and foster sustainable operation of AC transmission system.
CO5. realize the principle of multiple FACTS controllers in AC transmission system and techniques to coordinate them for sustainable operation.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO AC TRANSMISSION SYSTEMS (7 Periods)

Overview of interconnected power system. Power flow in AC systems – Expression for real and reactive power flow between two nodes of a power system, controllable parameters. Power flow in parallel and meshed system. Overview of compensated transmission lines – shunt and series compensation. Conventional controllers for real and reactive power flows – merits and demerits. FACTS – benefits, types of FACTS controllers.

UNIT-II: STATIC SHUNT COMPENSATION (10 Periods)

Expression for real and reactive power flow with mid-point voltage regulation. Variable impedance type static VAR generators - V-I characteristics and control schemes of TCR, TSR, TSC. QD-QO characteristic and control scheme of TSC-TCR. Switching converter type VAR generators – V-I characteristics and control schemes of STATCOM. Hybrid VAR generators – V-I characteristics of SVC and STATCOM, regulation of V-I slope. Applications of static shunt compensators – Voltage regulation, improvement in transient stability, prevention of voltage instability, power oscillation damping. Comparison of static shunt compensators.

UNIT-III: STATIC SERIES COMPENSATION (10 Periods)

Expression for real and reactive power flow with series line compensation. Variable impedance type series compensators: V-I characteristics and control schemes of GCSC,

TSSC, TCSC- modes of operation. Sub-synchronous resonance. Switching converter type series compensator – V-I characteristics, internal and external control schemes of SSSC. Applications of static series compensators – improvement in transient stability, power oscillation damping. Comparison of static series compensators.

UNIT-IV: STATIC PHASE ANGLE REGULATORS AND COMBINED COMPENSATORS (10 Periods)

Power flow control by phase angle regulators - Concept of voltage and phase angle regulation. Operation and control of TCVR and TCPAR. Switching converter type phase angle regulators. Objectives of TCPAR - improvement of transient stability, power oscillation damping. UPFC – Principle, expression for real and reactive power between two nodes of UPFC, independent real and reactive power flow control using UPFC, control schemes of UPFC - operating principle and characteristics of IPFC.

UNIT-V: CO-ORDINATION OF FACTS CONTROLLERS (8 Periods)

FACTS controller interactions – interaction between multiple SVC's – interaction between multiple TCSC's – SVC-TCSC interaction – Coordination of multiple controllers using linear control techniques. Comparative evaluation of different FACTS controllers: performance comparison and cost comparison, Control coordination using Genetic Algorithm, Future direction of FACTS technology.

Total periods: 45

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

TEXT BOOKS:

1. Narain G. Hingorani, Laszi Gyugyi, *Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems*, Wiley-IEEE Press, 1999.
2. R. Mohan Mathur and Rajiv k. Varma, *Thyristor based FACTS Controllers for Electrical Transmission Systems*, Wiley-IEEE Press, 2002.

REFERENCE BOOKS:

1. Xiao-Ping, Rehtanz, Christian, Pal, Bikash, *Flexible AC Transmission Systems: Modeling and Control*, Springer Power Systems Series, 2006.
2. T.J.E. Miller, *Reactive Power Control in Electric Systems*, Wiley, 1982.

IV B. Tech. –I Semester

(20BT70206) DIGITAL SIGNAL PROCESSING FOR ELECTRICAL ENGINEERS

(Professional Elective-5)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Signals & Networks.

COURSE DESCRIPTION: Discrete-time signals and systems; Discrete Fourier series, Discrete Fourier Transforms (DFT) and Fast Fourier Transform (FFT) algorithms for the analysis of discrete time sequences; design and realization of digital IIR and FIR filters; DSP based control of stepper motors; DSP based implementation of DC-DC buck-boost converters.

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

CO1. perform various operations on signals by applying the concepts of Fourier, z-transform and realize the behavior of systems.
CO2. analyze various discrete time signals and systems using DFT and evaluate the discrete Fourier transform of discrete time signals using FFT techniques.
CO3. design and realize IIR and FIR digital filters using various transformation and realization methods.
CO4. apply relevant DSP controllers for various engineering applications.

DETAILED SYLLABUS:

UNIT-I: FUNDAMENTALS OF DSP (07 Periods)

Review of discrete time signals and systems, Solutions for difference equation of discrete time systems, frequency response of discrete time signals, A/D and D/A conversion, Introduction to DSP system with block diagram.

UNIT-II: FOURIER TRANSFORMS (10 Periods)

Discrete Fourier Transforms — Introduction, relation with other transforms, properties, circular and linear convolution. Fast Fourier Transforms — Radix-2 Decimation in time and Decimation in frequency algorithms.

UNIT-III: IIR DIGITAL FILTERS (10 Periods)

Digital Vs Analog filters, advantages and disadvantages of digital filters; Analog low pass filter design: Butterworth and Chebyshev low pass filters. Design of IIR filter from analog filters using Impulse Invariance and Bilinear transformation techniques. Frequency transformation in digital domain (theoretical approach); Realization of IIR Digital filters using Direct form-I and Direct form-II structures.

UNIT-IV: FIR DIGITAL FILTERS (8 Periods)

Introduction to linear phase FIR filters, Fourier series method for design of FIR filters. Design of FIR filters using windows -Rectangular, Triangular, Hanning and Blackmann windows.

UNIT-V: APPLICATIONS OF DSP (10 Periods)

Introduction to peripherals - types of physical memory - soft-ware used (Preliminary approach). DSP based control of step-per motors - principle of hybrid stepper motors - basic operation, stepper motor drive system, implementation of stepper-motor control system using LF2407 DSP controller. DSP based implementation of DC-DC buck boost converters - introduction, converter structure, continuous and discontinuous conduction modes, connecting DSP to buck-boost converter, controlling the buck-boost converter.

Total Periods: 45

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

TEXT BOOKS:

1. A. Anand Kumar, *Digital signal processing*, 2nd Edition, PHI learning Pvt.Ltd, Delhi 2015.
2. Hamid A. Toliyat, Steven G. Campbell, *DSP based electromechanical motion control*, CRC Press Special Indian Edition, 2012.

REFERENCE BOOKS:

1. John G. Proakis, Dimitris G. Manolakis, *Digital Signal Processing, Principles, Algorithms and Applications*, Pearson Education/ PHI, 4th Edition, 2007.
2. Alan.V. Oppenheim, Ronald.W. Schafer, John R Buck, *Discrete Time Signal Processing*, Prentice Hall, 2nd Edition, 2006.

ADDITIONAL LEARNING RESOURCES:

1. https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/ https://www.nptel.ac.in/courses/117/102/117102060/
2. https://swayam.gov.in/nd1_noc19_ee50/preview
3. https://www.coursera.org/learn/dsp1

IV B. Tech. – I Semester

(20BT70207) **POWER SYSTEM AUTOMATION**

(Professional Elective-5)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Power Systems Operation and control**.**

COURSE DESCRIPTION: Power system control and deregulation; Power system automation — Substation and distribution automation; Energy control centers.

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

CO1. understand the various modes of power system operation and interpret various market models of deregulated power system.

CO2. understand the power system automation procedures, communication systems, and norms for data acquisition for automation.

CO3. understand the role and responsibility of transmission control center in monitoring and maintaining the security of the transmission network following the relevant standards.

CO4. understand the role and responsibility of distribution control center to automate the distribution system using distributed management system following the relevant standards.

DETAILED SYLLABUS:

UNIT-I: POWER SYSTEM CONTROL AND DEREGULATION (08 Periods)

Introduction — Operation of power systems and modes, Organization and operator activities, Investment factor and control centre experiences. Deregulation — need for deregulation and Advantages of deregulation in power system; Restructuring Models — PoolCo. Model, Bilateral Model and Hybrid Model; Independent system operator (ISO) — Role of ISO; Congestion Management.

UNIT-II: POWER SYSTEM AUTOMATION (10 Periods)

Evolution of automation systems; SCADA in Power system; Building blocks of SCADA system; Remote terminal unit; Intelligent electronic devices; Data concentrators and merging units; SCADA communication systems; Master station; Human-machine interface; Classification of SCADA systems.

UNIT-III: SUBSTATION AUTOMATION (09 Periods)

Substation automation, conventional automation; new smart devices for substation automation; new integrated digital substation; technical issues new digital simulation; Substation automation architectures; substation automation applications functions; Benefits of data warehousing.

UNIT-IV: ENERGY CONTROL CENTERS (10 Periods)

Introduction — Energy control centers; EMS framework; Data acquisition and communication; Generation operation and management; Transmission operations and

management: Real time Study-mode Simulations; Post-event analysis and energy scheduling and accounting; Dispatcher training simulator; Smart transmission.

UNIT-V: DISTRIBUTION AUTOMATION (08 Periods)

Introduction to Distribution automation — Customer, feeder and substation automation; Subsystems in a distribution control center; Distributed Management System (DMS) framework integration with subsystems; advanced real-time DMS applications; Advanced analytical DMS applications; DMS coordination with other systems.

Total Periods: 45

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

TEXT BOOKS:

1. M Shahidehpour, Muwaffaq Alomoush, *Restructured electrical power systems operation, trading and volatility*, CRC Press, 1st Edition, 2001.
2. Mini S Thomas and John D Mcdonald, *Power System SCADA and Smart Grids*, CRC Press, 1st Edition 2015.

REFERENCE BOOKS:

1. Torsten cegrell, *Power systems control Technology*, Prentice Hall, 1st Edition, 1986.
2. James Northcote-Green and Robert Wilson, *Control and Automation of Electrical Power Distribution Systems*, CRC Press, 1st Edition, 2013.
3. Edmund Handschin, *Real time control of Electric Power System*, Elsevier Publishing company, 1st Edition, 1972.

ADDITIONAL LEARNING RESOURCES

1. https://www.eit.edu.au/cms/courses/industrial-automation-instrumentation-process-control/professional-certificate/in-iec-61850-based-substation-automation.
2. https://nptel.ac.in/courses/108106022/8.
3. https://nptel.ac.in/courses/108/101/108101005/

IV B. Tech. – I Semester

(20BT70208) POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS

(Professional Elective–5)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Electrical Machines-II and Power Electronics.

COURSE DESCRIPTION: Solar Energy Conversion System: Types of Photovoltaic Systems – Stand-alone, Hybrid and Grid Connected Systems; Wind Energy Conversion Systems: Types of WECS — Stand-alone and Grid Connected Systems; Generators in WECS; Power Quality: Issues, standards and problems in distributed generation.

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

CO1. analyze the solar PV system operating in different modes, assess a suitable convertor and control strategies for sustainability of PV system.
CO2. analyze the operation of various electrical machines and review their suitability for wind energy conversion system.
CO3. analyze the operation of various power converters for wind energy conversion system.
CO4. understand various power quality issues and their relevant standards, while mitigating the issues using custom power devices.

DETAILED SYLLABUS:

UNIT-I: POWER CONVERTERS FOR SOLAR APPLICATIONS (9 Periods)

Introduction to solar photovoltaic system; I-V and P-V characteristics; Block diagram of solar photo voltaic system. Principle of operation — line commutated converters (inversion-mode). Selection of inverter. Multilevel inverters and its classification. Battery sizing and array sizing.

UNIT-II: PHOTOVOLTAIC SYSTEMS (11 Periods)

PV Systems — Stand-alone PV system: Charge controllers — series and shunt charge regulators. Maximum power point tracking algorithm. Solar pumping application.
Grid Connected PV Systems: Inverter types — line, self-commutated inverters, PV inverter with high frequency transformer and grid-tied inverter characteristics. Grid connection issues.

UNIT-III: WIND ENERGY CONVERSION SYSTEMS (8 Periods)

Introduction to wind energy system, Components of Wind Energy Conversion System (WECS), classification of WECS, performance of induction generators for WECS; Principle of operation and analysis of induction generator, permanent magnet synchronous generator, squirrel cage and doubly fed induction generators.

UNIT-IV: POWER CONVERTERS FOR WIND APPLICATIONS (9 Periods)

Power converters: Three phase AC voltage controllers, AC-DC-AC converters — uncontrolled rectifiers, PWM inverters, grid interactive inverters, matrix converters. Stand

alone operation of fixed and variable speed WECS. Grid connection issues. Grid integrated PMSG and SCIG based WECS.

UNIT-V: POWER QUALITY ISSUES IN RENEWABLE ENERGY INTEGRATION

(8 Periods)

Power quality — Definition, Power quality issues, Sources and Effects; International standards of Power quality and Electro Magnetic Compatibility (EMC); Impact of power quality problems in grid integration of renewable energy sources. Power quality enhancement using custom Power devices-STATCOM and DVR.

Total Periods: 45

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

TEXT BOOKS:

1. Mukund R Patel, *Wind and Solar Power Systems*, CRC Press, 2005.
2. Arindam Ghosh, Gerard Ledwich, *Power Quality Enhancement Using Custom Power Devices*, Springer, 2002.

REFERENCE BOOKS:

1. Ion Boldea, *Variable speed generators*, Taylor & Francis group, 2015.
2. Andrzej M. Trzynnadlowski, *Introduction to Modern Power Electronics*, 3rd Edition, wiley India Pvt. Ltd, 2016.
3. Roger C. Dugan, Mark E. Mc. Granaghan, Surya Santosoh and H. Wayne Beaty, *Electrical Power Systems Quality*, Tata McGraw Hill, 3rd Edition, 2012.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108108078/
2. https://swayam.gov.in/nd1_noc19_ee37/preview
3. https://nptel.ac.in/courses/121/106/121106014/
4. https://nptel.ac.in/courses/103107157/

IV B.Tech. I Semester

(20BT70209) **SOFT COMPUTING TECHNIQUES**

(Professional Elective–5)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Basic Mathematics

COURSE DESCRIPTION: Fundamentals of Artificial Neural Networks, Back propagation Neural Networks, Deep Neural Networks, Fuzzy Logic Systems, Adaptive Neuro Fuzzy Inference Systems, evolutionary and swarm algorithms.

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

CO1. develop an architecture of a neural network, its training/learning algorithms and apply them to solve various real world problems.
CO2. develop a rule base fuzzy system and apply the control strategy to control various real world appliances.
CO3. develop an algorithm based on evolutionary principles and model an objective function to optimize the given problem.
CO4. develop an algorithm, mimicking the swarm behavior of a school and model the objective function to optimize the given problem.

DETAILED SYLLABUS:

UNIT-I: ARTIFICIAL NEURAL NETWORKS (12 Periods)

Biological neural network, architectures of artificial neural networks; Activation functions, learning strategies- supervised, un supervised, reinforced; learning rules; Single layer perceptron network, linear separability with AND & XOR examples; Back propagation neural network- architecture, training algorithm; Kohonen self-organizing maps- competitive process, training algorithm.

UNIT – II: DEEP NEURAL NETWORKS (8 Periods)

Introduction to deep learning, architecture of recurrent neural networks; Back propagation through time; multilayer recurrent networks; Long short-term memory; Regression (load forecasting) and classification (object classification) using neural network.

UNIT – III: FUZZY LOGIC SYSTEMS (10 Periods)

Fuzzy Logic Systems: Classical Vs fuzzy sets, fuzzy relations & operations; Membership functions; Fuzzification; Rule base; Inference mechanism; Defuzzification; Development of fuzzy control system; speed control of DC motors using fuzzy logic.

UNIT IV – EVOLUTIONARY ALGORITHMS (08 Periods)

Genetic Algorithms: Introduction to evolutionary computation, Genetic algorithms - (GA)biological background, traditional optimization and search techniques, basic terminologies, simple GA, flow chart; Operators in GA - encoding, selection, crossover, mutation, constraints in GA, fitness function; Advantages and limitations of GA.

Differential Evaluation: Overview, initialization, base vector selection, differential mutation, recombination, selection and termination criteria; Optimal allocation of DG.

UNIT V – PARTICLE SWARM OPTIMIZATION (07 Periods)

Introduction to swarm intelligence, the basic PSO method, characteristic features of PSO, PSO algorithm, optimum parameter setting for the best performance of PSO, comparison with other evolutionary computing techniques; MPPT for PV system.

Total Periods: 45

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

TEXT BOOKS:

1. S.N. Sivanandam, S.N. Deepa, *Principles of Soft computing*, Wiley India private Ltd., 2nd Edition, 2013.
2. Charu C. Aggarwal, *Neural Networks and Deep Learning***,** Springer International Publishing AG, part of Springer Nature, 2018.

REFERENCE BOOKS:

1. Jacek M. Zurada, *Introduction to Artificial Neural Networks*, Jaico Publishing House.
2. Simon Haykin, *Neural Networks – A Comprehensive Foundation*, Prentice-Hall Inc, 1999.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117/101/117101055/
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/

IV B. Tech. – I Semester

(20BT50403) **FPGA ARCHITECTURES AND APPLICATIONS**

(Inter Disciplinary Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Digital Electronics, and 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 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 (9 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 (8 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 (8 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, 8th Indian Reprint 2015.
2. Charles H. Roth Jr, Lizy Kurian 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/Samiha Mourad, Wayne Wolf, *Digital Design Using Field Programmable Gate Arrays,* Pearson Low Price Edition, 2009.

ADDITIONAL LEARNING RESOURCES

1. http://www2.eng.cam.ac.uk/~dmh/4b7/resource/section16.htm
2. https://nptel.ac.in/courses/106103016/21
3. https://nptel.ac.in/courses/106105161/54

IV B. Tech. – I Semester

(20BT60406) **IMAGE PROCESSING**

(Inter Disciplinary Elective-2)

(Common to EEE and CSSE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Courses on Signals and Networks and 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.

IV B. Tech. – I Semester

(20BT61003) **INDUSTRIAL DATA COMMUNICATIONS**

(Inter Disciplinary Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Computer Networks.

COURSE DESCRIPTION: Data networks, inter-networking and serial communications, HART and Field buses, MODBUS, PROFIBUS, Communication protocol, industrial Ethernet and wireless communication.

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

CO1: demonstrate knowledge on fundamentals of data communication.
CO2: analyze interfacing standards EIA-232 and EIA-485.
CO3: select a communication protocol for particular application.
CO4: demonstrate knowledge on foundation fieldbus.

DETAILED SYLLABUS:

UNIT-1: Industrial Data Communication Methodology (9 Periods)
Modern instrumentation and control systems, Open systems interconnection (OSI) model, Protocols, Standards Common problems and solutions, General comments on troubleshooting, a specific methodology, Grounding/shielding and noise, Sources of electrical noise, Electrical coupling of noise, Shielding, Cable ducting or raceways, Cable spacing, earthing and grounding requirements, Suppression techniques, Filtering.

UNIT-2: EIA-232 & EIA-485 Interface Standard (9 Periods)
EIA-232 interface standard: the major elements of EIA-232, Half-duplex operation of the EIA-232 interface, EIA/TIA-232 revisions, Limitations of EIA-232, troubleshooting: Introduction, Typical approach, Test equipment, Typical EIA-232 problems.EIA-485 interface standard, Troubleshooting. Introduction, EIA-485 vs EIA-422, EIA-485 installation, Noise problems, Test equipment.

UNIT-3: HART Protocol & AS-interface (AS-i) (7 Periods)
Introduction to HART and smart instrumentation, HART protocol: Physical layer, Data link layer, Application layer, troubleshooting. Introduction to AS-interface, Layer 1 – the physical layer, Layer 2 – the data link layer, Operating characteristics, Troubleshooting: Introduction, Tools of the trade.

UNIT-4: ProfiBus PA/DP/FMS protocol (11 Periods)
Introduction, ProfiBus protocol stack: Physical layer (layer 1), Data link layer (layer 2), Application layer, Fieldbus message specification (FMS), Lower layer interface (LLI),

Fieldbus management layer (FMA 7), The ProfiBus communication model, Relationship between application process and communication, Communication objects, Performance, System operation: Configuration, Data transfer between DPM1 and the DP-slaves, Synchronization and freeze modes, Safety and protection of stations, Mixed operation of FMS and DP stations, Troubleshooting: Introduction, Troubleshooting tools.

UNIT-5: Foundation Fieldbus (9 Periods)

Introduction to Foundation Fieldbus, The physical layer and wiring rules, The data link layer, The application layer, The user layer, Error detection and diagnostics, High-speed Ethernet (HSE), Good wiring and installation practice with Fieldbus: Termination preparation, Installation of the complete system, Troubleshooting: Introduction, Power problems, Communication problems, Foundation Fieldbus test equipment.

Total Periods: *45*

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

TEXT BOOKS:

1. Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, *Practical Industrial Data Networks Design, Installation and Troubleshooting*' Newnes Publication, Elsevier 1st Edition, 2004.

REFERENCE BOOKS:

1. Sunit Kumar Sen, *Fieldbus and Networking in Process Automation*, CRC Press, 1st Edition, 2014.
2. Andrew S. Tanenbaum, David J. Wetherall, *Computer Networks*, Prentice Hall of India Pvt. Ltd., 5th Edition. 2011.
3. Theodore S Rappaport, *Wireless Communication: Principles and Practice*, Prentice Hall of India 2nd Edition, 2001.
4. William Stallings, *Wireless Communication & Networks*, Prentice Hall of India, 2nd Edition, 2005.

ADDITIONAL LEARNING RESOURCES:

1. http://gtu-info.com/Subject/171703/IDC/Industrial_Data_Communication/Syllabus
2. https://www.gtu.ac.in/syllabus/NEW_Diploma/Sem6/3361704.pdf
3. https://rmd.ac.in/dept/eie/notes/7/IDN/syllabus.pdf
4. https://www.inspirenignite.com/anna-university/anna-university-b-tech-ic-r13-7th-sem-industrial-data-networks-syllabus/

IV B.Tech I Semester

(20BT71041) **PLC AND SCADA**

(Inter Disciplinary Elective-2)

(Common to ECE and EEE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PREREQUISITES: A course on Digital Electronics.

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. analyze 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 (9 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 (6 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 BOOK:

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 BOOK:

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

IV B. Tech. – I Semester
(20BT70231) POWER ELECTRONICS AND DRIVES LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE-REQUISITES: Courses on Analog Electronics and Analog Electronics Lab.

COURSE DESCRIPTION: Characteristics of power switching devices; Triggering and commutation circuits of SCR; Working of various power electronics and drives.

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

CO1. analyze the characteristics of various power converters and interpret the practical observations for validation.
CO2. analyze the switching characteristics of power semiconductor devices and select a suitable device for converter circuit.
CO3. analyze rectifier, AC voltage controller and cyclo-converter circuits for R and RL loads operating with different control signals and appropriate drives.
CO4. analyze chopper and inverter circuits for R and RL loads operating with different control signals and appropriate drives.
CO5. work independently or in teams to solve problems with effective communication.

List of Exercises/List of Experiments: Minimum **Ten** experiments are to be conducted.

PART-A: Any six of the experiments to be conducted from the following:
1. Analysis of single and three phase half and full controlled bridge converter for various loads.
2. Analysis of single phase AC voltage controller and cyclo-converter for various loads.
3. Single phase half and full controlled bridge converter with R and RL loads.
4. Single phase dual converter with R and RL loads.
5. Single phase AC voltage controller with R and RL Loads.
6. Single phase cyclo-converter with R and RL loads.
7. Single phase parallel inverter with R and RL loads.

PART-B: Any four of the experiments to be conducted from the following:
8. Speed control of separately excited DC motor using single-phase full converter.
9. Four quadrant chopper fed DC drive.
10. Speed control of single phase induction motor using IGBT based PWM inverter.
11. Speed control of single phase induction motor using cyclo-converter.
12. Analysis of choppers and inverters for various loads using PWM/sliding mode controller.

TEXT BOOKS:

1. L. Ashok Kumar, A. Kalaiarasi and Y. Uma Maheswari, *Power Electronics with MATLAB*, Cambridge University Press, 2017.
2. Narayanaswamy P R Iyer, *Power Electronic Converters – Interactive Modelling Using Simulink*, CRC Press, 2018.

REFERENCE BOOKS:

1. Muhammad H. Rashid, *Power Electronics – Devices, Circuits and Applications*, 4th Edition, Pearson, 2017.
2. Randall Shaffer, *Fundamentals of Power Electronics with MATLAB*, Laxmi Publications, 2nd Edition, 2013.

SOFTWARE/Tools used:

1. Matlab-R2019b (Version 9.7)

ADDITIONAL LEARNING RESOURCES:

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/power_electronics/labs/index.php
2. https://www.semicon.sanken-ele.co.jp/en/

IV B. Tech. – I Semester
(20BT70232) **POWER SYSTEM SIMULATION LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE-REQUISITES: A course on Power systems analysis.

COURSE DESCRIPTION: Investigations on various operational aspects of power system; power flow studies; faults and stability analysis; Power quality issues and its control aspects using simulation tools; FACTS controllers and grid connected PV system.

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

CO1. develop an appropriate simulation program/model to estimate the load profile, schedule the generators and analyze the dynamics of automatic generation control for various operating scenarios.
CO2. develop an appropriate simulation program/model, to model the transmission network and investigate the power flow, fault levels and stability limits for various operating scenarios.
CO3. develop an appropriate simulation/model to simulate various power quality issues and design appropriate filters to mitigate the harmonics.
CO4. develop an appropriate simulation/model to analyze operational aspects of the FACTS controllers for reactive power support and grid connected PV system.
CO5. Work independently or in teams to solve problems with effective communication.

Practical Exercises/List of Experiments: Minimum **Ten** experiments are to be conducted.

1. Load forecasting using statistical methods.
2. Solving economic load dispatch problem with transmission losses.
3. Simulation of AVR and load frequency control with and without integral controller.
4. Develop bus admittance matrix of a transmission network.
5. Develop bus impedance matrix of a transmission network.
6. Analyze Load flows for a given transmission network.
7. Symmetrical fault analysis using bus impedance matrix.
8. Analysis of rotor dynamics using swing equation.
9. Simulation of power quality problems (Sag/Swell, interruption, transients, harmonics, flickers).
10. Harmonic analysis and Single tuned filter design to mitigate harmonics.
11. Simulation of FACTS controllers (TCR and TCSC).
12. Simulation of single phase grid connected PV system.

SOFTWARES/Tools used: MATLAB/SIMULINK/MiPower/PSCAD

REFERENCE BOOKS/LABORATORY MANUALS:

1. Haadi A. Sadat, *Power System Analysis*, McGraw Hill Co. Ltd., India, 2000.

2. Dr. Shailendra Jain, *Modeling and simulation using MATLAB/SIMULINK*, 2nd Edition Wiley, 2017.
3. Randall Shaffer, *Fundamentals of Power Electronics with Matlab,1st Edition, Da Vinci Engineering Series, 2007.*
4. https://in.mathworks.com/help/documentation
5. https://in.mathworks.com/solutions/utilities-energy/power-system-analysis-design.html
6. PSCAD manuals.
7. Mipower manuals.

IV B.Tech. - I semester
(20BT70233) **SUMMER INTERNSHIP-II**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	100	100	-	-	-	1.5

PREREQUISITES: -

COURSE DESCRIPTION: Expose students to the industrial environment; Create competent professionals for the industry; sharpen the real time technical / managerial skills required at the job; Gain professional experience and understand engineer's responsibilities and ethics; Familiarize with latest equipment, materials and technologies; Gain exposure to technical report writing; Gain exposure to corporate working culture.

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

CO1. analyze latest equipment, 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.

IV B. Tech. – I Semester

(20BT702AC) **ELECTRICAL SAFETY AND SAFETY MANAGEMENT**

(Audit course)

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

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

COURSE DESCRIPTION: The course deals with the various aspects of potential risk due to electrical shock; safety precautions to be followed while working in hazardous zones; safe practices while handling various electrical equipment and during maintenance; and relevant electrical safety standards and Indian rules and acts.

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

CO1. understand the Indian electricity rules, regulations and various standards to be maintained for safety of life and equipment.
CO2. understand the potential effects of electrical shock and safety measures to protect against such risk.
CO3. understand the safety aspects and safe practices to be followed while installing residential, commercial and agricultural appliances.
CO4. identify various hazardous working zones and take necessary precautionary measures while working in such areas.
CO5. follow safety measures during installation, testing and commissioning and maintenance of electrical equipment/plant.

DETAILED SYLLABUS:

UNIT-I: INDIAN ELECTRICITY RULES AND ACTS, AND THEIR SIGNIFICANCE **(06 Periods)**

OSHA standards of electrical safety, Basic electrical safety rules as per OSHA; Objectives and scope of IE acts and IE rules, Ground clearance and Section Clearances, Clearance in transmission and distribution lines, Significance of Equipment earthing, Earthing of equipment bodies, structures and non-current carrying metallic parts, earthing of system neutral; Rules regarding first aid and firefighting facility, Electrical safety general requirements as per IE rules.

UNIT-II: INTRODUCTION TO ELECTRICAL SAFETY AND SAFETY MANAGEMENT **(07 Periods)**

Electric Safety: Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, Protection against electrical hazards and types, Effect of current on human body, Principles of electrical safety and approach to prevent accidents.

Electric shocks and its prevention: Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions

against contact shocks, flash shocks, burns, Safety precautions in LV installations and electric plant.

UNIT-III: ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL INSTALLATIONS (05 Periods)

Introduction—Wiring and fitting; Domestic appliances—water tap giving shock, shock from wet wall, fan firing shock; Multi-storied building, Temporary installations, Agricultural pump installation; Do's and Don'ts for safety in the use of domestic electrical appliances; Principles of safety management in electrical plants, safety auditing and economic aspects.

UNIT-IV: ELECTRICAL SAFETY IN HAZARDOUS AREAS (05 Periods)

Hazardous zones—class 0, 1 and 2; Sparks, flashovers and corona discharge in electrical plants; equipment for hazardous locations; scope for live line work, principles of live line maintenance, special tools for live line maintenance, safety instructions for working on HV lines/apparatus.

UNIT-V: SAFETY DURING INSTALLATION, TESTING AND MAINTENANCE (07 Periods)

Safety during installations: Preliminary preparations, preconditions for start of installation work and safe sequence, safety aspects during installations of Transformers and Rotating machines.

Safety during testing: Purpose of commissioning checks and tests, equipment tests, high voltage energization tests, performance and acceptance tests, safety aspects during commissioning.

Safety during maintenance: Operators safety, Types of safety maintenance, Safety procedures, safety precautions during maintenance, planning of maintenance.

Total Periods: 30

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

TEXT BOOKS:

1. S.Rao, Prof. H.L. Saluja, "*Electrical Safety, Fire Safety Engineering and Safety Management"*, 2nd Edition, Khanna Publishers. New Delhi, 2018 Reprint.

REFERENCE BOOKS:

1. Cadick, John, Mary Capelli-Schellpfeffer, and Dennis K. Neitzel. *Electrical safety handbook.* McGraw-Hill Education, 2012.

ADDITIONAL LEARNING RESOURCES:

Indian Electricity acts:

1. https://cercind.gov.in/Act-with-amendment.pdf
2. https://www.indiacode.nic.in/handle/123456789/2058?view_type=browse&sam_handle=123456789/1362

IV B. Tech. – II Semester
(20BT80231) **PROJECT WORK**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
100	100	200	-	-	-	12

PREREQUISITES: -

COURSE DESCRIPTION: Identification of topic for the project work; Literature survey; Collection of preliminary data; Identification of implementation tools and methodologies; Performing critical study and analysis of the topic identified; Time and cost analysis; Implementation of the project work; Preparation of thesis and presentation.

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

CO1. create/design Electrical and Electronic engineering systems or processes to solve complex civil 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 Electrical and Electronics engineering and allied problems.
CO3. perform individually or in a team besides communicating effectively in written, oral and graphical forms on Electrical and Electronic engineering systems or processes.

IV B. Tech. – II Semester
(20BT80232) **INTERNSHIP**

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

PREREQUISITES: -

COURSE DESCRIPTION: Expose students to the industrial environment; Create competent professionals for the industry; sharpen the real time technical / managerial skills required at the job; Gain professional experience and understand engineer's responsibilities and ethics; Familiarize with latest equipment, materials and technologies; Gain exposure to technical report writing; Gain exposure to corporate working culture.

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

CO1. analyze latest equipment, 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.