

ACADEMIC REGULATIONS (NR-23)
COURSE STRUCTURE
AND
DETAILED SYLLABI
FOR

B.Tech Regular Four Year Degree Courses

(For the Batches Admitted From 2023-2024)

&

B. Tech (Lateral Entry Scheme)

(For the Batches Admitted From 2024-2025)

ELECTRICAL AND ELECTRONICS
ENGINEERING



NARSIMHA REDDY ENGINEERING COLLEGE
UGC AUTONOMOUS INSTITUTION

Maisammaguda (V), Kompally - 500100, Secunderabad, Telangana state, India

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ACADEMIC REGULATIONS (NR23) FOR B.TECH REGULAR STUDENTS

WITH EFFECT FROM THE ACADEMIC YEAR 2023-24

1.0 **Under-Graduate Degree Programme in Engineering & Technology (UGP in E&T)**

Narsimha Reddy Engineering College (NRCM) offers a 4-year (8 semesters) **Bachelor of Technology** (B.Tech.) degree programme, under Choice Based Credit System (CBCS) with effect from the academic year **2023-24**.

2.0 **Eligibility for Admission**

- 2.1 Admission to the undergraduate(UG) programme shall be made on the basis of the merit rank obtained by the qualified student in entrance test conducted by the Telangana State Government (EAMCET), subject to reservations as prescribed by the government from time to time.
- 2.2 The medium of instructions for the entire undergraduate programme in Engineering & Technology will be **English** only.

3.0 **B.Tech. Programme Structure**

- 3.1 A student after securing admission shall complete the B.Tech. programme in a minimum period of **four** academic years (8 semesters), and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech course. Each student shall secure 160 credits (with CGPA ≥ 5) required for the completion of the undergraduate programme and award of the B.Tech. degree.
- 3.2 **UGC/ AICTE** specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms, which are listed below.

3.2.1 **Semester Scheme**

Each undergraduate programme is of 4 academic years (8 semesters) with the academic year divided into two semesters of 22 weeks (≥ 90 instructional days) each and in each semester - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)' under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) indicated by UGC, and curriculum/course structure suggested by AICTE are followed.

3.2.2 Credit Courses

All subjects/ courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/ course in an L: T: P: C (lecture periods: tutorial periods: practical periods: credits) structure based on the following general pattern.

- One credit for one hour/ week/ semester for Theory/ Lecture (L) courses or Tutorials.
- One credit for two hours/ week/ semester for Laboratory/ Practical (P) courses.

Courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization Lab are mandatory courses. These courses will not carry any credits.

3.2.3 Subject Course Classification

All subjects/ courses offered for the undergraduate programme in E&T (B.Tech. degree programmes) are broadly classified as follows. The University has followed almost all the guidelines issued by AICTE/UGC.

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes Mathematics, Physics and Chemistry subjects
2		ES - Engineering Sciences	Includes Fundamental Engineering Subjects
3		HS – Humanities and Social Sciences	Includes subjects related to Humanities, Social Sciences and Management
4	Core Courses (CoC)	PC – Professional Core	Includes core subjects related to the parent discipline/ department/ branch of Engineering.
5	Elective Courses (ElC)	PE – Professional Electives	Includes elective subjects related to the parent discipline/ department/ branch of Engineering.
6		OE – Open Electives	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering.
7	Core Courses	Project Work	B.Tech. Project or UG Project or UG Major Project or Project Stage I & II

8		Industry Training/ Internship/ Industry Oriented Mini- project/ Mini- Project/ Skill Development Courses	Industry Training/ Internship/ Industry Oriented Mini-Project/ Mini-Project/ Skill Development Courses
9		Seminar	Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering.
10	Minor Courses	-	1 or 2 Credit Courses (subset of HS)
11	Mandatory Courses (MC)	-	Mandatory Courses (non-credit)

4.0 Course Registration

- 4.1 A ‘faculty advisor or counselor’ shall be assigned to a group of 20 students, who will advise the students about the undergraduate programme, its course structure and curriculum, choice/option for subjects/ courses, based on their competence, progress, pre-requisites and interest.
- 4.2 The academic section of the college invites ‘registration forms’ from students before the beginning of the semester through ‘on-line registration’, ensuring ‘date and time stamping’. The online registration requests for any ‘current semester’ shall be **completed before the commencement of SEEs (Semester End Examinations) of the ‘preceding semester’**.
- 4.3 A student can apply for **on-line** registration, **only after** obtaining the ‘**written approval**’ from faculty advisor/counselor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with the Head of the Department, Faculty Advisor/ Counselor and the student.
- 4.4 A student may be permitted to register for all the subjects/ courses in a semester as specified in the course structure with maximum additional subject(s)/course(s) limited to 6 Credits (any 2 elective subjects), based on **progress** and SGPA/ CGPA, and completion of the ‘**pre-requisites**’ as indicated for various subjects/ courses, in the department course structure and syllabus contents.
- 4.5 Choice for ‘**additional subjects/courses**’, not more than any 2 elective subjects in any Semester, must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/Mentor/HOD.
- 4.6 If the student submits ambiguous choices or multiple options or erroneous entries during **online** registration for the subject(s) / course(s) under a given/ specified course group/ category as listed in the course structure, only the first mentioned subject/ course in that category will be taken into consideration.
- 4.7 Subject/ course options exercised through **on-line** registration are final and **cannot** be changed or inter-changed; further, alternate choices also will not be considered.

However, if the subject/ course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any inevitable or unexpected reasons, then the student shall be allowed to have alternate choice either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within **a week** after the commencement of class-work for that semester.

- 4.8** Dropping of subjects/ courses may be permitted, only after obtaining prior approval from the faculty advisor/ counselor ‘within a period of 15 days’ from the beginning of the current semester.
- 4.9** **Open Electives:** The students have to choose three Open Electives (OE-I, II & III) from the list of Open Electives given by other departments. However, the student can opt for an Open Elective subject offered by his own (parent) department, if the student has not registered and not studied that subject under any category (Professional Core, Professional Electives, Mandatory Courses etc.) offered by parent department in any semester. Open Elective subjects already studied should not repeat/should not match with any category (Professional Core, Professional Electives, Mandatory Courses etc.) of subjects even in the forthcoming semesters.
- 4.10** **Professional Electives:** The students have to choose six Professional Electives (PE-I to VI) from the list of professional electives given.

5.0 **Subjects/ courses to be offered**

- 5.1** A subject/ course may be offered to the students, **only if** a minimum of 15 students opt for it.
- 5.2** More than **one faculty member** may offer the **same subject** (lab/ practical may be included with the corresponding theory subject in the same semester) in any semester. However, selection of choice for students will be based on - ‘**first come first serve** basis and CGPA criterion’ (i.e. the first focus shall be on early **on-line entry** from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student).
- 5.3** If more entries for registration of a subject come into picture, then the Head of the Department concerned shall decide, whether or not to offer such a subject/ course for **two (or multiple) sections**.
- 5.4** In case of options coming from students of other departments/ branches/ disciplines (not considering **open electives**), first **priority** shall be given to the student of the ‘**parent department**’.

6.0 **Attendance requirements:**

- 6.1** A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects/ courses

(including attendance in mandatory courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization Lab) for that semester. **Two periods** of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject.

- 6.2 Shortage of attendance in aggregate upto 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.
- 6.3 A stipulated fee shall be payable for condoning of shortage of attendance.
- 6.4 Shortage of attendance below 65% in aggregate shall in **NO** case be condoned.
- 6.5 **Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled**, including all academic credentials (internal marks etc.) of that semester. **They will not be promoted to the next semester.** They may seek re-registration for all those subjects registered in that semester in which the student is detained, by seeking re-admission into that semester as and when offered; if there are any professional electives and/ or open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category.
- 6.6 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

7.0 Academic Requirements

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in Item No. 6.

- 7.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course, if student secures not less than 35% (14 marks out of 40 marks) in the Continuous Internal Evaluation (CIE), not less than 35% (21 marks out of 60 marks) in the semester end examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing 'C' grade or above in that subject/ course.
- 7.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Real-time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship (or) Seminar, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if he (i) does not submit a report on Industry Oriented Mini Project/Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in Real-time Research

Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship evaluations.

A student may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such ‘one reappearance’ evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.3 Promotion Rules

S. No.	Promotion	Conditions to be fulfilled
1	First year first semester to first year second semester	Regular course of study of first year first semester.
2	First year second semester to Second year first semester	(i) Regular course of study of first year second semester. (ii) Must have secured at least 20 credits out of 40 credits i.e., 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3.	Second year first semester to Second year second semester	Regular course of study of second year first semester.
4	Second year second semester to Third year first semester	(i) Regular course of study of second year second semester. (ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Third year first semester to Third year second semester	Regular course of study of third year first semester.
6	Third year second semester to Fourth year first semester	(i) Regular course of study of third year second semester. (ii) Must have secured at least 72 credits out of 120 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester.

- 7.4 A student (i) shall register for all courses/subjects covering 160 credits as specified and listed in the course structure, (ii) fulfills all the attendance and academic requirements for 160 credits, (iii) earn all 160 credits by securing SGPA ≥ 5.0 (in each semester), and CGPA ≥ 5 (at the end of 8 semesters), (iv) **passes all the mandatory courses**, to successfully complete the undergraduate programme. The performance of the student in these 160 credits shall be considered for the calculation of the final CGPA (**at the end of undergraduate programme**), and shall be indicated in the grade card / marks memo of IV-year II semester.
- 7.5 If a student registers for ‘**extra subjects**’ (in the parent department or other departments/branches of Engg.) other than those listed subjects totaling to 160 credits as specified in the course structure of his department, the performances in those ‘**extra subjects**’ (although evaluated and graded using the same procedure as that of the required 160 credits) will not be considered while calculating the SGPA and CGPA. For such ‘**extra subjects**’ registered, percentage of marks and letter grade alone will be indicated in the grade card / marks memo as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations Items 6 and 7.1 – 7.4 above.
- 7.6 A student eligible to appear in the semester end examination for any subject/ course, but absent from it or failed (thereby failing to secure ‘**C**’ grade or above) may reappear for that subject/ course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject/ course will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that subject.
- 7.7 A student **detained in a semester due to shortage of attendance may be re-admitted in the same semester in the next academic year for fulfillment of academic requirements**. The academic regulations under which a student has been re-admitted shall be applicable. Further, no grade allotments or SGPA/ CGPA calculations will be done for the entire semester in which the student has been detained.
- 7.8 A student **detained due to lack of credits, shall be promoted to the next academic year only after acquiring the required number of academic credits**. The academic regulations under which the student has been readmitted shall be applicable to him.
- 8.0 **Evaluation - Distribution and Weightage of Marks**
- 8.1 The performance of a student in every subject/course (including practicals and Project Stage – I & II) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination).

8.2 In CIE, for theory subjects, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of two parts i) **Part – A** for 10 marks, ii) **Part – B** for 20 marks with a total duration of 2 hours as follows:

1. Mid Term Examination for 30 marks:
 - a. Part - A : Objective/quiz paper for 10 marks.
 - b. Part - B : Descriptive paper for 20 marks.

The objective/quiz paper is set with multiple choice and fill-in the blanks type of questions for a total of 10 marks. The descriptive paper shall contain 6 full questions out of which, the student has to answer one question from each unit with either or choice with a weightage of 8M from Unit-1, 8M from Unit-2, 4M from Unit-3 for Mid-1 Examination and 4M from Unit-3, 8M from Unit-4, 8M from Unit-5 for Mid-2 Examination. The **average of the two Mid Term Examinations** shall be taken as the final marks for Mid Term Examination (for 30 marks).

The remaining 10 marks of Continuous Internal Evaluation are distributed as:

2. Assignment for 5 marks. (**Average of 2 Assignments** each for 5 marks)
3. Subject Viva-Voce/PPT/Poster Presentation/Case Study/Tech-Talk on a topic in the concerned subject for 5 marks.

While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus.

Five (5) marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The average of the two assignments shall be taken as the final marks for assignment (for 5 marks).

Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the subject concerned for 5 marks before II Mid-Term Examination.

- The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Over all 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores $\geq 35\%$ (14 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE.

There is NO Computer Based Test (CBT) for NR23 regulations.

The details of the end semester question paper pattern are as follows:

8.2.1 The semester end examinations (SEE), for theory subjects, will be conducted for 60 marks consisting of two parts viz. i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from each unit and may contain sub-questions. For each question there will be an “either” “or” choice, which means that there will be two questions from each unit and the student should answer either of the two questions.
- The duration of Semester End Examination is 3 hours.

8.2.2 For the subject, **Computer Aided Engineering Graphics**, the Continuous Internal Evaluation (CIE) and Semester End Examinations (SEE) evaluation pattern is same as for other theory subjects.

8.3 For practical subjects there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and 60 marks for semester end examination. Out of the 40 marks for internal evaluation:

1. A write-up on day-to-day experiment in the laboratory (in terms of aim, components/procedure, expected outcome) which shall be evaluated for 10 marks
2. **10 marks for viva-voce** (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
3. Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 10 marks.
4. The remaining 10 marks are for Laboratory Report/Project and Presentation, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

The Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the other colleges which will be decided by the Principal of the College.

In the Semester End Examination held for 3 hours, total 60 marks are divided and allocated as shown below:

1. 10 marks for write-up
 2. 15 for experiment/program
 3. 15 for evaluation of results
 4. 10 marks for presentation on another experiment/program in the same laboratory course and
 5. 10 marks for viva-voce on concerned laboratory course.
- The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Over all

40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores $\geq 35\%$ (14 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE.

8.4 The evaluation of courses having ONLY internal marks in I Year I Semester and IYear II Semester is as follows:

1. I Year I Semester course (ex., **Elements of CE/ME/EEE/ECE/CSE** etc): The internal evaluation is for 100 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The sum of the two Mid-Term examinations is the final for 100 marks. Student shall have to earn 40%, i.e 40 marks out of 100 marks. There shall be NO external evaluation. The student is deemed to have failed, if he (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.

For CSE/IT and allied branches and Mining Engineering, the Continuous Internal Evaluation (CIE) will be for 100 marks (i.e., Each Mid-Term examination 50 marks). Each Mid-Term examination consists of two parts i) **Part-A** for 20 marks, ii) **Part-B** for 20 marks with a total duration of 2 hours.

Part A: Objective/quiz paper is set with multiple choice, fill-in-the blanks and match the following type of questions for a total of 20 marks. **Part B:** Descriptive paper shall contain 6 full questions out of which, the student has to answer one question from each unit with either or choice with a weightage of 8M from Unit-1, 8M from Unit-2, 4M from Unit-3 for Mid-1 Examination and 4M from Unit-3, 8M from Unit-4, 8M from Unit-5 for Mid-2 Examination.

The remaining 10 marks of Continuous Internal Evaluation are for Assignment (5 marks) and Subject Viva-Voce/PPT/Poster Presentation/ Case Study (5 marks).

For all other branches, the Continuous Internal Evaluation (CIE) will be for 100 marks. Out of the 100 marks for internal evaluation:

- a) A write-up on day-to-day experiment in the laboratory (in terms of aim, components/procedure, expected outcome) which shall be evaluated for 20 marks
 - b) **20 marks for viva-voce** (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
 - c) Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 30 marks.
 - d) The remaining 30 marks are for Laboratory Report/Project and Presentation, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.
2. II Year II Semester *Real-Time (or) Field-based Research Project* course: The internal evaluation is for 100 marks and it shall take place during I Mid-Term examination and

II Mid-Term examination. The sum of two Mid-Term examinations is the final for 100 marks. Student shall have to earn 40%, i.e 40 marks out of 100 marks from the sum of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or (ii) secures less than 40% marks in this course.

- 8.5** There shall be an Industry training (or) Internship (or) Industry oriented Mini-project (or) Skill Development Courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project in collaboration with an industry of their specialization. Students shall register for this immediately after II-Year II Semester Examinations and pursue it during summer vacation/semester break & during III Year without effecting regular course work. Internship at reputed organization (or) Skill development courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project shall be submitted in a report form and presented before the committee in III-year II semester before end semester examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project (or) Internship etc, Internal Supervisor and a Senior Faculty Member of the Department. There shall be **NO internal marks** for Industry Training (or) Internship (or) Mini-Project (or) Skill Development Courses (or) Paper Presentation in reputed journal (or) Industry Oriented Mini Project.
- 8.6** The UG project shall be initiated at the end of the IV Year I Semester and the duration of the project work is one semester. The student must present Project Stage – I during IV Year I Semester before II Mid examinations, in consultation with his Supervisor, the title, objective and plan of action of his Project work to the departmental committee for approval before commencement of IV Year II Semester. Only after obtaining the approval of the departmental committee, the student can start his project work.
- 8.7** UG project work shall be carried out in two stages: Project Stage – I for approval of project before Mid-II examinations in IV Year I Semester and Project Stage – II during IV Year II Semester. Student has to submit project work report at the end of IV Year II Semester. The project shall be evaluated for 100 marks before commencement of SEE Theory examinations.
- 8.8** For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall approve the project work to begin before II Mid-Term examination of IV Year I Semester. The student is deemed to be not eligible to register for the Project work, if he does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule.

A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.9 For Project Stage – II, the external examiner shall evaluate the project work for 60 marks and the internal project committee shall evaluate it for 40 marks. Out of 40 internal marks, the departmental committee consisting of Head of the Department, Project Supervisor and a Senior Faculty Member shall evaluate the project work for 20 marks and Project Supervisor shall evaluate for 20 marks. The topics for Industry Oriented Mini Project/ Internship/SDC etc. and the main Project shall be different from the topic already taken. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

For conducting viva-voce of project, Principal selects an external examiner from the list of experts in the relevant branch submitted by the Head of the Department.

A student who has failed, may reappear once for the above evaluation, when it is scheduled again; if student fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.10 A student can re-register for subjects in a semester:

- If the internal marks secured by a student in the Continuous Internal Evaluation marks for 40 (Sum of average of two mid-term examinations consisting of Objective & descriptive parts, Average of two Assignments & Subject Viva- voce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject) are less than 35% and failed in those subjects.

They may seek re-registration for all those subjects registered in that semester in which the student is failed. The student has to re-appear for CIE and SEE as and when offered.

A student must re-register for the failed subject(s) for 40 marks within four weeks of commencement of the classwork in next academic year. His Continuous Internal Evaluation marks for 40 obtained in the previous attempt stand cancelled. The student has to obtain fresh set of marks for 40 allotted for CIE (Sum of average of two mid-term examinations consisting of Objective & descriptive parts, Average of two Assignments & Subject Viva-voce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject). Head of the Dept. will take care of this.

8.11 For mandatory courses of Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab, a student has to secure 40 marks out of 100 marks (i.e. 40% of the 100 marks allotted) in the Continuous Internal Evaluation for passing the subject/course. These marks should also be uploaded along with the internal marks of other subjects.

8.12 No marks or letter grades shall be allotted for mandatory/non-credit courses. Only Pass/Fail shall be indicated in Grade Card.

9.0 Grading Procedure

- 9.1 Grades will be awarded to indicate the performance of students in each Theory Subject, Laboratory/Practicals/ Industry-Oriented Mini Project/Internship/SDC and Project Stage. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade shall be given.
- 9.2 As a measure of the performance of a student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured in a Subject/Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
Greater than or equal to 90%	O (Outstanding)	10
80 and less than 90%	A ⁺ (Excellent)	9
70 and less than 80%	A (Very Good)	8
60 and less than 70%	B ⁺ (Good)	7
50 and less than 60%	B (Average)	6
40 and less than 50%	C (Pass)	5
Below 40%	F (FAIL)	0
Absent	Ab	0

- 9.3 A student who has obtained an 'F' grade in any subject shall be deemed to have 'failed' and is required to reappear as a 'supplementary student' in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier.
- 9.4 To a student who has not appeared for an examination in any subject, 'Ab' grade will be allocated in that subject, and he is deemed to have 'Failed'. A student will be required to reappear as a 'supplementary student' in the semester end examination, as and when offered next. In this case also, the internal marks in those subjects will remain the same as those obtained earlier.
- 9.5 A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.
- 9.6 A student earns Grade Point (GP) in each subject/ course, on the basis of the letter grade secured in that subject/ course. The corresponding 'Credit Points' (CP) are computed by multiplying the grade point with credits for that particular subject/ course.

$$\text{Credit Points (CP)} = \text{Grade Point (GP)} \times \text{Credits} \dots \text{For a course}$$

- 9.7 A student passes the subject/ course only when **GP ≥ 5 ('C' grade or above)**
- 9.8 The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points (ΣCP) secured from all subjects/ courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA is thus computed as

$$SGPA = \left\{ \sum_{i=1}^N C_i G_i \right\} / \left\{ \sum_{i=1}^N C_i \right\} \dots \text{For each semester,}$$

where 'i' is the subject indicator index (considering all subjects in a semester), 'N' is the no. of subjects '**registered**' for the semester (as specifically required and listed under the course structure of the parent department), C_i is the no. of credits allotted to the i^{th} subject, and G_i represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} subject.

- 9.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in **all** registered courses (of 160) in **all** semesters, and the total number of credits registered in **all** the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed from the I year II semester onwards at the end of each semester as per the formula

$$CGPA = \left\{ \sum_{j=1}^M C_j G_j \right\} / \left\{ \sum_{j=1}^M C_j \right\} \dots \text{for all S semesters registered}$$

(i.e., up to and inclusive of S semesters, $S \geq 2$),

where '**M**' is the **total** no. of subjects (as specifically required and listed under the course structure of the parent department) the student has '**registered**' i.e., from the 1st semester onwards up to and inclusive of the 8th semester, 'j' is the subject indicator index (takes into account all subjects from 1 to 8 semesters), C_j is the no. of credits allotted to the j^{th} subject, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} subject. After registration and completion of I year I semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA:

Course/Subject	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	4 x 8 = 32
Course 2	4	O	10	4 x 10 = 40
Course 3	4	C	5	4 x 5 = 20
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	C	5	3 x 5 = 15
	21			152

$$SGPA = 152/21 = 7.24$$

Illustration of Calculation of CGPA up to 3rd Semester:

Semester	Course/ Subject Title	Credits Allotted	Letter Grade Secured	Corresponding Grade Point (GP)	Credit Points (CP)
I	Course 1	3	A	8	24
I	Course 2	3	O	10	30
I	Course 3	3	B	6	18
I	Course 4	4	A	8	32
I	Course 5	3	A+	9	27
I	Course 6	4	C	5	20
II	Course 7	4	B	6	24
II	Course 8	4	A	8	32
II	Course 9	3	C	5	15
II	Course 10	3	O	10	30
II	Course 11	3	B+	7	21
II	Course 12	4	B	6	24
II	Course 13	4	A	8	32
II	Course 14	3	O	10	30
III	Course 15	2	A	8	16
III	Course 16	1	C	5	5
III	Course 17	4	O	10	40
III	Course 18	3	B+	7	21
III	Course 19	4	B	6	24
III	Course 20	4	A	8	32
III	Course 21	3	B+	7	21
	Total Credits	69		Total Credit Points	518

$$\text{CGPA} = 518/69 = 7.51$$

The calculation process of CGPA illustrated above will be followed for each subsequent semester until 8th semester. The CGPA obtained at the end of 8th semester will become the final CGPA secured for entire B.Tech programme.

- 9.10** For merit ranking or comparison purposes or any other listing, **only** the ‘**rounded off**’ values of the CGPAs will be used.
- 9.11** SGPA and CGPA of a semester will be mentioned in the semester Memorandum of Grades if all subjects of that semester are passed in first attempt. Otherwise the SGPA and CGPA shall be mentioned only on the Memorandum of Grades in which sittinghe passed his last exam in that semester. However, mandatory courses will not be taken into consideration.

10.0 Passing Standards

- 10.1 A student shall be declared successful or 'passed' in a semester, if he secures a GP ≥ 5 ('C' grade or above) in every subject/course in that semester (i.e. when the student gets an SGPA ≥ 5.0 at the end of that particular semester); and he shall be declared successful or 'passed' in the entire undergraduate programme, only when gets a CGPA ≥ 5.00 ('C' grade or above) for the award of the degree as required.
- 10.2 After the completion of each semester, a grade card or grade sheet shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, grade earned, etc.) and credits earned. **There is NO exemption of credits in any case.**

11.0 Declaration of results

- 11.1 Computation of SGPA and CGPA are done using the procedure listed in 9.6 to 9.9.
- 11.2 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used.

$$\% \text{ of Marks} = (\text{final CGPA} - 0.5) \times 10$$

12.0 Award of Degree

- 12.1 A student who registers for all the specified subjects/ courses as listed in the course structure and secures the required number of 160 credits (with CGPA ≥ 5.0), within 8 academic years from the date of commencement of the first academic year, shall be declared to have '**qualified**' for the award of B.Tech. degree in the branch of Engineering selected at the time of admission.
- 12.2 A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.
- 12.3 A student with final CGPA (at the end of the undergraduate programme) > 8.00 , and fulfilling the following conditions - shall be placed in '**First Class with Distinction**'. However, he
- Should have passed all the subjects/courses in '**First Appearance**' within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.
 - Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason.

A student not fulfilling any of the above conditions with final CGPA > 8 shall be placed in '**First Class**'.

- 12.4 Students with final CGPA (at the end of the undergraduate programme) ≥ 7.0 but < 8.00 shall be placed in '**First Class**'.
- 12.5 Students with final CGPA (at the end of the undergraduate programme) ≥ 6.00 but < 7.00 ,

shall be placed in '**Second Class**'.

12.6 All other students who qualify for the award of the degree (as per item 12.1), with final CGPA (at the end of the undergraduate programme) ≥ 5.00 but < 6 , shall be placed in '**pass class**'.

12.7 A student with final CGPA (at the end of the undergraduate programme) < 5.00 will not be eligible for the award of the degree.

12.8 Students fulfilling the conditions listed under item 12.3 alone will be eligible for award of '**Gold Medal**'.

12.9 Award of 2-Year B.Tech. Diploma Certificate

1. A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and earned all the 80 credits (within 4 years from the date of admission) upto B.Tech. II Year II Semester, if the student want to exit the 4-Year B.Tech. program and *requests for the 2 -Year B. Tech. (UG) Diploma Certificate.*
2. The student **once opted and awarded 2-Year UG Diploma Certificate, the student will be permitted to join** in B. Tech. III Year I Semester and continue for completion of remaining years of study for 4-Year B. Tech. Degree ONLY in the next academic year along with next batch students. *However, if any student wishes to continue the study after opting for exit, he/she should register for the subjects/courses in III Year I Semester before commencement of classwork for that semester.*
3. *The students, who exit the 4-Year B. Tech. program after II Year of study and wish to re-join the B.Tech. program, must submit the 2 -Year B. Tech. (UG) Diploma Certificate awarded to him, subject to the eligibility for completion of Course/Degree.*
4. A student may be permitted to take one year break after completion of II Year II Semester or B. Tech. III Year II Semester (with the permission of college Academic Committee well in advance) and can re-enter the course in **next Academic Year in the same college** and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year program).

13.0 Withholding of results

13.1 If the student has not paid the fees to the College at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and the student will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

14.0 Transitory Regulations

- A. For students detained due to shortage of attendance:
1. A student who has been detained in any semester of I, II, III and IV years of NR21 regulations for want of attendance, shall be permitted to join the corresponding semester of NR23 Regulations and is required to complete the study of B.Tech. within the stipulated period of eight academic years from the date of first admission in I Year. The NR23 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.
- B. For students detained due to shortage of credits:
1. A student of NR21 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of NR23 Regulations only after acquiring the required number of credits as per the corresponding regulations of his/her first admission. The total credits required are 160 including both NR21 & NR23 regulations. The student is required to complete the study of B.Tech. within the stipulated period of eight academic years from the year of first admission. The NR23 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.
- C. For readmitted students in NR23 Regulations:
1. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.
 2. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including NR23 Regulations. **There is NO exemption of credits in any case.**
 3. If a student is readmitted to NR23 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in NR23 Regulations will be substituted by another subject to be suggested by the College.

Note: If a student readmitted to NR23 Regulations and has not studied any subjects/topics in his/her earlier regulations of study which is prerequisite for further subjects in NR23 Regulations, the Head of the department concerned shall conduct remedial classes to cover those subjects/topics for the benefit of the students.

15.0 Student Transfers

- 15.1 There shall be no branch transfers after the completion of admission process.
- 15.2 The students seeking transfer to NRCM from various other Universities/institutions have to pass the failed subjects which are equivalent to the subjects of NRCM of NR23 regulation, and also pass the subjects of NRCM which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of NRCM, the students have to study those subjects in NRCM in spite of the fact that those subjects are repeated.

15.3 The colleges will provide one chance to write the internal examinations in the **equivalent subject(s)** to the students transferred from other universities/institutions to NRCM who are on rolls, as per the clearance (equivalence) letter issued by the Academic Committee.

16.0 Scope

16.1 The academic regulations should be read as a whole, for the purpose of any interpretation.

16.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

16.3 The College may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the College authorities.

16.4 Where the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

NARSIMHAREDDY ENGINEERING COLLEGE

UGC AUTONOMOUS INSTITUTION

Maisammaguda (V), Kompally - 500100, Secunderabad, Telangana state, India

ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME) FROM THE AY 2024-25

1. Eligibility for the award of B.Tech Degree (LES)

The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.

2. The student shall register for 120 credits and secure 120 credits with CGPA ≥ 5 from II year to IV-year B.Tech. programme (LES) for the award of B.Tech. degree.
3. The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.
4. The attendance requirements of B. Tech. (Regular) shall be applicable to B.Tech.(LES).

5. Promotion rule

S. No	Promotion	Conditions to be fulfilled
1	Second year first semester to second year second semester	Regular course of study of second year first semester.
2	Second year second semester to third year first semester	(i) Regular course of study of second year second semester. (ii) Must have secured at least 24 credits out of 40 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester to third year second semester	Regular course of study of third year first semester.
4	Third year second semester to fourth year first semester	(i) Regular course of study of third year second semester. (ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to

		third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester.

6. All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

7. LES students are not eligible for 2-Year B. Tech. Diploma Certificate.

Malpractices Rules

Disciplinary Action For / Improper Conduct in Examinations

	Nature of Malpractices/Improper conduct	Punishment
	If the student:	
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 subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student 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 subject only of all the students 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 subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the student is to be cancelled.
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that

		semester/year. The student is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the student 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 subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the student 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 subject.
6.	Refuses to obey the orders of the chief superintendent/assistant superintendent / 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 officer-in-charge 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 officer-in-charge, 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	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	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.	
7.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
8.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.
9.	If student of the college, who is not a student for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared for including practical examinations

		and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the student has appeared for including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the College Malpractice committee for further action to award a suitable punishment.	

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INSTITUTION VISION

To produce competent professionals who can contribute to the industry, research and societal benefits with environment consciousness and ethical Values.

INSTITUTION MISSION

- Adapt continuous improvements in innovative teaching-learning practices and state-of-the-art infrastructure to transform students as competent professionals and entrepreneurs in multi-disciplinary fields.
- Develop an innovative ecosystem with strong involvement and participation of students and faculty members.
- Impart National development spirit among the students to utilize their knowledge and skills for societal benefits with ethical values.

DEPARTMENT VISION

To be recognized as a centre of excellence by nurturing competent and ethical electrical engineers, fostering innovation, advanced research and setting global benchmarks in developing sustainable solutions for societal progress.

DEPARTMENT MISSION

Mission-1: To impart high-quality technical education integrated with rigorous academic learning, while fostering innovation and creative problem-solving skills in the field of Electrical and Electronics Engineering.

Mission-2: To promote a strong research culture among students and faculty to develop technologically advanced and cost-effective sustainable solutions for societal upliftment.

Mission-3: To actively engage, collaborate, and build partnerships with leading industries, research and academic institutions to strengthen technological advancements

PROGRAM OUTCOMES (POs)

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** 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. **Conduct investigations of complex problems:** 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. **Modern tool usage:** 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. **The engineer and society:** 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. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** 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. **Project management and finance:** 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. **Life-long learning:** 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 EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 : Preparation: Graduates excel in higher education and become successful professionals in Electrical Engineering and its allied domains.

PEO 2 : Core Competence: Graduates will have a strong foundation in engineering principles, scientific knowledge, and technical fundamentals, enabling them to address complex challenges in research, industry, higher education and entrepreneurship through rigorous learning.

PEO 3 : Professionalism & Lifelong Learning: Graduates shall have effective communication, teamwork, leadership, social responsibility, and ethical values while fostering adaptability and a commitment to lifelong learning.

PROGRAM SPECIFIC OBJECTIVES (PSOs)

PSO 1 : Engineering Knowledge and Analysis :

Apply principles of engineering, science, and mathematics through differential and integral calculus, complex variables to solve electrical engineering problems.

PSO 2 : System Design :

Ability to utilize logical and technical skills to model, analyze, design, realize physical systems, simulate, measuring, control and experimenting the components or processes by using software/hardware tools related to Electrical and Electronics Engineering problems and other allied themes.

PSO 3: Application of the knowledge on society/environment :

Apply the knowledge of Electrical and Electronics Engineering with self-learning to address societal and environmental challenges, while fostering leadership, economic understanding, and professional ethics in multidisciplinary environment.



B Tech in ELECTRICAL AND ELECTRONICS ENGINEERING
COURSE STRUCTURE & SYLLABUS (NR23 Regulations)

Applicable from AY 2023-24 Batch

I YEAR I SEMESTER

S.No.	Course Code	Course Title	C	L	T	P	Credits
1	23MA101	Matrices and Calculus	BS	3	1	0	4
2	23CH102	Engineering Chemistry	BS	3	1	0	4
3	23EN103	English for Skill Enhancement	HS	2	0	0	2
4	23EE104	Electrical Circuit Analysis-I	ES	3	0	0	3
5	23CS105	Programming for Problem Solving	ES	3	0	0	3
6	23EN106	English Language And Communication Skills Laboratory	HS	0	0	2	1
7	23CS107	Programming for Problem Solving Laboratory	ES	0	0	2	1
8	23CH108	Engineering Chemistry Laboratory	BS	0	0	2	1
9	23EE109	Elements of Electrical and Electronics Engineering	ES	0	0	2	1
10		Induction Program	-	-	-	-	-
Total				14	2	8	20

I YEAR II SEMESTER

S.No.	Course Code	Course Title	C	L	T	p	Credits
1	23MA201	Ordinary Differential Equations and Vector Calculus	BS	3	1	0	4
2	23PH202	Applied Physics	BS	3	1	0	4
3	23ME203	Computer Aided Engineering Graphics	ES	1	0	4	3
4	23EE205	Electrical Circuit Analysis - II	ES	2	0	0	2
5	23PH205	Applied Physics laboratory	BS	0	0	3	1.5
6	23CS206	Python Programming Laboratory	ES	1	0	2	2
7	23EE208	Electrical Circuit Analysis Laboratory	ES	0	0	2	1
8	23ME208	Engineering workshop	ES	1	0	3	2.5
Total				11	2	14	20

II YEAR I SEMESTER

S.No.	Course Code	Course Title	C	L	T	P	Credits	
1	23MA301	Numerical Methods and Complex variables	BS	3	1	0	4	
2	23EE302	Electrical Machines-I	PC	3	1	0	4	
3	23EE304	Power System-I	PC	3	0	0	3	
4	23EE305	Electro Magnetic Fields	PC	3	0	0	3	
5	23EC309	Analog Electronic Circuits	PC	3	0	0	3	
6	23EE306	Electrical Machines Laboratory-I	PC	0	0	2	1	
7	23EE308	Electrical Simulation tools Laboratory	PC	0	0	2	1	
8	23EC310	Analog Electronic Circuits Laboratory	PC	0	0	2	1	
	*MC3001	Gender Sensitization Laboratory	MC	0	0	2	0	
Total					15	02	08	20

II YEAR II SEMESTER

S.No.	Course Code	Course Title	C	L	T	P	Credits	
1	23ME401	Solid Mechanics & Hydraulic Machines	PC	3	1	0	4	
2	23EE402	Measurements and Instrumentation	PC	3	0	0	3	
3	23EE403	Electrical Machines-II	PC	3	0	0	3	
4	23EC410	Digital Electronics	PC	2	0	0	2	
5	23EE405	Power System-II	PC	3	0	0	3	
6	23EC411	Digital Electronics Laboratory	PC	0	0	2	1	
7	23EE407	Measurements and Instrumentation Laboratory	PC	0	0	2	1	
8	23EE408	Electrical Machines Laboratory-II	PC	0	0	2	1	
9	23EE409	Real-time Research Project/ Field Based Project	PW	0	0	4	2	
10	*MC4001	Constitution of India	MC	3	0	0	0	
Total					17	1	10	20

III YEAR I SEMESTER

S.No.	Course Code	Course Title	C	L	T	P	Credits
1	23EE501	Power Electronics	PC	3	1	0	4
2	23EE502	Control Systems	PC	3	1	0	4
3	23EC503	Microprocessors & Micro controllers	PC	3	0	0	3
4		Professional Elective-I	PE	3	0	0	3
5	23MB504	Business Economics and Financial Analysis	HS	3	0	0	3
6	23EC508	Microprocessors & Micro controllers Laboratory	PC	0	0	2	1
7	23EE509	Power Electronics Laboratory	PC	0	0	2	1
8	23EN508	Advanced English Communication Skills Laboratory	HS	0	0	2	1
9	*MC5001	Intellectual Property Rights	MC	3	0	0	0
Total				18	2	6	20

Professional Elective-I	
Code	Course Title
23EE504	IoT Applications in Electrical Engineering
23EE505	Electrical Installation and Estimation
23EE506	High Voltage Engineering

III YEAR II SEMESTER

S.No.	Course Code	Course Title	C	L	T	P	Credits
1	23EE601	Power System Protection	PC	3	0	0	3
2	23EE602	Power System Operation and Control	PC	3	0	0	3
3	23EC607	Digital Signal Processing	PC	3	0	0	3
4		Professional Elective-II	PE	3	0	0	3
5		Open Elective-I	OE	3	0	0	3
6	23EE608	Power System Laboratory	PC	0	0	2	1
7	23EE609	Control Systems Laboratory	PC	0	0	2	1
8	23EC610	Digital Signal Processing Lab	PC	0	0	2	1
9	23EE611	Industry Oriented Mini Project / internship	PW	0	0	4	2
10	*MC6001	Environmental Science	MC	3	0	0	0
Total				18	0	10	20

Professional Elective-II	
Code	Course Title
23EE603	Power Semiconductor Drives
23EE604	Wind and Solar Energy systems
23EE605	Energy Management and Auditing

Open Elective-I		
Department	Course Code	Course Title
EEE	23EE606	Renewable Energy Sources
	23EE607	Fundamental of Electric Vehicles

IV YEAR I SEMESTER

S.No.	Course Code	Course Title	C	L	T	P	Credits
1	23EE701	Power Electronic Applications to Renewable Energy Systems	PC	3	1	0	4
2		Professional Elective-III	PE	3	0	0	3
3		Professional Elective-IV	PE	3	0	0	3
4		Open Elective-II	OE	3	0	0	3
5	23MB710	Fundamentals of Management for Engineers	HS	2	0	0	2
6	23EE711	Simulation of Renewable Energy Systems Laboratory	PC	0	0	4	2
7	23EE712	Project Stage-I	PW	0	0	6	3
		Total		14	1	10	20

Professional Elective-III	
Code	Course Title
23EE702	Mobile Application Development
23EE703	Utilization of Electric Energy
23EE704	Electric and Hybrid Vehicles

Professional Elective-IV	
Code	Course Title
23EE705	HVDC Transmission
23EE706	Power System Reliability
23EE707	Embedded Systems Applications

Open Elective - II		
Department	Course Code	Course Title
EEE	23EE708	Signals and Systems
	23EE709	Energy Storage Systems

IV YEAR II SEMESTER

S.No.	Course Code	Course Title	C	L	T	P	Credits
1		Professional Elective-V	PE	3	0	0	3
2		Professional Elective-VI	PE	3	0	0	3
3		Open Elective-III	OE	3	0	0	3
4	23EE809	Project Stage-II	PW	0	0	22	11
Total				9	0	22	20

Professional Elective-V	
Code	Course Title
23EE801	Power Quality & FACTS
23EE802	Solar Power Batteries
23EE803	AI Techniques in Electrical Engineering

Professional Elective-VI	
Code	Course Title
23EE804	Smart Grid Technologies
23EE805	Introduction to PLC/SCADA Programming
23EE806	Machine Learning Applications to Electrical Engineering

Open Elective - III		
Department	Course Code	Course Title
EEE	23EE807	Charging Infrastructure for Electric Vehicles
	23EE808	Electrical Safety Engineering

MATRICES AND CALCULUS**B Tech I Year I Sem**

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23MA101	Basic Sciences	3	1	0	4	40	60	100
Contact Classes: 48	Tutorial Classes: 16	Practical Classes: Nil			Total Classes:64			

Pre-requisites: Mathematical Knowledge at pre-university level

Course Objectives: To learn

1. Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
2. Concept of Eigen values and Eigen vectors and to reduce the quadratic form to canonical form
3. Geometrical approach to the mean value theorems and their application to the mathematical problems and evaluation of improper integrals using Beta and Gamma functions.
4. Partial differentiation and finding maxima and minima of function of two or more variables.
5. Evaluation of multiple integrals and their applications

Course outcomes: The student will be able to

1. Solve the system of Linear equations in various engineering problems
2. Find the Eigen values and Eigen vectors and reduce the quadratic form to canonical form using orthogonal transformations.
3. Solve the applications on the mean value theorems and evaluate the improper integrals using Beta and Gamma functions
4. Find the extreme values of functions of two variables with/without constraints.
5. Evaluate the multiple integrals and apply the concept to find areas, volumes

UNIT - I: Matrices

Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations: linearly dependent and linearly independent solutions, Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method, L-U decomposition method

UNIT - II: Eigen values and Eigen vectors Linear Transformation and Orthogonal Transformation: Eigen values, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT - III: Calculus :Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series, Maclaurin's series. Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (Only in Cartesian coordinates), Definition of Improper Integral: Beta and Gamma functions and their applications.

UNIT - IV: Multivariable Calculus (Partial Differentiation and applications) Definitions of Limit and continuity. Partial Differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

UNIT-V: Multivariable Calculus (Integration) Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Evaluation of Triple Integrals: Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and Cylindrical polar coordinates) for triple integrals. Applications: Areas and volumes (by double integrals).

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5 th Editon, 2016.

REFERENCE BOOKS:

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition,Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delh

ENGINEERING CHEMISTRY**B Tech I Year I Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23CH102	Basic Sciences	3	1	0	4	40	60	100
Contact Classes: 48	Tutorial Classes: 16	Practical Classes: -			Total Classes:64			

BCourse Objectives:

1. To bring adaptability to new developments in Engineering Chemistry and to acquire the skills required to become a perfect engineer.
2. To include the importance of water in industrial usage, fundamental aspects of battery chemistry, significance of corrosion and its control to protect the structures.
3. To provide fundamental knowledge on properties and applications of polymers & to learn about polymers in a particular application area.
4. To impart knowledge about various types of fuels and their combustion.
5. To acquire required knowledge about engineering materials like cement, smart materials and Lubricants.

Course Outcomes:

1. The students are able to understand the basic properties of water and its usage in domestic and industrial purposes.
2. Students will acquire the basic knowledge of electrochemical procedures related to corrosion and its control.
3. Classify and characterize different polymer engineering materials and apply its knowledge to select suitable materials for specific applications.
4. To be able to understand various types of fuels and the advantages of alternate fuels over conventional sources.
5. They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs.

UNIT - I: Water and its treatment: [8]

Introduction to Water and its types – related numerical's. Estimation of hardness of water by complexometric method- related numerical. Potable water and its specifications – Steps involved in the treatment of potable water – Disinfection of potable water by chlorination and break - point chlorination -. Defluoridation - Determination of Fluoride ion by ion- selective electrode method.

Boiler troubles: Sludges, Scales and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning, External treatment methods - Softening of water by ion- exchange processes. Desalination of water – Reverse osmosis.

UNIT – II: Battery Chemistry & Corrosion [8]

Introduction - Classification of batteries- primary, secondary and reserve batteries with examples. Basic requirements for commercial batteries. Construction, working and applications of: Zn-air and Lithium ion battery, Applications of Li-ion battery to electrical vehicles. Fuel Cells- Differences between battery and a fuel cell, Construction and applications of Hydrogen oxygen fuel cell and Solid oxide fuel cell. Microbial fuel cell. Solar cells - Introduction and applications of Solar cells.

Corrosion: Causes and effects of corrosion – theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current methods.

UNIT - III: Polymeric materials: [8]

Definition – Classification of polymers with examples – Types of polymerization – addition (free radical addition) and condensation polymerization with examples – Nylon 6:6, Terylene

Fibers: Properties and engineering applications of - Nylon 6:6, Terylene.

Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, Properties and engineering applications of PVC and Bakelite, Teflon, Fiber reinforced plastics (FRP)

Rubbers: Natural rubber and its vulcanization.

Elastomers: Characteristics –preparation – properties and applications of Buna-S, Butyl and Thiokol rubber.

Conducting polymers: Characteristics and Classification with examples-mechanism of conduction in trans-poly acetylene and applications of conducting polymers.

Biodegradable polymers: Concept and advantages - Polylactic acid and poly vinyl alcohol and their applications.

UNIT - IV: Energy Sources: [8]

Introduction, Calorific value of fuel – HCV, LCV- Dulong's formula. Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition and uses of natural gas, LPG and CNG, Biodiesel – Transesterification, advantages. Alternate fuels.

UNIT - V: Engineering Materials: [8]

Cement: Portland cement, its composition, Setting and hardening of cement

Smart materials and their engineering applications Shape memory materials- Poly urethane, Thermo responsive materials- Polyacryl amides, Poly vinyl amides

Lubricants: Classification of lubricants with examples-characteristics of a good lubricant - mechanism of lubrication (thick film, thin film and extreme pressure)- properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.

TEXT BOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010
2. Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rath, Cengage learning, 2016
3. A text book of Engineering Chemistry by M. Thirumala Chary, E. Laxminarayana and K. Shashikala, Pearson Publications, 2021.
4. Textbook of Engineering Chemistry by Jaya Shree Anireddy, Wiley Publications.

REFERENCE BOOKS:

1. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015)
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi (2011)

ENGLISH FOR SKILL ENHANCEMENT**B Tech I Year I Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EN103	Humanity Sciences	2	0	0	2	40	60	100
Contact Classes: 32	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes:32			

B. INTRODUCTION

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of “English for Skill Enhancement” has been designed to develop linguistic, communicative and critical thinking competencies of Engineering students. In English classes, the focus should be on the skills development in the areas of vocabulary, grammar, reading and writing.

Course Objectives: This course will help to enable the students to:

1. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
2. Develop study skills and communication skills in various professional situations.
3. Equip students to study engineering subjects more effectively and critically using the theoretical and practical components of the syllabus.
4. Understand the importance of defining, classifying and Practice the unique qualities of Professional writing style.
5. Employ the acquired knowledge in Classroom with reference to various soCIEI and Professional spheres, thus leading to a lifelong learning process.

Course Outcomes:

1. Develop proficiency in reading and writing comprehensive skills from the known and unknown passages.
2. Use and interpret vocabulary and sentence structures in new situations.
3. Develop skills needed to participate in conversation that builds Proficiency in English.
4. Demonstrate, question and test their understanding of functional grammar.
5. To differentiate, organise, relate to develop English skills such as drafting paragraphs, letters, essays, abstracts, précis and reports in various contexts.

UNIT- I

Chapter entitled '**Toasted English**' by R.K.Narayan from "**English: Language, Context and Culture**" published by Orient Black Swan, Hyderabad.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.

Reading: Reading and Its Importance- Techniques for Effective Reading.

Writing: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT - II

Chapter entitled '**Appro JRD**' by Sudha Murthy from "**English: Language, Context and Culture**" published by Orient Black Swan, Hyderabad.

Vocabulary: Homophones, Homonyms and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice

Writing: Nature and Style of Writing- Defining /Describing People, Objects, Places and Events.

UNIT - III

Chapter entitled '**Lessons from Online Learning**' by F.Haider Alvi, Deborah Hurst et al from "**English: Language, Context and Culture**" published by Orient Black Swan, Hyderabad. **Vocabulary:** Words Often Confused - Words Often Misspelt - Words from Foreign Languages and their Use in English.

Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

Reading: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice.

Writing: Format of a Formal Letter-Writing Formal Letters E.g., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with Resume and CV .

UNIT - IV

Chapter entitled “**Art and Literature**’ by Abdul Kalam

Vocabulary: Standard Abbreviations in English-

Grammar: Redundancies and Clichés in Oral and Written Communication.

Reading: Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice

Writing: Writing Practices- Essay Writing-Writing Introduction and Conclusion –Précis Writing.

UNIT - V

Chapter entitled ‘**Go, Kiss the World**’ by Subroto Bagchi **from “English: Language, Context and Culture”** published by Orient Black Swan, Hyderabad.

Vocabulary: Technical Vocabulary and their Usage

Grammar: Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous units)

Reading: Reading Comprehension-Exercises for Practice

Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

TEXT BOOK:

“English: Language, Context and Culture” by Orient Black Swan Pvt. Ltd,

Hyderabad. 2022. Print.7

REFERENCE BOOKS:

1. Effective Academic Writing by Liss and Davis (OUP)
2. Richards, Jack C. (2022) Interchange Series. Introduction, 1,2,3. Cambridge University Press
3. Wood, F.T. (2007). Remedial English Grammar. Macmillan
4. Chaudhuri, Santanu Sinha. (2018). Learn English: A Fun Book of
5. Functional Language, Grammar and Vocabulary. (2 nd ed.,). Sage Publications India Pvt. Ltd.
6. (2019). Technical Communication. Wiley India Pvt. Ltd.
7. Vishwamohan, Aysha. (2013). English for Technical Communication for.
8. Engineering Students. Mc Graw-Hill Education India Pvt. Ltd.

ELECTRICAL CIRCUIT ANALYSIS-I**B Tech I Year I Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE104	Engineering Sciences	3	0	0	3	40	60	100
		Practical Classes: Nil				Total Classes:48		
Contact Classes: 48	Tutorial Classes: Nil							

Prerequisites: Mathematics**Course Objectives:**

1. To gain knowledge in circuits and to understand the fundamentals of derived circuit laws.
2. To learn steady state and transient analysis of single phase circuits.
3. To understand the concepts of Theorems.
4. To learn steady state and transient analysis of 3-phase circuits.
5. To understand concepts of coupled circuits.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Understand network analysis, techniques using mesh and node analysis.
2. Evaluate steady state and transient behavior of single phase circuits for DC and AC excitations.
3. Analyze electric circuits using network theorems.
4. Evaluate steady state and transient behavior of three phase circuits for AC excitations
5. Analyze electric circuits using concepts of coupled circuits.

UNIT-I:

Network Elements & Laws: Active elements, Independent and dependent sources. Passive elements —R, L and C, Energy stored in inductance and capacitance, Ohm's Law, Kirchhoff's laws, Source transformations, Star-delta transformations, Node voltage method, Mesh current method including super node and super mesh analysis.

UNIT-II:

Single-Phase Circuits: RMS and average values of periodic sinusoidal and non-sinusoidal waveforms, Phasor representation, Steady-state response of series, parallel and series-parallel circuits. Impedance, Admittance, Current locus diagrams of RL and RC series and parallel circuits with variation of various parameters. Resonance: Series and parallel circuits, Bandwidth and Q-factor.

UNIT-III:

Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorems, Maximum power transfer theorem, Tellegen's theorem, Compensation theorem, Milliman's theorem and Reciprocity theorem.(AC&DC).

UNIT-IV:

Poly-phase Circuits: Two & Three phase systems, Star and delta connections, Analysis of Power Triangle, Analysis of balanced and unbalanced 3-phase circuits, Measurement of three-phase power for balanced and unbalanced loads.

UNIT-V:

Coupled circuits: Concept of self and mutual inductance, Dot convention, Coefficient of coupling, Analysis of circuits with mutual inductance.

Topological Description of Networks: Graph, tree, chord, cut-set, incident matrix, circuit matrix and cut-set matrix,

TEXT BOOKS:

1. Van Valken burg M.E, "Network Analysis", Prentice Hall of India, 3rdEdition, 2000.
2. Ravish R Singh, "Network Analysis and Synthesis", McGrawHill, 2ndEdition, 2019.

REFERENCE BOOKS:

1. B.Subramanyam, "Electric Circuit Analysis", Dream tech Press & Wiley, 2021.
2. James W.Nilsson, Susan A.Riedel, "Electric Circuits", Pearson,11th Edition, 2020.
3. ASudhakar, Shyammohan S Palli, "Circuits and Networks: Analysis and Synthesis", McGrawHill, 5thEdition,2017.
4. Jagan N.C, Lakshrni narayana C., "Network Analysis", B.S.Publications, 3rd Edition, 2014.
5. William HaytH, Kimmerly JackE. And StevenDurbinM, "Engineering Circuit Analysis", McGrawHill, 6thEdition, 2002.
6. ChakravarthyA., "CircuitTheory", Dhanpat Rai&Co., First Edition, 1999.

PROGRAMMING FOR PROBLEM SOLVING

B Tech I Year I Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23CS105	Basic Sciences	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes:48			

Course Objectives:

1. To learn the fundamentals of computers.
2. To understand the various steps in program development.
3. To learn the syntax and semantics of the C programming language.
4. To learn the usage of structured programming approaches in solving problems.

Course Outcomes: The student will learn

1. To write algorithms, draw flowcharts for solving problems and to convert to problems to C programs
2. To use arrays, pointers, strings and structures to write C programs.
3. To decompose a problem into functions and to develop modular reusable code.
4. To implement searching and sorting problems.
5. To learn about preprocessor directive and files concepts.

UNIT - I: Introduction to Programming Compilers, compiling and executing a program. Representation of Algorithm - Algorithms for finding roots of a quadratic equations, finding minimum and maximum numbers of a given set, finding if a number is prime number Flowchart/Pseudo code with examples, Program design and structured programming

Introduction to C Programming Language: variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code, Operators, expressions and precedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion, The main method and command line arguments Bitwise operations: Bitwise AND, OR, XOR and NOT operators

Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do- while loops I/O: Simple input and output with scanf and printf, formatted I/O, Introduction to stdin, stdout and stderr. Command line arguments

UNIT - II: Arrays, Strings, Structures and Pointers:

Arrays: one and two dimensional arrays, creating, accessing and manipulating elements of arrays Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strstr etc.), arrays of strings

Structures: Defining structures, initializing structures, unions, Array of structures

Pointers: Idea of pointers, Defining pointers, Pointers to Arrays and Structures, Use of Pointers in self-referential structures, usage of self-referential structures in linked list (no implementation) Enumeration data type

UNIT - III: Function and Dynamic Memory Allocation:

Functions: Designing structured programs, Declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, Passing arrays to functions, passing pointers to functions, idea of call by reference, Some C standard functions and libraries Recursion: Simple programs, such as Finding Factorial, Fibonacci series etc., Limitations of Recursive functions Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of different data types

UNIT - IV: Searching and Sorting:

Basic searching in an array of elements (linear and binary search techniques), Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms), Basic concept of order of complexity through the example programs

UNIT - V: Preprocessor and File handling in C:

Preprocessor: Commonly used Preprocessor commands like include, define, undef, if, ifdef, ifndef Files: Text and Binary files, Creating and Reading and writing text and binary files, Appending data to existing files, Writing and reading structures using binary files, Random access using fseek, ftell and rewind functions.

TEXT BOOKS:

1. Jeri R. Hanly and Elliot B.Koffman, Problem solving and Program Design in C 7th Edition, Pearson
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill
3. Yashavant Kanetkar, Let Us C, 18th Edition, BPB
4. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
5. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
6. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition
7. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

B Tech I Year I Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EN106	Humanity Sciences	0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32			Total Classes:32			

The English Language and Communication Skills (ELCS) Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Course Objectives:

1. To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
2. To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
3. To bring about a consistent accent and intelligibility by providing an opportunity for practice in speaking
4. To improve the fluency of students in spoken English and neutralize the impact of dialects.
5. To train students to use language appropriately for public speaking, group discussions and interviews

Course Outcomes: Students will be able to:

1. Understand the nuances of English language through audio- visual experience and group activities
2. Use English with proper pronunCIETion and intonation
3. Neutralize their accent for intelligibility
4. Develop speaking skills with clarity and confidence which in turn enhances their employability skills
5. Communicate confidently in Various situations and apply them in Professional communication

English Language and Communication Skills Lab (ELCS) shall have two parts:

1. **Computer Assisted Language Learning (CALL) Lab**
2. **Interactive Communication Skills (ICS) Lab**

Listening Skills

Objectives

1. To enable students develop their listening skills so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.

- a. Listening for general content
- b. Listening to fill up information
- c. Intensive listening
- d. Listening for specific information

Speaking Skills

Objectives

1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional contexts
 - Oral practice
 - Describing objects/situations/people
 - Role play – Individual/Group activities
 - Just A Minute (JAM) Sessions

The following course content is prescribed for the **English Language and Communication Skills Lab**

Exercise – I

CALL Lab:

Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening.

Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants – Minimal Pairs Consonant Clusters- Past Tense Marker and Plural Marker- Testing Exercises

ICS Lab:

Understand: Spoken vs. Written language- Formal and Informal English.

Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Exercise – II**CALL Lab:**

Understand: Structure of Syllables – Word Stress– Weak Forms and Strong Forms – Stress pattern in sentences – Intonation.

Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Stress pattern in sentences – Intonation - Testing Exercises

ICS Lab:

Understand: Features of Good Conversation – Strategies for Effective Communication.

Practice: Situational Dialogues – Role Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise - III**CALL Lab:**

Understand: Errors in Pronunciation- Neutralizing Mother Tongue Interference (MTI).

Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation -Testing Exercises

ICS Lab:

Understand: Descriptions- Narrations- Giving Directions and Guidelines – Blog Writing

Practice: Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions.

Exercise – IV**CALL Lab:**

Understand: Listening for General Details.

Practice: Listening Comprehension Tests - Testing Exercises

ICS Lab:

Understand: Public Speaking – Exposure to Structured Talks - Non-verbal Communication Presentation Skills.

Practice: Making a Short Speech – Extempore- Making a Presentation.

Exercise – V**CALL Lab:**

Understand: Listening for Specific Details.

Practice: Listening Comprehension Tests -Testing Exercises.

ICS Lab:

Understand: Group Discussion

Practice: Group Discussion

Source of Material (Master Copy):

- Exercises in Spoken English. Part 1,2,3. CIEFL and Oxford University Press

Suggested Software:

- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley.
- Punctuation Made Easy by Darling Kindersley.
- Oxford Advanced Learner's Compass, 10th Edition.
- English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
- Digital All
- Orell Digital Language Lab (Licensed Version)

REFERENCE BOOKS:

1. (2022). English Language Communication Skills – Lab Manual cum Workbook. Cengage Learning India Pvt. Ltd.
2. Shobha, KN & Rayen, J. Lourdes. (2019). Communicative English – A workbook. Cambridge University Press
3. Kumar, Sanjay & Lata, Pushp. (2019). Communication Skills: A Workbook. Oxford University Press
4. Board of Editors. (2016). ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities. Orient Black Swan Pvt. Ltd.
5. Mishra, Veerendra et al. (2020). English Language Skills: A Practical Approach. Cambridge University Press.

PROGRAMMING FOR PROBLEM SOLVING LABORATORY

B Tech I Year I Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23CS107	Engineering Sciences	0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32			Total Classes:32			

*[Note: The programs may be executed using any available Open Source/
Freely available IDE Some of the Tools available are:
Code Lite: <https://codelite.org/>*

Code: Blocks: <http://www.codeblocks.org/>

DevCpp: <http://www.bloodshed.net/devcpp.html>

Eclipse: <http://www.eclipse.org>

This list is not exhaustive and is NOT in any order of preference]

Course Objectives: The students will learn the following:

1. To work with an IDE to create, edit, compile, run and debug programs
2. To analyze the various steps in program development.
3. To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
4. To develop modular, reusable and readable C Programs using the concepts like functions, arrays etc.
5. To Write programs using the Dynamic Memory Allocation concept.
6. To create, read from and write to text and binary files

Course Outcomes: The candidate is expected to be able to:

1. formulate the algorithms for simple problems
2. translate given algorithms to a working and correct program
3. correct syntax errors as reported by the compilers
4. identify and correct logical errors encountered during execution
5. represent and manipulate data with arrays, strings and structures
6. use pointers of different types
7. create, read and write to and from simple text and binary files
8. modularize the code with functions so that they can be reused

Practice sessions:

- a. Write a simple program that prints the results of all the operators available in C (including pre/ post increment , bitwise and/or/not , etc.). Read required operand values from standard input.

- b. Write a simple program that converts one given data type to another using auto conversion and casting. Take the values from standard input.

Simple numeric problems:

- a. Write a program for finding the max and min from the three numbers.
 b. Write the program for the simple, compound interest.
 c. Write a program that declares Class awarded for a given percentage of marks, where mark

<40%= Failed, 40% to <60% = Second class, 60% to <70%=First class, >= 70% = Distinction. Read percentage from standard input.

- d. Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be:
 e. e. $5 \times 1 = 5$
 f. f. $5 \times 2 = 10$
 g. g. $5 \times 3 = 15$
 h. h. Write a program that shows the binary equivalent of a given positive number between 0 to 255.

Expression Evaluation:

- a. A building has 10 floors with a floor height of 3 meters each. A ball is dropped from the top of the building. Find the time taken by the ball to reach each floor. (Use the formula $s = ut + \frac{1}{2}at^2$ where u and a are the initial velocity in m/sec (= 0) and acceleration in m/sec^2 (= 9.8 m/s^2)).
 b. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use Switch Statement)
 c. Write a program that finds if a given number is a prime number
 d. Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.
 e. 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 C program to generate the first n terms of the sequence.
 f. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
 g. Write a C program to find the roots of a Quadratic equation.
 h. Write a C program to calculate the following, where x is a fractional value. i. $1 - \frac{x}{2} + \frac{x^2}{4} - \frac{x^3}{6}$
 j. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: $1 + x + x^2 + x^3 + \dots + x^n$. For example: if n is 3 and x is 5, then the program computes $1 + 5 + 25 + 125$.

Arrays, Pointers and Functions:

- a. Write a C program to find the minimum, maximum and average in an array of integers.
- b. Write a function to compute mean, variance, Standard Deviation, sorting of n elements in a single dimension array.
- c. Write a C program that uses functions to perform the following:
- d. Addition of Two Matrices
- e. Multiplication of Two Matrices
- f. Transpose of a matrix with memory dynamically allocated for the new matrix as row and column counts may not be the same.
- g. Write C programs that use both recursive and non-recursive functions
- h. To find the factorial of a given integer.
- i. To find the GCD (greatest common divisor) of two given integers.
- j. To find x^n
- k. Write a program for reading elements using a pointer into an array and display the values using the array.
- l. Write a program for display values reverse order from an array using a pointer.
- m. Write a program through a pointer variable to sum of n elements from an array.

Files:

- a. Write a C program to display the contents of a file to standard output device.
- b. Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.
- c. Write a C program to count the number of times a character occurs in a text file. The file name and the character are supplied as command line arguments.
- d. Write a C program that does the following:

It should first create a binary file and store 10 integers, where the file name and 10 values are given in the command line. (hint: convert the strings using atoi function)

Now the program asks for an index and a value from the user and the value at that index should be changed to the new value in the file. (hint: use fseek function)

The program should then read all 10 values and print them back.

- e. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file).

Strings:

- a. Write a C program to convert a Roman numeral ranging from I to L to its decimal equivalent.
- b. Write a C program that converts a number ranging from 1 to 50 to Roman equivalent
- c. Write a C program that uses functions to perform the following operations:
- d. To insert a sub-string into a given main string from a given position.
- e. To delete n Characters from a given position in a given string.
- f. Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)
- g. Write a C program that displays the position of a character ch in the string S or - 1 if S doesn't contain ch.
- h. Write a C program to count the lines, words and characters in a given text.

Miscellaneous:

- a. Write a menu driven C program that allows a user to enter n numbers and then choose between finding the smallest, largest, sum, or average. The menu and all the choices are to be functions. Use a switch statement to determine what action to take. Display an error message if an invalid choice is entered.

- b. Write a C program to construct a pyramid of numbers as follows:

```

1           *           1           1           *
1 2        **         2 3         2 2         **
1 2 3      ***        4 5 6        3 3 3        ***
                                     4 4 4 4        ****

```

Sorting and Searching:

- a. Write a C program that uses non recursive function to search for a Key value in a given
- b. list of integers using linear search method.
- c. Write a C program that uses non recursive function to search for a Key value in a given
- d. sorted list of integers using binary search method.
- e. Write a C program that implements the Bubble sort method to sort a given list of
- f. integers in ascending order.
- g. Write a C program that sorts the given array of integers using selection sort in descending order
- h. Write a C program that sorts the given array of integers using insertion sort in ascending order
- i. Write a C program that sorts a given array of names

TEXT BOOKS:

1. Jeri R. Hanly and Elliot B.Koffman, Problem solving and Program Design in C 7th Edition, Pearson
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PHI
2. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill
3. Yashavant Kanetkar, Let Us C, 18th Edition, BPB
4. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
5. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
6. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition
7. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

ENGINEERING CHEMISTRY LABORATORY**B Tech I Year I Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23CH108	Basic Sciences	0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32			Total Classes:32			

Course Objectives: The course consists of experiments related to the principles of chemistry required for engineering student. The student will learn:

1. Estimation of hardness of water to check its suitability for drinking purpose.
2. To perform estimations of acids and bases using conductometry, potentiometry and pH metry methods.
3. To prepare polymers such as Bakelite and nylon-6 in the laboratory.
4. Skills related to the lubricant properties such as saponification value, surface tension and viscosity of oils
5. How to analyze the rate of corrosion of steel.

Course outcomes:

The students will be able to:

1. Determination of parameters like hardness of water and rate of corrosion of mild steel in various conditions.
2. Perform methods such as conductometry, potentiometry and pH metry in order to find out the concentrations or equivalence points of acids and bases.
3. Prepare polymers like bakelite and nylon-6.
4. Estimate surface tension and viscosity of lubricant oils.
5. Determine the rate of corrosion of steel in presence and absence of inhibitor

LIST OF EXPERIMENTS:

1. Volumetric Analysis: Estimation of Hardness of water by EDTA Complexometry method.
2. Conductometry: Estimation of the concentration of an acid by Conductometry.
3. Potentiometry: Estimation of the amount of Fe⁺² by Potentiometry.
4. pH Metry: Determination of an acid concentration using pH meter.
5. Preparations:
 1. Preparation of Bakelite.
 2. Preparation Thiokol Rubber.

6. Lubricants:

1. Estimation of acid value of given lubricant oil.
2. Estimation of Viscosity of lubricant oil using Ostwald's Viscometer.
3. Estimation of Surface Tension of lubricant oil using Stalagmometer.

7. Virtual lab experiments

1. Construction of Fuel cell and it's working.
2. Smart materials for biomedical applications
3. Batteries for electrical vehicles.
4. Functioning of solar cell and its applications.
5. Corrosion: Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.
6. Preparation of nylon-6.

REFERENCE BOOKS:

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022)
2. Vogel's text book of practical organic chemistry 5th edition
3. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007)

ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING

B Tech I Year I Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE109	Engineering Sciences	0	0	2	1	40	60	100
		Practical Classes: 32				Total Classes:32		
Contact Classes: Nil	Tutorial Classes: Nil							

Prerequisites: Elements of Electrical Engineering

Course Objectives:

1. To measure the electrical parameters for different types of DC and AC circuits using conventional approach.
2. To study the transient response of various R, L and C circuits using different excitations.
3. To evaluate the concepts of theorem for electrical circuits
4. To determine the performance of different types of DC machines
5. To determine the performance of Transformers

Course Outcomes: After learning the contents of this paper the student must be able to

1. Verify the basic Electrical circuits through different experiments.
2. Analyze the transient responses of R, L and C circuits for different input conditions
3. Evaluate and apply the concepts of theorem for electrical circuits
4. Evaluate the performance calculations of Electrical Machines through various testing methods
5. Evaluate the performance calculations of Transformers through various testing methods

List of experiments/demonstrations:

PART-A (compulsory)

1. Verification of Ohm's Law
2. Verification of KVL and KCL
3. Verification of Thevenin's and Norton's theorem
4. Verification of Superposition theorem
5. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits

6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
7. Performance Characteristics of a DC Shunt Motor
8. Open Circuit and Short Circuit Tests on 1-phase Transformer

PART-B (any two experiments from the given list)

1. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
2. Verification of Reciprocity and Milliman's Theorem.
3. Verification of Maximum Power Transfer Theorem.
4. Determination of form factor for non-sinusoidal waveform
5. Transient Response of Series RL and RC circuits for DC excitation

TEXT BOOKS:

1. D.P.Kothari and I.J.Nagrath, "Basic Electrical Engineering", Tata Mc Graw Hill, 4th Edition, 2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata Mc Graw Hill, 2nd Edition, 2008.

REFERENCE BOOKS:

1. P.Ramana, M.Suryakalavathi, G.T.Chandrasheker, "Basic Electrical Engineering", S.Chand, 2nd Edition, 2019.
2. D.C.Kulshreshtha, "Basic Electrical Engineering", Mc Graw Hill, 2009
3. M.S.Sukhija, T.K.Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford, 1st Edition, 2012.
4. Abhijit Chakrabarthy, Sudipta Debnath, Chandan Kumar Chanda, "Basic Electrical Engineering", 2nd Edition, Mc Graw Hill, 2021.
5. L.S.Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
6. E.Hughes, "Electrical and Electronics Technology", Pearson, 2010.
7. V. D.Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989

ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS**B Tech I Year II Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23MA201	Basic Sciences	3	1	0	4	40	60	100
Contact Classes: 48	Tutorial Classes: 16	Practical Classes: Nil			Total Classes:64			

Pre-requisites: Mathematical Knowledge at pre-university level

Course Objectives: To learn

1. Various analytical Methods to solve first order first degree ordinary differential equations.
2. Methods to solve higher order ordinary differential equations.
3. Concept, properties of Laplace transforms and solving ordinary differential equations using Laplace transforms techniques.
4. The physical quantities involved in engineering field related to vector valued functions
5. Line, Surface and Volume integrals and their applications

Course outcomes: the student will be able to

1. Find the solutions of first order first degree differential equations and their applications.
2. Solve higher differential equation and apply the concept of differential equation to real world problems.
3. Use the Laplace transforms techniques for solving ordinary differential equations.
4. Calculate gradient of scalar point function and divergence, curl of vector point function.
5. Evaluate the line, surface and volume integrals and converting them from one to another.

UNIT-I: First Order ODE: Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (Cartesian & Polar Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay, First order but not of first degree: solvable for 'p' and Clairaut's equations.

UNIT-II: Ordinary Differential Equations of Higher Order

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax} , \sin , $\cos ax$, polynomials in x , $e^{ax}V(x)$ and $x^m V(x)$, (method of variation of parameters, Equations reducible to linear ODE with constant coefficients: Cauchy-Euler equation.

UNIT-III: Laplace transforms

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

UNIT-IV: Vector Differentiation

Vector point functions and scalar point functions, Gradient, Divergence and Curl, Directional derivatives, Tangent plane and normal line, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration Line, Surface and Volume Integrals, Theorems of Green, Gauss and Stokes (without proofs) and their applications.

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5 th Edition, 2016.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

APPLIED PHYSICS**B Tech I Year II Sem**

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23PH202	Basic Sciences	3	1	0	4	40	60	100
Contact Classes: 48	Tutorial Classes: 16	Practical Classes: Nil			Total Classes:64			

Course Objectives:

The objectives of this course for the student are to:

1. Understand the basic principles of quantum physics and band theory of solids.
2. Understand the underlying mechanism involved in construction and working principles of various semiconductor devices.
3. Study the fundamental concepts related to the dielectric, magnetic and energy materials.
4. Identify the importance of nanoscale, quantum confinement and various fabrications techniques.
5. Study the characteristics of lasers and optical fibers

Course Outcomes: Upon graduation he student will be able to:

1. Analyze the concepts of Quantum mechanics and visualize the difference between conductor, semiconductor, and an insulator by classification of solids.
2. Identify the role of semiconductor devices in science and engineering Applications.
3. Explore the fundamental properties of dielectric and magnetic materials.
4. Appreciate the features and applications of Nanomaterials.
5. Analyze various aspects of Lasers and Optical fiber and their applications in diverse fields.

UNIT - I: QUANTUM PHYSICS AND SOLIDS

Quantum Physics: Introduction to quantum physics, Blackbody radiation – Stefan-Boltzmann’s law, Planck’s radiation law - Wein’s and Rayleigh-Jean’s law, Photoelectric effect, Matter Waves, de - Broglie Hypothesis, Davisson and Germer experiment, Heisenberg uncertainty principle, Time independent Schrodinger wave equation, Born interpretation of the wave function, Particle in one dimensional potential box.

Solids: Classical & Quantum free electron theory (Qualitative), Bloch’s theorem, Kronig-Penney model, E-K diagram, Effective mass of electron, Origin of energy bands - classification of solids.

UNIT - II: SEMICONDUCTORS AND DEVICES

Intrinsic and extrinsic semiconductors(Qualitative) – Hall effect - direct and indirect band gap semiconductors - construction, principle of operation and I-V characteristics of P-N Junction diode, Zener diode, bipolar junction Transistor(BJT) - LED, PIN diode, avalanche photo diode (APD) and solar cells, their structure, materials, working principle and I-V characteristics.

UNIT - III: DIELECTRIC AND MAGNETIC MATERIALS

Dielectric Materials: Basic definitions, Types of polarizations (qualitative) -Langevin-Debye equation, Internal fields in a solid, Clausius - Mossotti equation ferroelectric, piezoelectric, and pyroelectric materials – applications, liquid crystal displays (LCD) and crystal oscillators.

Magnetic Materials: Basic definitions, Classification of magnetic materials, Domain theory, Hysteresis - soft and hard magnetic materials, magnetostriction, magneto resistance - applications - magnetic field sensors and multiferroics.

UNIT-IV : NANOTECHNOLOGY

Nanoscale, Quantum Confinement, Surface to volume ratio, Bottom-Up Fabrication: Sol-Gel – Precipitation- Combustion methods, Top-Down Fabrication: Ball Milling - Physical Vapor Deposition (PVD) - Chemical Vapor Deposition (CVD), Characterization Techniques: XRD, SEM & TEM, Applications of Nano materials.

UNIT - V: LASER AND FIBER OPTICS

Lasers: Laser beam characteristics, Three quantum processes, Einstein coefficients and their relations, Population Inversion, Lasing action, Pumping methods, Ruby laser, He-Ne Laser , CO₂ Laser, Nd-Yag Laser, semiconductor laser-applications of laser.

Fiber Optics: Introduction to optical fiber- advantages of optical Fibers - total internal reflection, construction of optical fiber - acceptance angle - numerical aperture-classification of optical fibers -losses in optical fiber - optical fiber for communication system - applications.

TEXT BOOKS:

1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy” A Text book of Engineering Physics”- S. Chand Publications, 11th Edition 2019.
2. Engineering Physics by Shatendra Sharma and Jyotsna Sharma, Pearson Publication,2019
3. Semiconductor Physics and Devices- Basic Principle – Donald A, Neamen, Mc Graw Hill, 4 thEdition,2021.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2ndEdition,2022.
5. Essentials of Nanoscience & Nanotechnology by Narasimha Reddy Katta, Typical Creatives NANO DIGEST, 1st Edition, 2021.
6. Modern Engineering Physics by Dr. K. Vijay Kumar, Dr. Chandralingam, S.Chand Publications,

REFERENCE BOOKS:

1. Quantum Physics, H.C. Verma, TBS Publication, 2nd Edition 2012.
2. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley & Sons, 11th Edition, 2018.
3. Introduction to Solid State Physics, Charles Kittel, Wiley Eastern, 2019.
4. Elementary Solid State Physics, S.L. Gupta and V. Kumar, Pragathi Prakashan, 2019. 5. A.K. Bhandhopadhya - Nano Materials, New Age International, 1st Edition, 2007.

COMPUTER AIDED ENGINEERING GRAPHICS**B Tech I Year II Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23ME203	Engineering Sciences	3	1	0	4	40	60	100
Contact Classes: 48	Tutorial Classes: 16	Practical Classes: Nil			Total Classes:64			

Course Objectives:

1. To develop the ability of visualization of different objects through technical drawings
2. To acquire computer drafting skill for communication of concepts, ideas in the design of engineering products

Course Outcomes: At the end of the course, the student will be able to:

1. Apply computer aided drafting tools to create 2D and 3D objects
2. Sketch conics and different types of solids
3. Appreciate the need of Sectional views of solids and Development of surfaces of solids Read and interpret engineering drawings
4. Conversion of orthographic projection into isometric view and vice versa manually and by using computer aided drafting

UNIT – I:

Introduction to Engineering Graphics: Principles of Engineering Graphics and their Significance, Scales – Plain & Diagonal, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Introduction to Computer aided drafting – views, commands and conics

UNIT- II:

Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes. Computer aided orthographic projections – points, lines and planes

UNIT – III:

Projections of Regular Solids – Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views, Computer aided projections of solids – sectional views

UNIT – IV:

Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone, Development of surfaces using computer aided drafting

UNIT – V:

Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions. Conversion of orthographic projection into isometric view using computer aided drafting.

TEXT BOOKS:

1. Engineering Drawing N.D. Bhatt / Charotar
2. Engineering Drawing and graphics Using AutoCAD Third Edition, T. Jeyapooan, Vikas: S. Chand and company Ltd.

REFERENCE BOOKS:

1. Engineering Drawing, Basant Agrawal and C M Agrawal, Third Edition McGraw Hill
2. Engineering Graphics and Design, WILEY, Edition 2020
3. Engineering Drawing, M. B. Shah, B.C. Rane / Pearson.
4. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford
5. Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

Note: - External examination is conducted in conventional mode and internal evaluation to be done by the conventional as well as using computer aided drafting.

ELECTRICAL CIRCUIT ANALYSIS – II**B Tech I Year II Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE205	Engineering Sciences	2	0	0	2	40	60	100
Contact Classes: 32	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes:32			

Prerequisites: Mathematics

Course Objectives:

1. To study the transient analysis of various R, L and C circuits for different inputs.
2. To analyze the electrical circuits using Laplace transformation.
3. To learn about two-port networks.
4. To understand the Fourier series.
5. To learn about concept of filters.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Observe the response of various R, L and C circuits for different excitations.
2. Examine the behavior of circuits using Laplace transforms and transfer function of single port network.
3. Obtain two port network parameters and applications and design of various filters.
4. Examine the behavior of circuits using Fourier series and transfer function of single port network.
5. Obtain the design concepts of various filters and their applications.

Course Outcomes	Program Outcomes											
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	3											2
CO2	3	2										2
CO3	3	2										2
CO4	3	2										2
CO5	3	2	2									2

UNIT-I

Transient analysis: Transient response of R, L & C circuits, Formulation of integral differential equations, Initial conditions, Transient Response of RL, RC and RLC (series and parallel) networks subjected to internal energy, Response to impulse, step, and ramp, exponential and sinusoidal excitations.

UNIT-II

Electrical circuit Analysis using Laplace Transforms: Application of Laplace Transforms to RL, RC and RLC (series and parallel) Networks for impulse, step, and ramp, exponential and sinusoidal excitations.

UNIT-III

Two port network parameters: Open circuit impedance, short-circuit admittance, Transmission, Hybrid parameters & inter-relationships, Series, parallel and cascade connection of two port networks, System function, and Impedance and admittance functions.

UNIT-IV

Fourier Series and Integral: Fourier series representation of periodic functions, Symmetry conditions, Exponential Fourier series, Discrete spectrum, Fourier integral and its properties, Continuous spectrum, Application to simple networks

UNIT-V

Filters: Classification of filters – Low pass, High pass, Band pass and Band Elimination, Constant-k and M-derived filters-Low pass and High pass Filters and Band pass and Band elimination filters(Elementary treatment only)

TEXT BOOKS:

1. VanValkenburg M.E, "Network Analysis", Prentice Hall of India, 3rd Edition, 2000.
2. Ravish R Singh, "Network Analysis and Synthesis", McGraw Hill, 2nd Edition, 2019.

REFERENCEBOOKS:

1. B. Subramanyam, "Electric Circuit Analysis", Dream tech Press & Wiley, 2021.
2. James W. Nilsson, Susan A. Riedel, "Electric Circuits", Pearson, 11th Edition, 2020.
3. A Sudhakar, Shyammohan S Palli, "Circuits and Networks: Analysis and Synthesis", Mc Graw Hill, 5th Edition, 2017.
4. Jagan N.C, Lakshrninarayana C., "Network Analysis", B.S. Publications, 3rd Edition, 2014.
5. William Hayt H , Kimmerly Jack E. And Steven Durbin M, "Engineering Circuit Analysis", Mc Graw Hill, 6th Edition, 2002.
6. Chakravarthy A., "Circuit Theory", Dhanpat Rai & Co., First Edition, 1999.

APPLIED PHYSICS LAB**B Tech I Year II Sem**

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23PH205	Basic Sciences	0	0	3	1.5	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 48			Total Classes:48			

Course Objectives: The objectives of this course for the student to

1. Capable of handling instruments related to the Hall effect and photoelectric effect experiments and their measurements.
2. Understand the characteristics of various devices such as PN junction diode, Zener diode, BJT, LED, solar cell, lasers and optical fiber and measurement of energy gap and resistivity of semiconductor materials.
3. Able to measure the characteristics of dielectric constant of a given material.
4. Study the behavior of B-H curve of ferromagnetic materials.
5. Understanding the method of least squares fitting.

Course Outcomes: The students will be able to:

1. Know the determination of the Planck's constant using Photo electric effect and identify the material whether it is n-type or p-type by Hall experiment.
2. Appreciate quantum physics in semiconductor devices and optoelectronics.
3. Gain the knowledge of applications of dielectric constant.
4. Understand the variation of magnetic field and behavior of hysteresis curve.
5. Carried out data analysis.

LIST OF EXPERIMENTS:

1. Determination of work function and Planck's constant using photoelectric effect.
2. Determination of Hall co-efficient and carrier concentration of a given semiconductor.
3. Characteristics of series and parallel LCR circuits.
4. V-I characteristics of a p-n junction diode and Zener diode
5. Input and output characteristics of BJT (CE, CB & CC configurations)
6. a) V-I and L-I characteristics of light emitting diode (LED)
b) V-I Characteristics of solar cell
7. Determination of Energy gap of a semiconductor.
8. Study B-H curve of a magnetic material.
9. Determination of dielectric constant of a given material
10. a) Determination of the beam divergence of the given LASER beam
b) Determination of Acceptance Angle and Numerical Aperture of an optical fiber.
11. Understanding the method of least squares – torsional pendulum as an example.

Note: Any 8 experiments are to be performed.

REFERENCE BOOK: S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.

PYTHON PROGRAMMING LABORATORY**B Tech I Year II Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23CS206	Engineering Sciences	1	0	2	2	40	60	100
Contact Classes: 16	Tutorial Classes: Nil	Practical Classes: 32			Total Classes:48			

Course Objectives:

- To install and run the Python interpreter
- To learn control structures.
- To Understand Lists, Dictionaries in python
- To Handle Strings and Files in Python

Course Outcomes: After completion of the course, the student should be able to

1. Develop the application specific codes using python.
2. Understand Strings, Lists, Tuples and Dictionaries in Python
3. Verify programs using modular approach, file I/O, Python standard library
4. Implement digital system using Python
5. Implement GUI program to create window wizard

Note: The lab experiments will be like the following experiment examples

Week -1:

1. i) Use a web browser to go to the Python website <http://python.org>. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.
 - ii) Start the Python interpreter and type help() to start the online help utility.
2. Start a Python interpreter and use it as a Calculator.
 3.
 - i. Write a program to calculate compound interest when principal, rate and number of periods are given.
 - ii. Given coordinates (x1, y1), (x2, y2) find the distance between two points
4. Read name, address, email and phone number of a person through keyboard and print the details.

Week - 2:

1. Print the below triangle using for loop.

5

4 4

3 3 3

2 2 2 2

1 1 1 1 1

2. Write a program to check whether the given input is digit or lowercase character or uppercase character or a special character (use 'if-else-if ladder')
3. Python Program to Print the Fibonacci sequence using while loop
4. Python program to print all prime numbers in a given interval (use break)

Week - 3:

1. i) Write a program to convert a list and tuple into arrays.
ii) Write a program to find common values between two arrays.
2. Write a function called gcd that takes parameters a and b and returns their greatest common divisor.
3. Write a function called palindrome that takes a string argument and returns True if it is a palindrome and False otherwise. Remember that you can use the built-in function len to check the length of a string.

Week - 4:

1. Write a function called is sorted that takes a list as a parameter and returns True if the list is sorted in ascending order and False otherwise.
2. Write a function called has duplicates that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.
 - i. Write a function called remove duplicates that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.
 - ii. The wordlist I provided, words.txt, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.
 - iii. Write a python code to read dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys.
3. i) Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'
ii. Remove the given word in all the places in a string?

- iii. Write a function that takes a sentence as an input parameter and replaces the first letter of every word with the corresponding upper case letter and the rest of the letters in the word by corresponding letters in lower case without using a built-in function?

4. Writes a recursive function that generates all binary strings of n-bit length

Week - 5:

1.
 - i) Write a python program that defines a matrix and prints
 - ii. Write a python program to perform addition of two square matrices
 - iii. Write a python program to perform multiplication of two square matrices
2. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.
3. Use the structure of exception handling all general purpose exceptions.

Week-6:

1.
 - a. Write a function called `draw_rectangle` that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.
 - b. Add an attribute named `color` to your Rectangle objects and modify `draw_rectangle` so that it uses the `color` attribute as the fill color.
 - c. Write a function called `draw_point` that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas.
 - d. Define a new class called Circle with appropriate attributes and instantiate a few Circle objects. Write a function called `draw_circle` that draws circles on the canvas.
2. Write a Python program to demonstrate the usage of Method Resolution Order (MRO) in multiple levels of Inheritances.
3. Write a python code to read a phone number and email-id from the user and validate it for correctness.

Week- 7

1. Write a Python code to merge two given file contents into a third file.
2. Write a Python code to open a given file and construct a function to check for given words present in it and display on found.
3. Write a Python code to Read text from a text file, find the word with most number of occurrences
4. Write a function that reads a file *file1* and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters.

Week - 8:

1. Import numpy, Plotpy and Scipy and explore their functionalities.
2. a) Install NumPy package with pip and explore it.
3. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
4. Write a program to implement Half Adder, Full Adder, and Parallel Adder

5. Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset.

TEXT BOOKS:

1. Supercharged Python: Take your code to the next level, Overland.
2. Learning Python, Mark Lutz, O'reilly.

REFERENCE BOOKS:

1. Python for Data Science, Dr. Mohd. Abdul Hameed, Wiley Publications - 1st Ed. 2021.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.
3. Python Programming A Modular Approach with Graphics, Database, Mobile, and Web Applications, Sheetal Taneja, Naveen Kumar, Pearson.
4. Programming with Python, A User's Book, Michael Dawson, Cengage Learning, India Edition.
5. Think Python, Allen Downey, Green Tea Press.
6. Core Python Programming, W. Chun, Pearson.
7. Introduction to Python, Kenneth A. Lambert, Cengage.

ELECTRICAL CIRCUIT ANALYSIS LABORATORY**B Tech I Year II Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE208	Engineering Sciences	0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32			Total Classes: 32			

Prerequisites: Elements of Electrical Engineering & Electrical Circuit Analysis

Course Objectives:

1. To design electrical systems and analyze them by applying various Network Theorems
2. To measure three phase Active and Reactive power.
3. To understand the locus diagrams and concept to resonance.
4. To study the operation of low pass and high pass filters.
5. To evaluate the two-port network parameters.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Analyze complex DC and AC linear circuits
2. Apply concepts of electrical circuits across engineering
3. Evaluate response of a given network by using theorems.
4. Study and apply the operation of low pass and high pass filters
5. Evaluate two-port network parameters.

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2							2			2
CO2	3	2							2			2
CO3	3	2	1	1					2			2
CO4	3	2							2			2
CO5	3	2	1	1					2			2

The following experiments are required to be conducted as compulsory

1. To draw the locus Diagrams of RL (R-Varying) and RC (R-Varying) Series Circuits.
2. Verification of Series and Parallel Resonance.
3. Determination of Time response of first order RL and RC circuit for periodic non-sinusoidal inputs–Time Constant and Steady state error.
4. Determination of Two port network parameters – Z & Y parameters.
5. Determination of Two port network parameters – A, B, C, D parameters.
6. Determination of Co-efficient of Coupling and Separation of Self and Mutual inductance in a Coupled Circuits.
7. Frequency domain analysis of Low-pass filters.
8. Frequency domain analysis of Band-pass filters.

In addition to the above eight experiments, atleast any two of the experiments from the following list are required to be conducted

1. Harmonic Analysis of non-sinusoidal wave form signals using Harmonic Analyzer and plotting frequency spectrum.
2. Measurement of Active Power for Star and Delta connected balanced loads.
3. Measurement of Reactive Power for Star and Delta connected balanced loads.
4. Frequency domain analysis of High-pass filters.
5. Determination of Two port network parameters – Hybrid parameters.
6. To draw the locus Diagrams of RL (L-Varying) and RC (C-Varying) Series Circuits.
7. Determination of Time response of first order RLC circuit for periodic non-sinusoidal inputs – Time Constant and Steady state error.

TEXT BOOKS:

1. Van Valkenburg M.E, “Network Analysis”, Prentice Hall of India, 3rd Edition, 2000.
2. Ravish R Singh, “Network Analysis and Synthesis”, Mc Graw Hill, 2nd Edition, 2019.

REFERENCE BOOKS:

1. B. Subramanyam, “Electric Circuit Analysis”, Dream tech Press & Wiley, 2021.
2. James W. Nilsson, Susan A. Riedel, “Electric Circuits”, Pearson, 11th Edition, 2020.
3. A Sudhakar, Shyammohan S Palli, “Circuits and Networks: Analysis and Synthesis”, Mc Graw Hill, 5th Edition, 2017.
4. Jagan N.C, Lakshrninarayana C., “Network Analysis”, B.S. Publications, 3rd Edition, 2014.
5. William Hayt H, Kimmerly Jack E. and Steven Durbin M, “Engineering Circuit Analysis”, Mc Graw Hill, 6th Edition, 2002.
6. Chakravarthy A., “Circuit Theory”, Dhanpat Rai & Co., First Edition, 1999.

ENGINEERING WORKSHOP**B Tech I Year II Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23ME208	Engineering Sciences	1	0	3	2.5	40	60	100
Contact Classes: 16	Tutorial Classes: Nil	Practical Classes: 48			Total Classes:64			

Pre-requisites: Practical skill

Course Objectives:

1. To Study of different hand operated power tools, uses and their demonstration.
2. To gain a good basic working knowledge required for the production of various engineering products.
3. To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
4. To develop a right attitude, team working, precision and safety at work place.
5. It explains the construction, function, use and application of different working tools, equipment and machines.
6. To study commonly used carpentry joints.
7. To have practical exposure to various welding and joining processes.
8. Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

Course Outcomes: At the end of the course, the student will be able to:

1. Study and practice on machine tools and their operations
2. Practice on manufacturing of components using workshop trades including plumbing, fitting, carpentry, foundry, house wiring and welding.
3. Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
4. Apply basic electrical engineering knowledge for house wiring practice.
5. Apply basic mechanical knowledge for metal cutting and use of power tools in construction of wood working.

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

I. Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)

II. Fitting – (V-Fit, Dovetail Fit & Semi-circular fit)

III. Tin-Smithy – (Square Tin, Rectangular Tray & Conical Funnel)

IV. Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)

V. Welding Practice – (Arc Welding & Gas Welding)

VI. House-wiring – (Parallel & Series, Two-way Switch and Tube Light)

VII. Black Smithy – (Round to Square, Fan Hook and S-Hook)

2. TRADES FOR DEMONSTRATION & EXPOSURE:

Plumbing, Machine Shop, Metal Cutting (Water Plasma), Power tools in construction and Wood Working

TEXT BOOKS:

1. Workshop Practice /B. L. Juneja / Cengage
2. Workshop Manual / K. Venugopal / Anuradha.

REFERENCE BOOKS:

1. Work shop Manual - P. Kannaiah/ K.L. Narayana/ Scitech
2. Workshop Manual / Venkat Reddy/ BSP

NUMERICAL METHODS AND COMPLEX VARIABLES**B Tech II Year I Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23MA301	Basic Sciences	3	1	0	4	40	60	100
Contact Classes: 48	Tutorial Classes: 16	Practical Classes: Nil			Total Classes:64			

Pre-requisites: Mathematics courses of first year of study.

Course Objectives: To learn

1. Various numerical methods to find roots of polynomial and transcendental equations.
2. Concept of finite differences and to estimate the value for the given data using interpolation.
3. Evaluation of integrals using numerical techniques
4. Solving ordinary differential equations of first order using numerical techniques.
5. Differentiation and integration of complex valued functions.
6. Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
7. Expansion of complex functions using Taylor's and Laurent's series.

Course outcomes: After learning the contents of this paper the student must be able to

1. Express any periodic function in terms of sine and cosine
2. Find the root of a given polynomial and transcendental equations and Estimate the value for the given data using interpolation
3. Find the numerical solutions for a given first order ODE's
4. Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems
5. Taylor's and Laurent's series expansions in complex function

UNIT-I:**Fourier Series & Fourier Transforms:**

Fourier series - Dirichlet's Conditions - Half-range Fourier series - Fourier Transforms: Fourier Sine and cosine transforms - Inverse Fourier transforms.

UNIT-II:**Numerical Methods-I**

Solution of polynomial and transcendental equations: Bisection method, Iteration Method, Newton- Raphson method and Regula-Falsi method. Jacobi and Gauss-Seidal iteration methods for solving linear systems of equations. Finite differences: forward differences, backward differences, central differences, symbolic relations and separation of symbols, Interpolation using Newton's forward and backward difference formulae. Central difference interpolation: Gauss's forward and backward formulae, Lagrange's method of interpolation.

UNIT-III: Numerical Methods-II

Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8th rules. Ordinary differential equations: Taylor's series, Picard's method, Euler and modified Euler's methods, Runge-Kutta method of fourth order for first order ODE

UNIT-IV: Complex Differentiation

Limit, Continuity and Differentiation of Complex functions. Cauchy-Riemann equations (without proof), Milne-Thomson methods, analytic functions, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties. (All theorems without Proofs), Conformal mappings, Mobius transformations.

UNIT-V: Complex Integration:

Line integrals, Cauchy's theorem, Cauchy's Integral formula, zeros of analytic functions, singularities, Taylor's series, Laurent's series, Residues, Cauchy Residue theorem and their properties (All theorems without Proofs).

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

REFERENCE BOOKS:

1. M. K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering
2. Computations, New Age International publishers.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. J. W. Brown

ELECTRICAL MACHINES-I**B Tech II Year I Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE302	Professional core	3	1	0	4	40	60	100
Contact Classes: 48	Tutorial Classes: 16	Practical Classes: Nil			Total Classes:64			

Prerequisites: Electrical Circuit Analysis-1 & Electrical Circuit Analysis-2

Course Objectives:

1. To study and understand different types of DC Generators and their performance evaluation through various testing methods.
2. To study and understand different types of DC Motor and their performance evaluation through various testing methods
3. To analyze the performance of transformers through various testing methods.
4. To understand the operation of single Transformers
5. To understand the operation of poly-phase Transformers

Course Outcomes: After learning the contents of this paper, the student must be able to

1. Identify different parts of a DC generator & understand their operation.
2. Identify different parts of a DC motor & understand their operation.
3. Analyze and test the d.c machines performances.
4. Understand the operation and characteristics of transformers.
5. Analyze single & three phase transformers and their performance through testing.

UNIT-I:

D.C. GENERATORS: Principle of operation – Action of commutator– constructional features –armature windings – lap and wave windings – use of laminated armature – E.M.F Equation. Armature reaction–Cross magnetizing and de-magnetizing AT/pole – compensating winding–commutation– reactance voltage – methods of improving commutation. Methods of Excitation – separately excited and self-excited generators–build-up of E.M.F-critical field resistance and critical speed. Load characteristics and applications of shunt, series and compound generators.

UNIT-II:

D.C MOTORS: Principle of operation – Back E.M.F. - Torque equation – characteristics and application of shunt, series and compound motors – Armature reaction and commutation.

Speed control of D.C. Motors - Armature voltage and field flux control methods.

Motor starters (3- point and 4- point starters) Losses in D.C Machines– Constant & Variable losses –calculation of efficiency – condition for maximum efficiency.

UNIT-III:

TESTING OF DC MACHINES: Methods of Testing–direct, indirect, and regenerative testing–Brake test –Swinburne’s test–Hopkinson’s test–Field’s test–separation of stray losses in a D.C. motor test.

UNIT-IV:

SINGLE PHASE TRANSFORMERS: Types - constructional details-minimization of hysteresis and eddy current losses- EMF equation - operation on no load and on load - phasor diagrams and Applications. Auto transformer-constructional details and operation.

Equivalent circuit - losses and efficiency – regulation - All day efficiency - effect of variations of frequency & supply voltage on iron losses.

UNIT-V:

TESTING OF TRANSFORMERS AND POLY-PHASE TRANSFORMERS: Open Circuit and Short Circuit tests- Sumpner’s test - predetermination of efficiency and regulation -separation of losses test- parallel operation with equal and unequal voltage ratios - auto transformers-equivalent circuit - comparison with two winding transformers. Poly-phase transformers – Poly-phase connections -Y/Y, Y/ Δ , Δ /Y, Δ / Δ and open Δ , Scott connection and Applications.

TEXT BOOKS:

1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
2. I.J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

REFERENCE BOOKS:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, “Electrical Machines”, Oxford, 2017.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. A.E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
4. A.E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.

POWER SYSTEM-I**B Tech II Year I Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE304	Professional Core				3			
		3	0	0		40	60	100
Contact Classes: 48	Tutorial Classes:	Practical Classes: Nil			Total Classes:48			

Prerequisites:

1. Electrical Circuit Analysis-1 & Electrical Circuit Analysis-2, Electrical Machines-I & Electrical Machines-II

Course Objectives:

1. To understand the power generation through conventional and non-conventional sources.
2. To illustrate the economic aspects of power generation and tariff methods.
3. To know about over headline insulators, substations and AC &DC distribution systems.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Understand the operation of conventional and renewable electrical power generating stations.
2. Evaluate the power tariff methods and Economics associated with power generation.
3. Understand the working of different types of distribution & transmission systems.
4. Analyze the operations of AIS & GIS, Insulators and Distribution systems.
5. Evaluate the cost analysis techniques in management of load dispatch.

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											1
CO2	3	2										1
CO3	3											1
CO4	3	2	1									1
CO5	3	2	2									1

UNIT-I: GENERATION OF ELECTRIC POWER:

Conventional Sources (Qualitative): Hydro station, Steam Power Plant, Nuclear Power Plant and Gas Turbine Plant.

Non-Conventional Sources (Elementary Treatment):

Solar Energy, Wind Energy, Fuel Cells, Ocean Energy, Tidal Energy, Wave Energy, Cogeneration, Energy conservation and storage.

UNIT-II:

ECONOMICS OF POWER GENERATION: Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load duration curve, number and size of generator units. Base load and peak load plants. Cost of electrical energy-fixed cost, running cost, Tariff on charge to customer.

UNIT-III:

OVER HEAD TRANSMISSION LINES: Line conductors, inductance and capacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing, Composite conductors-trans position, bundled conductors, and effect of earth on capacitance, skin and proximity effects.

OVERHEAD LINE INSULATORS: Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, testing of insulators, Sag and tension calculations.

UNIT-IV:

SUBSTATIONS: AIR INSULATED SUBSTATIONS (AIS): Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment. Bus bar arrangements in the Sub-Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.

GAS INSULATED SUBSTATIONS (GIS): Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, bus bar, construction aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

UNIT-V:

DC DISTRIBUTION: Classification of Distribution Systems. - Comparison of DC vs. AC and Under-Ground vs. Over- Head Distribution Systems. - Requirements and Design features of Distribution Systems. -Voltage Drop Calculations (Numerical Problems) in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal Voltages) and Ring Main Distributor.

A.C. DISTRIBUTION: Introduction, AC distribution, Single phase, 3- phase, 3phase 4 wire system, bus bar arrangement, Selection of site for substation. Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

TEXT BOOKS:

1. C.L. Wadhwa, "Generation, Distribution and Utilization of Electrical Energy", 2n d Edition, New Age International, 2009.
2. V.K Mehta and Rohit Mehta, "Principles of Power Systems", S. Chand & Company Ltd, New Delhi, 2004.

REFERENCE BOOKS:

1. Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, "A Text book on Power System Engineering", Dhanpat Rai Publishing Company (P) Ltd, 2008.
2. C.L. Wadhwa, "Electrical Power Systems", 5th Edition, New Age International, 2009.
3. M.V. Deshpande, "Elements of Electrical Power Station Design", 3rd Edition, Wheeler Pub. 1998.
4. H.Cotton & H. Barber, "The Transmission and Distribution of Electrical Energy", 3rd Edition, 1970.
5. W.D.Stevenson, "Elements of Power System Analysis", 4th Edition, McGraw Hill, 1984.

ELECTROMAGNETIC FIELDS**B Tech II Year I Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE305	Professional Core	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes:48			

Prerequisites: Mathematics & Applied Physics

Course Objectives:

1. To introduce the concepts of electric field and magnetic field.
2. To know Applications of electric and magnetic fields in the development of the theory for power transmission lines and electrical machines.
3. To study about electromagnetic waves.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Understand the basic laws of electromagnetism and apply in their applications.
2. Obtain the electric and magnetic fields for simple configurations under static conditions
3. Analyze time varying electric and magnetic fields.
4. Examine Maxwell's equation in different forms and different media.
5. Understand and analyze the propagation of EM waves.

Course Outcomes	Program Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3	3										2
CO2	3	1	1									
CO3	3	2										1
CO4	3	2	1									2
CO5	3	2										2

UNIT-I:

STATIC ELECTRIC FIELD: Review of conversion of a vector from one coordinate system to another co-ordinate system, Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and it's applications. Absolute Electric potential, potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

UNIT-II:

CONDUCTORS, DIELECTRICS AND CAPACITANCE: Current and current density, Ohms Law in Point form, Continuity equation, Boundary conditions of conductors and dielectric materials. Capacitance, Capacitance of a two-wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation.

UNIT-III:

STATIC MAGNETIC FIELDS AND MAGNETIC FORCES: Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors. Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions, Magnetic circuits, Self-inductances and mutual inductances.

UNIT-IV:

TIMEVARYING FIELDS AND MAXWELL'S EQUATIONS: Faraday's law for Electromagnetic induction, Displacement current, point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces.

UNIT-V:

ELECTROMAGNETIC WAVES: Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane wave in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors. Pointing theorem.

TEXT BOOKS:

1. M.N.O.Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. W.Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

REFERENCE BOOKS:

1. A.Pramanik, "Electromagnetism Problems with solution", Prentice Hall India, 2012.
2. G.W.Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
3. W.J. Duffin, "Electricity and Magnetism", Mc Graw Hill Publication, 1980.
4. W.J.Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
5. E.G.Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
6. B.D.Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
7. A.Pramanik, "Electro magnetism-Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.

ANALOG ELECTRONIC CIRCUITS**B Tech II Year I Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EC309	Professional Core	3	0	0	3	40	60	100
		Practical Classes: Nil				Total Classes:48		
Contact Classes: 48	Tutorial Classes: Nil							

Course Objectives:

1. To introduce components such as diodes, BJTs and FETs their switching characteristics, applications
2. Learn the concepts of high frequency analysis of transistors.
3. To give understanding of various types of basic and feedback amplifier circuits such as small signal, cascaded, large signal and tuned amplifiers.
4. To introduce the basic building blocks of linear integrated circuits.
5. To introduce the concepts of wave form generation and introduce some special function ICs.

Course Outcomes: At the end of this course, students will be able to

1. Know the characteristics, utilization of various components.
2. Understand the biasing techniques
3. Design and analyze various rectifiers, small signal amplifier circuits.
4. Design sinusoidal and non-sinusoidal oscillators.
5. Designs OP-AMP based circuit switch linear integrated circuits.

UNIT-I:

Diode and Bipolar Transistor Circuits: P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, clamping and clipping circuits. Input output characteristics of BJT in CB, CE, CC configurations, biasing circuits, Load line analysis, common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits,

UNIT-II:

FET Circuits: FET Structure and VI Characteristics, MOSFET structure and I-V characteristics. MOSFET as a switch. Small signal equivalent circuits-gain, input and output impedances, small-signal model and common-source, common-gate and common- drain amplifiers, trans conductance, high frequency equivalent circuit.

UNIT-III:

Multi-Stage and Power Amplifiers: Direct coupled and RC Coupled multi-stage amplifiers; Differential Amplifiers, Power amplifiers- Class A, Class B, Class C

UNIT-IV:

Feedback Amplifiers: Concepts of feedback– Classification of feedback amplifiers– General characteristics of Negative feedback amplifiers – Effect of Feedback on Amplifier characteristics –Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations – Simple problems.

Oscillators: Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LC type Oscillators–Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators.

UNIT-V:

Operational Amplifiers: Ideal op-amp, Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product, Inverting and non-inverting amplifier, Differentiator, integrator, Square-wave and triangular-wave generators.

TEXT BOOKS:

1. Integrated Electronics, Jacob Millman, Christos Chalkias, McGraw Hill Education, 2nd edition 2010
2. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 2003.

REFERENCE BOOKS:

1. Electronic Devices Conventional and current version-Thomas L. Floyd 2015, pearson.
2. J.Millman and A.Grabel, "Microelectronics", Mc Graw Hill Education, 1988.
3. P.Horowitz and W.Hill, "The Art of Electronics", Cambridge University Press, 1989.
4. P. R.Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.

ELECTRICAL MACHINES LABORATORY-I**B Tech II Year I Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE306	Professional Core	0	0	2	1	40	60	100
		Practical Classes: 32				Total Classes:32		
Contact Classes: Nil	Tutorial Classes: Nil							

Prerequisites: Electrical Machines- I

Course Objectives:

1. To expose the students to the operation of DC Generators.
2. To know the operation of various types of DC Motors.
3. To examine the performance of Single and Three Phase Transformers.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Understand the principle and operating characteristics verification of D.C generators.
2. Analyses the control characteristics of Different DC generators.
3. Understand the principle and operating characterizes of D.C motors.
4. Assess the performance of different machines using different testing methods
5. Evaluate the performance of different Transformers using different testing methods

Course Outcomes	Program Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3	3							2	1		2
CO2	3	3	1						3	2		3
CO3	3	2							2	1		2
CO4	3	3	2						3	2		3
CO5	3	3	2						3	2		3

The following experiments are required to be conducted compulsory experiments:

1. Magnetization characteristic of DC shunt generator (Determination of critical field resistance and critical speed)
2. Load test on DC shunt generator (Determination of characteristics)
3. Load test on DC series generator (Determination of characteristics)
4. Hopkinson 's test on DC shunt machines (Predetermination of efficiency)
5. Swinburne's test and speed control of DC shunt motor (Predetermination of efficiencies)
6. Brake test on DC compound motor (Determination of performance curves)
7. OC and SC Test on Single Phase Transformer
8. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star)

In addition to the above eight experiments, atleast any two of the experiments from the following list are required to be conducted:

1. Sumpner's test on a pair of single-phase transformers
2. Brake test on DC shunt motor (Determination of performance curves)
3. Load test on DC compound generator (Determination of characteristics).
4. Fields test on DC series machines (Determination of efficiency)
5. Retardation test on DC shunt motor (Determination of losses at rated speed)
6. Separation of losses in DC shunts motor.
7. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
8. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)

TEXT BOOKS:

1. P.S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I.J.Nagrath and D.P.Kothari, "Electric Machines", McGraw Hill Education, 2010.

REFERENCE BOOKS:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, "Electrical Machines", Oxford, 2017.
2. M.G.Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. A.E.Fitzgerald and C.Kingsley, "Electric Machinery", New York, Mc Graw Hill Education, 2013.
4. A.E.Clayton and N.N.Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

ELECTRICAL SIMULATION TOOLS LABORATORY**B Tech II Year I Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE308	Professional Core	0	0	2	1	40	60	100
		Practical Classes: 32				Total Classes:32		
Contact Classes: Nil	Tutorial Classes: Nil							

Course Objectives:

1. To understand basic block sets of different simulation platform used in electrical/electronic circuit design.
2. To understand use and coding in different software tools used in electrical/electronic circuit design.
3. To understand the simulation of electric machines/circuits for performance analysis.

Course Outcomes: After learning the contents of this paper, the student must be able to

1. Solve the linear and nonlinear equations.
2. Verify the network theorem using simulation tools.
3. Apply the knowledge of software packages to model electrical and electronics systems.
4. Develop a program used for designing electrical and electronics systems.
5. Analyze the performance of different electrical and electronic systems.

Course Outcomes	Program Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3	2	1	1	3				2	1	1	2
CO2	3	1	1	1	3				2	1	1	1
CO3	3	1	1	1	3				2	1	1	1
CO4	3	1	1	1	3				2	1	1	1
CO5	3	1	1	1	3				2	1	1	1

Students should be encouraged to use open-source software's such as **SCILAB, ORCAD, LTSPICE, Ngspice, Octave, Solve Elec, Simulide, Circuit Lab, QElectroTech, Circuit Sims, DC AC Lab, Every Circuit, DoCircuits** etc. for carrying out the lab simulation listed below.

Use of Professional Licensed versions of software's like **MATLAB, LabVIEW, NI Multisim, PSpice, PowerSim, TINA** etc. is also allowed.

Use of 'Python' platform for simulating components/ circuit behaviour.

Suggested List of Laboratory Experiments:

The following any TEN experiments need to be performed from various subject domains.

1. Introduction to basic block sets of simulation platforms. Basic matrix operations, Generation of standard test signals
2. Solving the linear and nonlinear differential equations
3. Measurement of Voltage, Current and Power in DC circuits.
4. Verification of different network theorems with dependent and independent sources using suitable simulation tools.
5. Verification of performance characteristics of basic Electronic Devices using suitable simulation tools.
6. Analysis of series and parallel resonance circuits using suitable simulation tools
7. Obtaining the response of electrical network for standard test signals using suitable simulation tools.
8. Modeling and Analysis of Low pass and High pass Filters using suitable simulation tools.
9. Performance analysis of DC motor using suitable simulation tools
10. Modeling and analysis of Equivalent circuit of transformer using suitable simulation tools.
11. Analysis of single-phase bridge rectifier with and without filter using suitable Simulation tools.
12. Modeling and Verification of Voltage Regulator using suitable simulation tools.
13. Modeling of transmission line using simulation tools.
14. Performance analysis of Solar PV model using suitable simulation tools

ANALOG ELECTRONIC CIRCUITS LABORATORY**B Tech II Year I Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EC310	Professional Core	0	0	2	1	40	60	100
		Practical				Classes:	Total Classes:32	
Contact Classes: Nil	Tutorial Classes: Nil	32						

Prerequisites: Analog Electronic Circuits

Course Objectives:

- To introduce components such as diodes, BJTs and FETs their switching characteristics, applications
- Learn the concepts of high frequency analysis of transistors.
- To give understanding of various types of basic and feedback amplifier circuits such as small signal, cascaded, large signal and tuned amplifiers.
- To introduce the basic building blocks of linear integrated circuits.
- To introduce the concepts of wave for generation and introduce some special function ICs.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Know the characteristics, utilization of various components.
- Understand the biasing techniques
- Design and analyze various rectifiers, small signal amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators.
- Design OP-AMP based circuit switch linear integrated circuits.

List of Experiments:

1. Draw the VI Characteristics of given PN Junction diode. Determine the Static and Dynamic resistance of the Diode.
2. Determine the Ripple factor, %Regulation PIV and TUF of the given Rectifier with & without filter.
3. Obtain the I/O Characteristics of CE configurations of BJT. Calculate h-parameters from the Characteristics.
4. Obtain the I/O Characteristics of CB configurations of BJT. Calculate h-parameters from the Characteristics.
5. Obtain the I/O Characteristics of CC configurations of BJT. Calculate h-parameters from the Characteristics.
6. Obtain the Drain and Transfer characteristics of CD, CS configuration of JFET. Calculate gm, rd from the Characteristics Adder and Subtractor using Op Amp.
7. Inverting and Non-inverting Amplifiers using Op Amps
8. Adder and Subtractor using Op Amp
9. Integrator Circuit using IC 741.
10. Differentiator circuit using Op Amp.
11. Current Shunt Feedback amplifier
12. Design an RC phase shift oscillator circuit and derive the gain condition for oscillations practically for given frequency.

13. Design a Colpitts oscillator circuit for the given frequency and draw the output waveform.
14. Design transformer coupled class A power amplifier and draw the input and output waveforms, find its efficiency
 - **Experiments related to MOSFET may be included**

GENDER SENSITIZATION LAB**B Tech II Year I Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
MC3001	Mandatory Course	0	0	2	0	100	-	100
						Total Classes:32		
Contact Nil	Classes: Nil	Tutorial Nil	Classes: Nil	Practical 32	Classes:			

COURSE DESCRIPTION

This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies – to examine cultural assumptions about sex, gender, and sexuality.

This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities. This course also seeks to build an understanding and initiate and strengthen programmes combating gender-based violence and discrimination. The course also features several exercises and reflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact of gender-based violence on education, health and development.

Objectives of the Course

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To introduce students to information about some key biological aspects of genders.
4. To expose the students to debates on the politics and economics of work.
5. To help students reflect critically on gender violence.
6. To expose students to more egalitarian interactions between men and women.

Learning Outcomes

1. Students will have developed a better understanding of important issues related to gender in contemporary India.
2. Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
3. Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
4. Students will acquire insight into the gendered division of labor and its relation to politics and economics.
5. Men and women students and professionals will be better equipped to work and live together as equals.
6. Students will develop a sense of appreciation of women in all walks of life.

7. Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

Unit-I: UNDERSTANDING GENDER

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

Unit – II: GENDER ROLES AND RELATIONS

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences- Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary

Unit – III: GENDER AND LABOUR

Division and Valuation of Labour-Housework: The Invisible Labor- “My Mother doesn’t Work.” “Share the Load.”-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

Unit – IV: GENDER - BASED VIOLENCE

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No!-Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: “*Chupulu*”. Domestic Violence: Speaking Out/Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-“I Fought for my Life....”

Unit – V: GENDER AND CULTURE

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks- The Brave Heart.

- ***Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments. Apart from the above prescribed book, Teachers can make use of any authentic materials related to the topics given in the syllabus on “Gender”.***
- **ESSENTIAL READING:** The Textbook, “*Towards a World of Equals: A Bilingual Textbook on Gender*” written by A.Suneetha, Uma Bhugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu **published by Telugu Akademi, Telangana Government in 2015.**

ASSESSMENT AND GRADING:

- Discussion & Classroom Participation: 20%
- Project/Assignment: 30%
- End Term Exam: 50%

SOLID MECHANICS AND HYDRAULIC MACHINES**B Tech II Year II Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23ME401	Professional Core	3	1	0	4	40	60	100
Contact Classes: 48	Tutorial Classes: 16	Practical Classes: Nil			Total Classes:64			

Course Objectives:

1. To identify an appropriate structural system and work comfortably with basic engineering mechanics and types of loading & support conditions that act on structural systems
2. To Understand the meaning of centers of gravity, centroids, moments of Inertia and rigid body dynamics
3. To Study the characteristics of hydroelectric power plant and Design of hydraulic machinery.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Solve problems dealing with forces, beam and cable problems and understand distributed force systems.
2. Solve friction problems and determine moments of Inertia and centroid of practical shapes.
3. Apply knowledge of mechanics in addressing problems in hydraulic machinery and its principles that will be utilized in Hydropower development and for other practical usages.

UNIT-I:

INTRODUCTION OF ENGINEERING MECHANICS: Basic concepts of System of Forces-Coplanar Forces-Components in Space-Resultant- Moment of Forces and its Application – Couples and Resultant of Force System-Equilibrium of System of Forces-Free body diagrams-Direction of Force Equations of Equilibrium of Coplanar Systems and Spatial Systems – Vector cross product- Support reactions different beams for different types of loading – concentrated, uniformly distributed and uniformly varying loading. Types of friction – Limiting friction – Laws of Friction – static and Dynamic Frictions – Angle of Friction –Cone of limiting friction

UNIT-II:

CENTROID AND CENTER OF GRAVITY: Centroids – Theorem of Pappus- Centroids of Composite figures – Centre of Gravity of Bodies – Area moment of Inertia:-polar Moment of Inertia-Transfer- Theorems - Moments of Inertia of Composite Figures.

SIMPLE STRESSES AND STRAINS ANALYSIS: Concept of stress and strain- St. Venant's Principle- Stress and Strain Diagram - Elasticity and plasticity – Types of stresses and strains-Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Pure shear and Complementary shear - Elastic moduli, Elastic constants and the relationship between them

UNIT-III:

KINEMATICS & KINETICS: Introduction – Rectilinear motion – Motion with uniform and variable acceleration–Curvilinear motion– Components of motion– Circular motion Kinetics of a particle – D’Alembert’s principle – Motion in a curved path – work, energy and power. Principle of conservation of energy – Kinetics of a rigid body in translation, rotation – work done – Principle of work- energy – Impulse-momentum.

UNIT-IV:

BASICS OF HYDRAULIC MACHINERY: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, Jet striking centrally and at tip, Velocity triangles at inlet and outlet, expressions for work done and efficiency Elements of a typical Hydropower installation – Heads and efficiencies

UNIT-V:

TURBINES & PUMPS: Classification of turbines – Pelton wheel – Francis turbine – Kaplan turbine – working, working proportions, velocity diagram, work done and efficiency, hydraulic design. Draft tube – Classification, functions and efficiency. Governing of turbines, Performance of turbines Pump installation details – classification – work done – Manometric head – minimum starting speed – losses and efficiencies – specific speed. multistage pumps – pumps in parallel

TEXT BOOKS:

1. M.V. Seshagirirao and Durgaih, “Engineering Mechanics”, University Press.
2. P.N Modi and Seth, “Fluid Mechanics and Hydraulic Machinery”, standard Book House

REFERENCE BOOKS:

1. B. Bhattacharya, “Engineering Mechanics”, Oxford University Publications.
2. Hibbler, “Engineering Mechanics (Statics and Dynamics)”, Pearson Education.
3. Fedrinand L. Singer, “Engineering Mechanics” Harper Collings Publishers.
4. A.K.Tayal, “Engineering Mechanics” , Umesh Publication.
5. Domkundwar & Domkundwar, “Fluid mechanics & Hydraulic Machines”, Dhanpat Rai & C
6. R.C.Hibbeler, “Fluid Mechanics”, Pearson India Education Servieces Pvt. Ltd
7. D.S.Kumar, “Fluid Mechanic & Fluid Power Engineering”, Kataria & Sons Publications Pvt. Ltd.
8. Banga & Sharma, “Hydraulic Machines” Khanna Publishers.

MEASUREMENTS AND INSTRUMENTATION**B Tech II Year II Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE402	Professional Core	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes:	Practical Classes: Nil			Total Classes:48			

Prerequisites: Electrical Circuit Analysis-1 & Electrical Circuit Analysis-2, Analog Electronics Electro Magnetic Fields.

Course Objectives:

1. To introduce the basic principles of all measuring instruments.
2. To deal with the measurement of voltage, current, Power factor, power, energy and magnetic measurements.
3. To understand the basic concepts of smart and digital metering.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Understand different types of measuring instruments, their construction, operation and characteristics and identify the instruments suitable for typical measurements.
2. Apply the knowledge about transducers and instrument transformers to use them effectively.
3. Apply the knowledge of smart and digital metering for industrial applications.

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1									2
CO2	3	2	1	1								2
CO3	3	2	1	1								2
CO4	3	2	1	1								2
CO5	3	2	1	1								2

UNIT-I

INTRODUCTION TO MEASURING INSTRUMENTS: Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters-electrometer type and attracted disc type – extension of range of E.S.Voltmeters.

UNIT-II

POTENTIOMETERS & INSTRUMENT TRANSFORMERS: Principle and operation of D.C. Crompton's potentiometer – standardization– Measurement of unknown resistance, current, voltage A.C. Potentiometers: polar and coordinate type's standardization – applications. CT and PT – Ratio and phase angle errors

UNIT-III

MEASUREMENT OF POWER & ENERGY: Single phase dynamometer wattmeter, LPF and UPF, Double element and three element dynamometer wattmeter, expression for deflecting and control torques– Extension of range of wattmeter using instrument transformers–Measurement of active and reactive powers Inbalanced and unbalanced systems.

Single phase induction type energy meter – driving and braking torques – errors and compensations –testing by phantom loading using R.S.S. meter. Three phase energy meter –tri-vector meter, maximum demand meters.

UNIT-IV

DC & AC BRIDGES: Method of measuring low, medium and high resistance – sensitivity of Wheat-stone’s bridge–CareyFoster’s bridge, Kelvin’s double bridge for measuring low resistance, measurement of high resistance –loss of charge method.

Measurement of inductance- Maxwell’s bridge, Hay’s bridge, Anderson’s bridge – Desauty’s Bridge -Wien’s bridge–Schering Bridge.

UNIT-V

TRANSDUCERS: Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of LVDT and capacitor transducers; LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples, Piezoelectric transducers, photovoltaic, photoconductive cells, and photodiodes.

INTRODUCTION TO SMART AND DIGITAL METERING: Digital Multi-meter, True RMS meters, Clamp- on meters, Digital Energy Meter, Cathode Ray Oscilloscope, Digital Storage Oscilloscope.

TEXTBOOKS:

1. A.K.Sawhney ,“Electrical & Electronic Measurement & Instruments”, Dhanpat Rai &Co. Publications,2005.
2. Dr.Rajendra Prasad, “Electrical Measurements & Measuring Instruments”, Khanna Publishers1989.

REFERENCEBOOKS:

1. G.K.Banerjee ,“Electrical and Electronic Measurements”, PHI Learning Pvt. Ltd., 2nd Edition, 2016.
2. R.K.Rajput, “Electrical & Electronic Measurement & Instrumentation”, S.Chandand Company Ltd., 2007.
3. S.C.Bhargava, “Electrical Measuring Instruments and Measurements”, BS Publications, 2012.
4. Bucking hamand Price, “ElectricalMeasurements”, Prentice–Hall,1988.
5. Reissland, M. U, “Electrical Measurements: Fundamentals, Concepts, Applications”, New Age International(P) Limited Publishers, 1st Edition 2010.
6. E.W.Golding and F.C.Widdis, “Electrical Measurements and measuring Instruments”, fifth Edition, Wheeler Publishing, 2011.

ELECTRICAL MACHINES – II**B Tech II Year II Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE403	Professional Core	3	0	0	3	40	60	100
		Practical Classes: Nil				Total Classes:48		
Contact Classes: 48	Tutorial Classes:	Practical Classes: Nil			Total Classes:48			

Prerequisites: Electrical Circuit Analysis-1 & Electrical Circuit Analysis-2 & Electrical Machines-I

Course Objectives:

1. To deal with the detailed analysis of poly-phase induction motors & Alternators
2. To understand operation, construction and types of single-phase motors and their applications in household appliances and control systems.
3. To introduce the concept of parallel operation of alternators.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Understand the concepts of rotating magnetic fields.
2. Examine the operation of ac machines
3. Analyze performance characteristics of ac machines.

Course Outcomes	Program Outcomes											
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	3	2									1	3
CO2	3	2	1								1	3
CO3	3	2	2	1							1	3
CO4	3	2	1	1							1	3
CO5	3	2	1	1							1	3

UNIT-I:

POLY-PHASE INDUCTION MACHINES: Constructional details of cage and wound rotor machines production of a rotating magnetic field - principle of operation - rotor EMF and rotor frequency – rotor reactance, rotor current and Power factor at standstill and during operation. Rotor power input, rotor copper loss and mechanical power developed and their inter relation.

UNIT-II:

CHARACTERISTICS OF INDUCTION MACHINES: Torque equation-expressions for maximum torque and starting torque - torque slip characteristic - equivalent circuit - phasor diagram - crawling and cogging, No-load Test and Blocked rotor test – Predetermination of performance-Methods of starting and starting current and Torque calculations, Applications.
SPEED CONTROL METHODS: Change of voltage, change of frequency, voltage/frequency, injection of an EMF into rotor circuit (qualitative treatment only)-induction generator-principle of operation.

UNIT-III:

SYNCHRONOUS MACHINES: Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation. Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics. Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reaction analysis – experimental determination of X_d and X_q (Slip test) Phasor diagrams – Regulation of salient pole alternators.

UNIT-IV:

PARALLEL OPERATION OF SYNCHRONOUS MACHINES: Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactance's and Applications.

SYNCHRONOUS MOTORS: Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed. – Hunting and its Suppression – Methods of starting – synchronous induction motor.

UNIT-V:

SINGLE PHASE MACHINES: Single phase induction motor – Constructional Features- Double revolving field theory – split-phase motors – AC series motor- Universal Motor- - Shaded pole motor and Applications.

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TEXT BOOKS:

1. P.S.Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I.J.Nagrath and D.P.Kothari, "Electric Machines", Mc Graw Hill Education, 2010

REFERENCE BOOKS:

1. Prithwi raj Purkait, Indrayudh Bandyopadhyay, "Electrical Machines", Oxford, 2017.
2. M.G.Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. A.E.Fitzgerald and C.Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013
4. A.E.Clayton and N.N.Hancock, "Performance and design of DC machines", CBS Publisher, 2004.

DIGITAL ELECTRONICS**B Tech II Year II Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EC410	Professional Core	2	0	0	2	40	60	100
Contact Classes: 32	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes:32			

Prerequisites: Analog Electronics

Course Objectives:

1. To learn fundamental concepts of digital system design and common forms of number representations and their conversions.
2. To implement and design logical operations using combinational logic circuits and sequential logic circuits.
3. To understand the semiconductor memories and programmable logic devices.

Course Outcomes: After learning the contents of this paper, the student must be able to

1. Understand the working of logic families and logic gates.
2. Design and implement Combinational and Sequential logic circuits.
3. Implement the given logical problems using programmable logic devices.

UNIT-I:

Fundamentals of Digital Systems and Logic Families: Digital signals, Digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, Examples of IC gates, Number systems-binary, Signed binary, Octal hexadecimal number, Binary arithmetic, One's and Two's complements arithmetic.

UNIT-II:

Combinational Circuits-I: Standard representation for logic functions, K-map representation and simplification of logic functions using K- map, Minimization of logical functions, don't care conditions, Multiplexer, De-Multiplexer

UNIT-III:

Combinational Circuits-II: Adders, Subtractors, Carry look ahead adder, Digital comparator, Parity checker/generator, Code converters, Priority encoders, Decoders/Drivers for display devices, Q-M method of function realization.

UNIT-IV:

Sequential Circuits: Introduction to flip-flops, SR, JK, T and D type's flip-flops, Shift registers, Conversion of flip-flops, Ring counter, Ripple (Asynchronous) counters, Synchronous counters.

UNIT-V:

Semiconductor Memories and Programmable Logic Devices: Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read-only memory (ROM), ROM types, Read and write memory (RAM) types, Programmable logic array, Programmable array logic, Field Programmable Gate Array (FPGA).

TEXT BOOKS:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

REFERENCE BOOKS:

1. R.S. Sedha, "A Textbook of Digital Electronics", S.Chand, 2005
2. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

POWER SYSTEMS-II**B Tech II Year II Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE405	Professional Core	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes:48			

Prerequisites: Power Systems –I & Electro Magnetic Fields

Course Objectives:

1. To study the performance of transmission lines and travelling waves.
2. To understand the concept of voltage control, compensation methods and per unit representation of power systems.
3. To know the methods of overvoltage protection, Insulation coordination, Symmetrical components and fault calculation analysis.

Course Outcomes: After learning the contents of this paper, the student must be able to

1. Analyze transmission line performance and Apply load compensation techniques to control reactive power.
2. Understand the application of per unit quantities in power systems.
3. Design over voltage protection, insulation coordination and determine the fault currents for symmetrical and unbalanced faults.

Course Outcomes	Program Outcomes											
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	3	2										2
CO2	3	3										2
CO3	3	3	2									2
CO4	3	2										2
CO5	3	3	2									2

UNIT - I:

PERFORMANCE OF LINES: Representation of lines, short transmission lines, medium length lines, nominal T and PI- representations, long transmission lines. The equivalent circuit representation of a long Line, A, B, C, D constants, Ferranti Effect. **Corona:** Introduction, disruptive critical voltage, corona loss, Factors affecting corona loss and methods of reducing corona loss, Disadvantages of corona, interference between power and Communication lines.

UNIT-II:

VOLTAGE CONTROL & POWER FACTOR IMPROVEMENT: Introduction – methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase modifiers, power factor improvement methods.

COMPENSATION IN POWER SYSTEMS: Introduction - Concepts of Load compensation – Load ability characteristics of overhead lines – Uncompensated transmission line – Symmetrical line – Radial line with asynchronous load – Compensation of lines.

UNIT-III:

PER UNIT REPRESENTATION OF POWER SYSTEMS: The one-line diagram, impedance and reactance diagrams, per unit quantities, changing the base of per unit quantities, advantages of per unit system.

TRAVELLING WAVES ON TRANSMISSION LINES: Production of travelling waves, open circuited line, short-circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at T-junction line terminated through a capacitance, capacitor connection at a T-junction, Attenuation of travelling waves.

UNIT-IV:

OVERVOLTAGE PROTECTION AND INSULATION COORDINATION: Over voltage due to arcing ground and Peterson coil, lightning, horn gaps, surge diverters, rod gaps, expulsion type lightning arrester, valve type lightning arrester, ground wires, ground rods, counter poise, surge absorbers, insulation coordination, volt-time curves.

UNIT-V:

SYMMETRICAL COMPONENTS AND FAULT CALCULATIONS: Significance of positive, negative and zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks, fault calculations, sequence network equations, single line to ground fault, line to line fault, double line to ground fault, three phase fault, faults on power systems, faults with fault impedance, reactors and their location, short circuit capacity of a bus.

TEXT BOOKS:

1. C.L. Wadhwa, "Electrical Power Systems", New Age International Pub. Co, Third Edition, 2001.
2. D.P. Kothari and I.J. Nagrath, "Modern Power System Analysis", Tata Mc Graw Hill Pub. Co., New Delhi, Fourth edition, 2011.

REFERENCE BOOKS:

1. A. Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, "A Text book on Power System Engineering", Dhanpat Rai Publishing Company (P) Ltd, 2008.
2. John J. Grainger & W.D. Stevenson, "Power System Analysis", Mc Graw Hill International, 1994.
3. Hadi Scadat, "Power System Analysis", Tata Mc Graw Hill Pub. Co. 2002.
4. W.D. Stevenson, "Elements of Power system Analysis", McGraw Hill International Student Edition.

DIGITAL ELECTRONICS LAB**B Tech II Year II Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EC411	Professional Core	0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32			Total Classes:32			

Prerequisites: Analog Electronics & Digital Electronics

Course Objectives:

- To learn basic techniques for the design of digital circuits and number conversion systems.
- To implement simple logical operations using combinational logic circuits.
- To design combinational logic circuits, sequential logic circuits.

Course Outcomes: After learning the contents of this paper the student must be able to

- Understand the working of logic families and logic gates.
- Design and implement Combinational and Sequential logic
- Analyze different types of semiconductor memories

List of Experiments:

1. Realization of Boolean Expressions using Gates
2. Design and realization logic gates using universal gates
3. Generation of clock using NAND/NOR gates
4. Design a 4 – bit Adder / Subtractor
5. Design and realization a 4 – bit gray to Binary and Binary to Gray Converter
6. Design and realization of a 4-bit pseudo random sequence generator using logic gates.
7. Design and realization of an 8-bit parallel load and serial out shift register using flip-flops.
8. Design and realization Asynchronous and Synchronous counters using flip-flops
9. Design and realization 8x1 using 2x1 mux
10. Design and realization 2-bit comparator
11. Verification of truth tables and excitation tables
12. Realization of logic gates using DTL, TTL, ECL, etc.,

TEXT BOOKS:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

REFERENCE BOOKS:

1. R.S. Sedha, "A Textbook of Digital Electronics", S.Chand, 2005
2. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

MEASUREMENTS AND INSTRUMENTATION LABORATORY**B Tech II Year II Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE407	Professional Core	0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32			Total Classes:32			

Prerequisites: Measurements and Instrumentation

Course Objectives:

- To calibrate Watt, Energy and PF Meter and determination of three phase active & reactive powers.
- To determine unknown inductance, resistance, capacitance by performing experiments on D.C Bridges & A. C Bridges.
- To determine the ratio and phase angle errors of Instrument transformers.

Course Outcomes: After learning the contents of this paper the student must be able to

- Choose and test any measuring instruments.
- Find the accuracy of any instrument by performing experiments.
- Calculate the various parameters using different types of measuring instruments.

Course Outcomes	Program Outcomes											
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	3	2							2			1
CO2	3	1							2			1
CO3	3	2							2			1
CO4	3	2							2			1
CO5	3	1							2			1

The following experiments are required to be conducted as compulsory experiments:

1. Calibration and Testing of single-phase energy Meter.
2. Calibration of dynamometer power factor meter.
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter.
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Dielectric oil testing using H.T. testing Kit.
6. Schering Bridge & Anderson Bridge.
7. Measurement of 3 - Phase reactive power with single-phase wattmeter.
8. Measurement of displacement with the help of LVDT.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:

1. Calibration LPF wattmeter – by Phantom testing.
2. Measurement of 3-phase power with single watt meter and two CTs.
3. C.T. testing using mutual Inductor – Measurement of % ratio error and phase angle of given CT by Null method.
4. PT testing by comparison – V. G. as Null detector – Measurement of % ratio error and phase angle of the given PT
5. Resistance strain gauge – strain measurements and Calibration.
6. Transformer turns ratio measurement using AC bridges.
7. Measurement of % ratio error and phase angle of given CT by comparison.

TEXT BOOKS:

1. A. K. Sawhney, “Electrical & Electronic Measurement & Instruments”, Dhanpat Rai & Co. Publications, 2005.
2. Dr. Rajendra Prasad, “Electrical Measurements & Measuring Instruments”, Khanna Publishers 1989.

REFERENCE BOOKS:

1. G. K. Banerjee, “Electrical and Electronic Measurements”, PHI Learning Pvt. Ltd., 2nd Edition, 2016.
 2. R. K. Rajput, “Electrical & Electronic Measurement & Instrumentation”, S. Chand and Company Ltd., 2007.
 3. S. C. Bhargava, “Electrical Measuring Instruments and Measurements”, BS Publications, 2012.
 4. Buckingham and Price, “Electrical Measurements”, Prentice – Hall, 1988.
 5. Reissland, M. U, “Electrical Measurements: Fundamentals, Concepts, Applications”, New Age International (P) Limited Publishers, 1st Edition 2010.
 6. E.W. Golding and F. C. Widdis, “Electrical Measurements and measuring Instruments”, fifth Edition, Wheeler Publishing, 2011
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ELECTRICAL MACHINES LABORATORY -II**B Tech II Year II Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE408	Professional Core	0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32			Total Classes:32			

Prerequisites: Electrical Machines-I & Electrical Machines-II

Course Objectives:

1. To understand the operation of Induction, Synchronous machines and Transformers.
2. To study the performance analysis of Induction and Synchronous Machines through various testing methods.
3. To analyze the performance of single and 3-phase phase transformer with experiments.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Assess the performance of different types of AC machines using different testing methods.
2. Analyze the suitability of AC machines and Transformers for real word applications.
3. Design the machine models based on the application requirements.

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2						1	1	3	2
CO2	3	3	1						1	1	1	3
CO3	3	3	2						1	2	1	3
CO4	3	3	2						1	1	2	3
CO5	3	3	2	1					1	2	2	3

The following experiments are required to be conducted as compulsory experiments:

1. Load Test on Single phase Induction Motor
2. No-load & Blocked rotor tests on three phase Induction motor
3. Regulation of a three -phase alternator by synchronous impedance & m.m.f. methods
4. 'V' and 'Inverted V' curves of a three—phase synchronous motor.
5. Equivalent Circuit of a single-phase induction motor
6. Determination of Xd and Xq of a salient pole synchronous machine
7. Load test on three phase Induction Motor
8. Regulation of three-phase alternator by Z.P.F. and A.S.A methods

In addition to the above experiments, at least any two of the following experiments are required to be conducted from the following list:

1. Separation of core losses of a single-phase transformer
2. Efficiency of a three-phase alternator
3. Parallel operation of Single-phase Transformers
4. Heat run test on a bank of 3 Nos. of single-phase Delta connected transformers
5. Measurement of sequence impedance of a three-phase alternator.
6. Vector grouping of Three Transformer
7. Scott Connection of transformer

TEXT BOOKS:

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I.J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

REFERENCE BOOKS:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, "Electrical Machines", Oxford, 2017.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
4. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

CONSTITUTION OF INDIA**B Tech II Year II Sem**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
*MC4001	Mandatory Course	3	0	0	0	100	-	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: 0			Total Classes:48			

Course Objectives: Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes: Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution
4. Discuss the passage of the Hindu Code Bill of 1956.

UNIT - 1 History of Making of the Indian Constitution- History of Drafting Committee.

UNIT - 2 Philosophy of the Indian Constitution- Preamble Salient Features

UNIT - 3 Contours of Constitutional Rights & Duties - Fundamental Rights

1. Right to Equality
2. Right to Freedom
3. Right against Exploitation
4. Right to Freedom of Religion
5. Cultural and Educational Rights
6. Right to Constitutional Remedies
7. Directive Principles of State Policy
8. Fundamental Duties.

UNIT - 4 Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT - 5 Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT - 6 Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

SUGGESTED READING:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

POWER ELECTRONICS

III Year B.Tech. I-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE501	Core	3	1	0	4	40	60	100
		Practical Classes: Nil				Total Classes:64		
Contact Classes: 48	Tutorial Classes: 16							

Course Objectives:

- To Design/develop suitable power converter for efficient control or conversion of power in drive applications
- To Design/develop suitable power converter for efficient transmission and utilization of power in power system applications.

Course Outcomes: Students will be able to

- Apply the basic operation and characteristics of various power semiconductor devices and intelligent power module.
- Design AC/DC rectifier circuit
- Evaluate chopper circuits
- Examine three phase inverter circuits
- Create AC voltage controller circuits

UNIT-I

Power Switching Devices: Power Switching Devices: Concept of power electronics, scope and applications, types of power converters; Power semiconductor switches and their V-I characteristics – Power Diodes, Power BJT, SCR, Power MOSFET, Power IGBT; Thyristor ratings and protection, Series and parallel connections of SCRs, Two transistor analogy of SCR, methods of SCR commutation, UJT as a trigger source, gate drive circuits for BJT and MOSFETs

UNIT-II

AC-DC Converters (Phase Controlled Rectifiers): AC-DC Converters (Phase Controlled Rectifiers): Principles of single-phase fully controlled converter with R, RL, and RLE load, Principles of single- phase half-controlled converter with RL and RLE load, Principles of three-phase fully-controlled converter operation with RLE load, Effect of load and source inductances, General idea of gating circuits, Single phase and Three phase dual converters.

UNIT-III

DC-DC Converters (Chopper/SMPS): Introduction, elementary chopper with an active switch and diode, concepts of duty ratio, average inductor voltage, average capacitor current. Buck converter -Power circuit, analysis and waveform at steady state, duty ratio control of output voltage. Boost converter-Power circuit, analysis and Wave forms at steady state, relation between duty ratio and average output voltage. Buck-Boost converter-Power circuit, analysis and wave forms at steady state, relation between duty ratio and average output voltage

UNIT-IV

AC-DC Inverters: Introduction, principle of operation ,performance parameters, single phase bridge inverters with R,RL loads, 3-phase bridge inverters - 120- and 180- degrees mode of operation, Voltage control of single- phase inverters–single pulse width modulation, multiple pulse width modulation, sinusoidal pulse width modulation.

UNIT-V

AC-AC Converters: Phase Controller (AC Voltage Regulator) - Introduction, modes of operation of Triac, principle of operation of single-phase voltage controllers for R, R-L loads and its applications. Cyclo-converter- Principle of operation of single phase cyclo-converters, relevant waveforms, circulating current mode of operation, Advantages and disadvantages.

TEXT BOOKS:

1. M.H.Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
2. N.Mohan and T.M.Underland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.

REFERENCES:

1. R.W. Erickson and D.Maksimovic, "Fundamentals of Power Electronics" Springer Science & Business Media, 2007.
2. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

CONTROL SYSTEMS

B.Tech. III Year I Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE502	Core	3	1	0	4	40	60	100
		Practical Classes: Nil				Total Classes:64		
Contact Classes: 48	Tutorial Classes: 16	Practical Classes: Nil			Total Classes:64			

Prerequisite: Linear Algebra and Calculus, Ordinary Differential Equations and Multivariable Calculus Laplace Transforms, Numerical Methods and Complex variables

Course objectives:

- To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response.
- To assess the system performance using time domain analysis and methods for improving it.
- To assess the system performance using frequency domain analysis and techniques for improving the performance.
- To design various controllers and compensators to improve system performance.

Course Outcomes:

- Model linear time-invariant systems using transfer functions and state-space representations for electrical, mechanical, and electromechanical systems.
- Analyze the time-domain response of control systems using standard test inputs and derive transient and steady-state performance measures.
- Evaluate system stability using Routh-Hurwitz criterion and root locus methods, and apply them to design basic feedback controllers.
- Interpret frequency-domain responses using Bode, Polar, and Nyquist plots, and analyze relative stability through gain and phase margins.
- Design and analyze state-space models, evaluate eigenvalues, and determine system properties such as controllability and observability.

UNIT – I

Introduction to Control Systems: Industrial and domestic Control examples. Open loop and closed loop control systems, classification of control systems, characteristics and effects of feedback, Mathematical modeling of physical systems: Mechanical and Electrical Systems,

Transfer Function Representation: Transfer function of DC and AC Servomotor, Synchro transmitter and receiver, Block diagram reduction techniques, signal flow graphs, reduction using Mason's gain formula.

UNIT – II

Time Response Analysis: Standard test signals, time response of first order systems, characteristic equation of feedback control systems, transient response of second order systems- Design specifications for second-order systems based on the time-response, steady state response-steady state errors and error constants

UNIT-III

Stability Analysis in Time Domain: Concept of stability, Routh-Hurwitz stability criterion, qualitative and conditional stability.

Root Locus Technique: The root locus concept, construction of root loci, effects of adding poles and zeros to $G(s)H(s)$ on the root loci. Effects of proportional derivative, proportional integral systems. Introduction to PID Controller

UNIT – IV

Frequency Domain Analysis: Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response. Lead and Lag compensation in designs.

UNIT – V

State Variable Analysis And Design: Concept of State, State variables and State model. State – Space Representation, Transformation of State variables, Solution of state equations and Complete response of the Systems. Stability Analysis of Linear Systems. Concept of controllability and observability.

TEXT BOOKS:

1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

REFERENCE BOOKS:

1. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
2. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.

MICROPROCESSORS & MICROCONTROLLERS

III Year B.Tech. I-Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
23EC503	Core	L	T	P	3	CIE	SEE	TOTAL
		3	0	0		40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:48			

Prerequisite: Programming, Digital Electronics

Course Objectives:

- To develop an understanding of the operations of microprocessors and micro controllers
- To understand machine language programming and interfacing techniques.
- To gain knowledge about input output and memory systems.

Course Outcomes: At the end of this course, students will be able to:

- Understand the internal architecture and organization of 8086, 8051 and ARM processors/controllers.
- Understand the interfacing techniques to 8086 and 8051
- Develop assembly language programming to design microprocessor/ micro controller-based systems.
- Analyze and implement serial communication protocols
- Design and develop microcontroller-based embedded systems

UNIT-1

8086 Architecture

Pin diagram, Register Organization, Memory Segmentation, Programming Model, Modes of operation, Timing diagrams, Memory addresses, Physical Memory Organization, interrupts of 8086.

Instruction Set And Assembly Language Programming Of 8086: Instruction formats, addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations, Software Debugging tools, MDS.

UNIT-II:

I/O Interface

8255 PPI, Various modes of operations and interface of I/O devices to 8086, A/D, D/A Converter Interfacing.

Interfacing With Advanced Devices: 8086 System bus structure, Memory and I/O Interfacing with 8086, Interfacing through various IC Peripheral Chips, 8257 (DMA Controller), 8259 (Interrupt Priority Control).

UNIT-III:

Communication Interface:

Serial Communication Standards, USART Interfacing RS-232, IEEE-488, 20mA Current Loop, Prototyping and Troubleshooting

UNIT-IV:

Introduction To Micro Controllers: Overview of 8051 Micro Controller, Architecture, I/O ports and Memory Organization, addressing modes and Instruction set of 8051, Simple Programs using Stack Pointer, Assembly language programming of 8051. Interrupts Communication: Interrupts - Timer/Counter and Serial Communication, Interrupt Priority in the 8051, Programming of 8051- Timers, Counters and Interrupts.

UNIT-V:

Interfacing And Industrial Applications: Applications of Micro Controllers, Interfacing 8051 to LED's, Keyboard Interfacing, Interfacing Seven Segment Display, ADC and DAC Interfacing, Stepper Motor Interfacing.

TEXT BOOKS:

1. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, MHE, 2nd Edition 2006.
2. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd. Ed.

REFERENCE BOOKS:

1. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012
2. Microprocessors and Interfacing, D. V. Hall, MGH, 2nd Edition 2006.
3. Introduction to Embedded Systems, Shibu K.V, MHE, 2009
4. The 8051 Microcontrollers, Architecture and Programming and Applications -K.Uma Rao, Andhe Pallavi, Pearson, 2009.

IOT APPLICATIONS IN ELECTRICAL ENGINEERING

Professional Elective-I

III Year B.Tech. I-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE504	PE	3	0	0	3	40	60	100
		Practical Classes: Nil				Total Classes:48		
Contact Classes: 48	Tutorial Classes: 0							

Prerequisite: Programming, Digital Electronics

Course Objectives:

- To learn about a few applications of Internet of Things and distinguish between motion less and motion detectors as IoT applications
- To know about Micro Electro Mechanical Systems (MEMS) fundamentals in design and fabrication process
- To understand about applications of IoT in smart grid and new concept of IoE for various applications

Course Outcomes: At the end of this course, students will be able to:

- To get exposed to recent trends in few applications of IoT in Electrical Engineering
- To understand about usage of various types of motionless sensors and motion detectors
- To understand about basic concepts of MEMS design,Sensors.
- To get exposed to various applications of IoT in smart grid.
- To get exposed to future working environment with Energy internet.

UNIT-I: Sensors: Definitions, Terminology, Classification, Temperature sensors, Thermosensitive, Resistance, temperature detectors, Silicon resistive thermistors, Semiconductor, Piezoelectric, Humidity and moisture sensors. Capacitive, Electrical conductivity, Thermal conductivity, time domain reflectometer, Pressure and Force sensors: Piezoresistive, Capacitive, force, strain and tactile sensors, Strain gauge, Piezoelectric.

UNIT-II: Occupancy and Motion detectors Capacitive occupancy, Inductive and magnetic, potentiometric - Position, displacement and level sensors, Potentiometric, Capacitive, Inductive, magnetic velocity and acceleration sensors, Capacitive, Piezoresistive, piezoelectric cables, Flow sensors, Electromagnetic, Acoustic sensors -Resistive microphones, Piezoelectric, Photo resistors.

UNIT-III:MEMS Basic concepts of MEMS design, Beam/diaphragm mechanics, electrostatic actuation and fabrication, Process design of MEMS based sensors and actuators, Touch sensor, Pressure sensor, RF MEMS switches, Electric and Magnetic field sensors.

UNIT-IV IoT for Smart grid: Driving factors, Generation level, Transmission level, Distribution level, Applications, Metering and monitoring applications, Standardization and interoperability, Smart home.

UNIT-V: Internet of Energy: Concept of Internet of Energy, Evaluation of IoE concept, Vision and motivation of IoE, Architecture, Energy routines, information sensing and processing issues, Energy internet as smart grid.

TEXT BOOKS:

1. Jon S. Wilson, "Sensor Technology Hand book", Newnes Publisher, 2004
2. Tai Ran Hsu, "MEMS and Microsystems: Design and manufacture", 1st Edition, McGraw hill Education, 2017
3. Ersan Kabalci and Yasin Kabalci, "From Smart grid to Internet of Energy", 1st Edition, Academic Press, 2019.

REFERENCE BOOKS:

1. Raj Kumar Buyya and Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", Kindle Edition, Morgan Kaufmann Publisher, 2016
2. Yen Kheng Tan and Mark Wong, "Energy Harvesting Systems for IoT Applications": Generation, Storage and Power Management, 1st Edition, CRC Press, 2019
3. RMD Sundaram Shriram, K. Vasudevan and Abhishek S. Nagarajan, "Internet of Things", Wiley, 2019.

Electrical Installation and Estimation
Professional Elective-I

III Year B.Tech. I-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE505	PE	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:48			

Prerequisites: A course on “Electrical basics and power systems.

Course Objectives:

- To emphasize the estimation and costing aspects of all electrical equipment, installation and designs on the cost viability.
- To design and estimation of wiring.
- To design overhead and underground distribution lines, substations and illumination.

Course Outcomes:

- Understand the design considerations of electrical installations.
- Design electrical installation for buildings and small industries.
- Identify and design the various types of light sources for different applications
- Estimate and analyze the materials, tools, and labor costs
- Apply knowledge of departmental procedures, REC schemes, and the Electricity Act 2003.

UNIT – I Wiring Systems and Safety Procedures: Introduction, importance of electrical wiring, uses of cables, standard wire gauge, size and current carrying capacity of a wire/cable, systems of wiring, electrical wiring accessories, safety accessories, safety procedures, reason for not using fuse in neutral wire, electric shock, procedure for first-aid in case of electric shock.

UNIT – II

Estimation of Lighting and Power Loads: Introduction, types of service mains, selection of service main, selection of system wiring, drawing a wire/cable through a conduit, list of electrical materials & their approximate rates, problems on internal wiring scheme, wiring layouts of a office building, work shop, industry,/cement factory/sugar factory, hotel with a 4-storied with lift arrangement, estimation of power load, single line diagram, types of wiring system, size of cable/wire, materials used in power wiring and their rates, estimation of irrigation pump sets, submersible irrigation pump sets, material used in irrigation pump sets.

UNIT - III

Estimation of Overhead Lines and Earthing: Introduction, main components of overhead lines, conductors, insulators, cross-arms and clamps, guys and stays, steps to solve problems on estimation of OH lines, estimation of pole and plinth mounted substations, construction of pole and plinth mounted substations, estimation of materials electrical accessories of pole and plinth mounted transformers, earthing, selection of earthing, earth resistance, methods of reducing earth resistance, estimation of materials for pipe and plate earthing.

UNIT – IV

Estimating and Costing of Repairs and Maintenance of Electrical Devices and Equipment: D.O.L. starter, small motor, mono block pump, automatic electric iron, table/ceiling fan, ICDP/ICTP Switch, Preparation of detailed drawing work of the product, Preparation of material quantity sheet for the product, Materials and cost required for maintenance work, Estimation of repairing cost and overall cost, Tools used for repairs & maintenance work Preparation of cost schedule for repair and maintenance of electric fan, automatic electric iron, single phase transformer, mixer grinder, D.O.L. starter.

UNIT - V

Departmental Test, REC and Electrical Act 2003: Introduction, departmental procedure for obtaining a service connection, insulation resistance desirable for electrical installation, earth resistance to be maintained for an electric installation, testing of wiring installation, rural electrification scheme, survey of load in a village, capacity of transformer, location of transformer, estimation of electrification of a village, economic feasibility of the scheme, Indian electricity(I.E) rules, general conditions for supply and use of energy, electric supply lines, systems and apparatus for low and medium voltages.

TEXT BOOKS:

1. K. B. Raina, S. K. Bhattacharya, "Electrical Design Estimating and Costing", New Age International Publisher, 2010.
2. Er.V. K. Jain, Er. Amitabh Bajaj, "Design of Electrical Installations", University Science Press.

REFERENCE BOOKS:

1. Electrical installation and estimation, by K. Manjunath, Falcon publications.
2. Gupta J. B., Katson, Ludhiana, "Electrical Installation, estimating and costing", S. K. Kataria and sons, 2013.
3. Bureau of Indian standards, Electricity supply act-1948.
4. Code of practice for Electrical wiring installations, (System voltage not exceeding 650 volts), Indian Standard Institution, IS: 732-1983.
5. Guide for Electrical layout in residential buildings, Indian Standard Institution, IS: 4648-1968.

HIGH VOLTAGE ENGINEERING
Professional Elective-I

III Year B.Tech. I-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE506	PE	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:48			

Prerequisite: Power Systems – I, Electro Magnetic Fields

Course Objectives:

- To deal with the detailed analysis of Breakdown occurring in gaseous, liquids and solid dielectrics
- To inform about generation and measurement of High voltage and current
- To introduce High voltage testing methods.

Course outcomes : At the end of this course ,students will be able to:

- Understand the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials, generation and measurement of D.C., A.C., & Impulse voltages.
- Knowledge of tests on H.V. equipment and on insulating materials, as per standards.
- Knowledge of how over-voltages arise in a power system, and protection against these over- voltages.
- Identify the causes of lightning and switching over-voltages and design protection schemes.
- Interpret and follow IS/IEC standards for high voltage testing of electrical equipment.

UNIT-I: Breakdown In Gases

Ionization processes and de-ionization processes, Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non-uniform gaps, Townsend's theory, Streamer mechanism, Corona discharge
Breakdown In Liquid And Solid Insulating Materials: Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials.

UNIT-II Generation Of High Voltages: Generation of high voltages, generation of high D. C. and A.C. voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

UNIT-III Measurements Of High Voltages And Currents: Peak voltage, impulse voltage and high direct current measurement method, cathode ray oscillographs for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements.

UNIT-IV Lightning And Switching Over-Voltages: Charge formation in clouds, Stepped leader, Dart leader, Lightning Surges. Switching overvoltage's, Protection against over-voltages, Surge diverters, Surge modifiers.

UNIT-V: High Voltage Testing Of Electrical Apparatus And High Voltage Laboratories

Various standards for HV Testing of electrical apparatus, IS, IEC standards, testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and some high voltage equipment, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs.

TEXT BOOKS:

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering", McGraw Hill Education, 2013.
2. C. L. Wadhwa, "High Voltage Engineering", New Age International Publishers, 2007.

REFERENCE BOOKS:

1. D. V. Razevig (Translated by Dr. M. P. Chourasia), "High Voltage Engineering Fundamentals", Khanna Publishers, 1993.
2. E. Kuffel, W. S. Zaengl and J. Kuffel, "High Voltage Engineering Fundamentals", Newnes Publication, 2000.
3. R. Arora and W. Mosch "High Voltage and Electrical Insulation Engineering", John Wiley & Sons, 2011.
4. Various IS standards for HV Laboratory Techniques and Testing.

BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

III Year B.Tech. I-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23MB504	HS	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:48			

Course Objective: To learn the basic business types, impact of the economy on Business and Firms specifically. To analyze the Business from the Financial Perspective.

Course Outcome:

- Understand the fundamental concepts of business and economics
- Analyze the principles of demand and supply, including elasticity and demand forecasting techniques
- Evaluate production and cost functions, and compare different market structures and pricing strategies
- Apply fundamental accounting principles to record financial transactions using the double-entry system
- Interpret and analyze financial statements using key financial ratios

UNIT - I: Introduction to Business and Economics: Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply and Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT - II: Demand and Supply Analysis:

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function and Law of Supply.

UNIT - III: Production, Cost, Market Structures & Pricing: Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition. Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

UNIT - IV: Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts (Simple Problems).

UNIT - V: Financial Ratios Analysis: Concept of Ratio Analysis, Importance and Types of Ratios, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios – Analysis and Interpretation (simple problems).

TEXT BOOKS:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata Mc –Graw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata Mc Graw Hill Education Pvt. Ltd. 2012.

REFERENCE BOOKS:

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

MICROPROCESSORS & MICROCONTROLLERS LAB

III Year B.Tech. I-Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EC508	Core	0	0	2	1	40	60	100
Contact Classes: 0	Tutorial Classes: 0	Practical Classes: 32			Total Classes:32			

Prerequisites: Digital Electronics, Microprocessors and Microcontrollers

Course Objectives:

- To develop an understanding of the operations of microprocessors and micro controllers.
- To develop assembly language programming to perform various applications.
- To understand the interfacing of various external devices to the processor and controllers.

Course Outcomes: At the end of this course, students will be able to:

- Understands the internal architecture and organization of 8086 ,8051 and ARM processors/controllers.
- Understands the interfacing techniques to 8086 and 8051 and can develop assembly language programming to design microprocessor/ micro controller-based systems.
- Develop programs for interfacing various external devices
- Implement serial and parallel communication techniques
- Design and verify real-time embedded applications

The following programs/experiments are to be written for assembler and to be executed the same with 8086 and 8051 kits.

List of Experiments:

1. Programs for 16-bit arithmetic operations 8086(using various addressing modes)
2. Programs for sorting an array for 8086.
3. Programs for searching for a number of characters in a string for 8086.
4. Programs for string manipulation for 8086.
5. Programs for digital clock design using 8086.
6. Interfacing ADC and DAC to 8086.
7. Parallel communication between two microprocessor kits using 8255.
8. Serial communication between two microprocessor kits using 8251.
9. Interfacing to 8086 and programming to control stepper motor.
10. Programming using arithmetic, logical and bit manipulation instructions of 8051.
11. Program and verify Timer/Counter in 8051.
12. Program and verify interrupt handling in 8051.
13. UART operation in 8051.
14. Communication between 8051 kit and PC
15. Interfacing LCD to 8051
16. Interfacing Matrix/Keyboard to 8051
17. Data transfer from peripheral to memory through DMA controller 8237/8257

TEXT BOOKS:

1. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, MHE, 2nd Edition 2006.
2. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed.

REFERENCE BOOKS:

1. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012
2. Microprocessors and Interfacing, D. V. Hall, MGH, 2nd Edition 2006.
3. Introduction to Embedded Systems, Shibu K.V, MHE, 2009
4. The 8051 Microcontrollers, Architecture and Programming and Applications -K.Uma Rao, Andhe Pallavi, Pearson, 2009.

POWER ELECTRONICS LAB

III Year B.Tech. I-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE509	Core	0	0	2	1	40	60	100
Contact Classes: 0	Tutorial Classes: 0	Practical Classes: 32			Total Classes:32			

Prerequisite: Power Electronics

Course Objectives:

- To apply the concepts of power electronic converters for efficient conversion
- To control power converters power flow from source to load.
- Design the power converter with suitable switches meeting a specific load requirement.

Course Outcomes: At the end of this course, students will be able to:

- Understand the operating principles of various power electronic converters.
- Use power electronic simulation packages & hardware to develop power converters.
- Analyze and choose the appropriate converters for various applications
- Design and implement firing and commutation circuits for controlled devices
- Analyze output waveforms from hardware and simulation experiments to assess the modes of operation

Any eight experiments should be conducted

1. Study of Characteristics of SCR, MOSFET & IGBT,
2. Gate firing circuits for SCR's
3. Single Phase AC Voltage Controller with R and RL Loads
4. Single Phase half controlled & fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)
6. Single Phase Cyclo-converter with R and RL loads
7. Single Phase series & parallel inverter with R and RL loads
8. Single Phase Bridge inverter with R and RL loads

Any two experiments should be conducted

1. DC Jones chopper with R and RL Loads
2. Three Phase half-controlled bridge converter with R-load
3. Single Phase dual converter with RL loads
4. (a) Simulation of single-phase Half wave converter using R and RL loads
(b) Simulation of single-phase full converter using R, RL and RLE loads
(c) Simulation of single-phase Semi converter using R, RL and RLE loads
5. (a) Simulation of Single-phase AC voltage controller using R and RL loads
(b) Simulation of Single phase Cyclo-converter with R and RL-loads
6. Simulation of Buck chopper
7. Simulation of single-phase Inverter with PWM control
8. Simulation of three phase fully controlled converter with R and RL loads, with and without freewheeling diode. Observation of waveforms for Continuous and Discontinuous modes of operation.
9. Study of PWM techniques

TEXT BOOKS:

1. M. H. Rashid, Simulation of Electric and Electronic circuits using PSPICE – by M/s PHI Publications.
2. User's manual of related software's

REFERENCE BOOKS:

1. Reference guides of related software's
2. Rashid, Spice for power electronics and electric power, CRC Press

ADVANCED ENGLISH COMMUNICATION SKILLS LAB

III Year B.Tech. I-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EN508	Core	0	0	2	1	40	60	100
		Practical Classes: 32				Total Classes:32		
Contact Classes: 0	Tutorial Classes: 0							

CO1. Understand and **apply** effective listening and reading strategies to comprehend spoken and written English in academic and professional contexts

CO2. Develop clear and well-structured written communication, including letters, emails, résumés, reports, and blog posts, using correct vocabulary and format.

CO3. Demonstrate confident and relevant oral communication through role plays, conversations, and individual or group presentations.

CO4. Participate effectively in group discussions by expressing ideas fluently, organizing thoughts logically, and using appropriate body language

CO5. Prepare for and perform successfully in interviews (including virtual formats) by applying suitable strategies for answering questions and presenting oneself professionally.

1. Introduction

The introduction of the Advanced English Communication Skills Lab is considered essential at the B.Tech 3rd year level. At this stage, the students need to prepare themselves for their career which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use appropriate English and perform the following:

1. Gathering ideas and information to organise ideas relevantly and coherently.
2. Making oral presentations.
3. Writing formal letters.
4. Transferring information from non-verbal to verbal texts and vice-versa.
5. Writing project/research reports/technical reports.
6. Participating in group discussions.
7. Engaging in debates.
8. Facing interviews.
9. Taking part in social and professional communication.

2. Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, with a focus on vocabulary
- To enable them to listen to English spoken at normal conversational speed by educated English speakers
- To respond appropriately in different socio-cultural and professional contexts
- To communicate their ideas relevantly and coherently in writing
- To prepare the students for placements.

3. Syllabus:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. **Activities on Listening and Reading Comprehension:** Active Listening – Development of Listening Skills Through Audio clips - Benefits of Reading – Methods and Techniques of Reading – Basic Steps to Effective Reading – Common Obstacles – Discourse Markers or Linkers - Sub- skills of reading - Reading for facts, negative facts and Specific Details- Guessing Meanings from Context, Inferring Meaning - Critical Reading -- Reading Comprehension – Exercises for Practice.

2. **Activities on Writing Skills:** Vocabulary for Competitive Examinations - Planning for Writing – Improving Writing Skills - Structure and presentation of different types of writing – Free Writing and Structured Writing - Letter Writing – Writing a Letter of Application – Resume vs. Curriculum Vitae – Writing a Résumé – Styles of Résumé - e-Correspondence – Emails – Blog Writing - (N)etiquette – Report Writing – Importance of Reports – Types and Formats of Reports– Technical Report Writing– Exercises for Practice.
3. **Activities on Presentation Skills** - Starting a conversation – responding appropriately and relevantly – using the right language and body language – Role Play in different situations including Seeking Clarification, Making a Request, Asking for and Refusing Permission, Participating in a Small Talk – Oral presentations (individual and group) through JAM sessions- PPTs – Importance of Presentation Skills – Planning, Preparing, Rehearsing and Making a Presentation – Dealing with Glossophobia or Stage Fear – Understanding Nuances of Delivery - Presentations through Posters/Projects/Reports – Checklist for Making a Presentation and Rubrics of Evaluation
4. **Activities on Group Discussion (GD):** Types of GD and GD as a part of a Selection Procedure - Dynamics of Group Discussion- Myths of GD - Intervention, Summarizing - Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas – Do’s and Don’ts - GD Strategies – Exercises for Practice.
5. **Interview Skills:** Concept and Process - Interview Preparation Techniques - Types of Interview Questions – Pre-interview Planning, Opening Strategies, Answering Strategies - Interview Through Tele-conference & Video-conference - Mock Interviews.

4. **Minimum Requirement:**

The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- One PC with latest configuration for the teacher
- T. V, a digital stereo & Camcorder
- Headphones of High quality

5. **Suggested Software:** The software consisting of the prescribed topics elaborated above should be procured and used.

- **TOEFL & GRE** (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- **Oxford Advanced Learner’s Dictionary**, 10th Edition
- Cambridge Advanced Learner’s Dictionary
- **DELTA’s key to the Next Generation TOEFL Test: Advanced Skill Practice.**
- **Lingua TOEFL CBT Insider**, by Dreamtech

6. Books Recommended:

1. Rizvi, M. Ashraf (2018). *Effective Technical Communication*. (2nd ed.). McGraw Hill Education (India) Pvt. Ltd.
2. Suresh Kumar, E. (2015). *Engineering English*. Orient BlackSwan Pvt. Ltd.
3. Bailey, Stephen. (2018). *Academic Writing: A Handbook for International Students*. (5th Edition). Routledge.
4. Koneru, Aruna. (2016). *Professional Communication*. McGraw Hill Education (India) Pvt. Ltd.
5. Raman, Meenakshi & Sharma, Sangeeta. (2022). *Technical Communication, Principles and Practice*. (4TH Edition) Oxford University Press.
6. Anderson, Paul V. (2007). *Technical Communication*. Cengage Learning Pvt. Ltd. New Delhi.
7. McCarthy, Michael; O'Dell, Felicity & Redman, Stuart. (2017). *English Vocabulary in Use Series*. Cambridge University Press
8. Sen, Leela. (2009). *Communication Skills*. PHI Learning Pvt Ltd., New Delhi.
9. Elbow, Peter. (1998). *Writing with Power*. Oxford University Press.
10. Goleman, Daniel. (2013). *Emotional Intelligence: Why it can matter more than IQ*. Bloomsbury Publishing.

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III Year B.Tech. I-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks
MC5001	MC	L	T	P	0	100
		3	0	0		
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: 0			Total Classes:32	

Course Objectives:

- To Design/develop suitable power converter for efficient control or conversion of power in drive applications
- To Design/develop suitable power converter for efficient transmission and utilization of power in power system applications.

Course Outcomes: Students will be able to

- Apply the basic operation and characteristics of various power semiconductor devices and intelligent power module.
- Design AC/DC rectifier circuit
- Evaluate chopper circuits
- Examine three phase inverter circuits
- Create AC voltage controller circuits

UNIT-I

Power Switching Devices: Power Switching Devices: Concept of power electronics, scope and applications, types of power converters; Power semiconductor switches and their V-I characteristics – Power Diodes, Power BJT, SCR, Power MOSFET, Power IGBT; Thyristor ratings and protection, Series and parallel connections of SCRs, Two transistor analogy of SCR, methods of SCR commutation, UJT as a trigger source, gate drive circuits for BJT and MOSFETs.

UNIT-II

AC-DC Converters (Phase Controlled Rectifiers): AC-DC Converters (Phase Controlled Rectifiers): Principles of single-phase fully controlled converter with R, RL, and RLE load, Principles of single-phase half-controlled converter with RL and RLE load, Principles of three-phase fully-controlled converter operation with RLE load, Effect of load and source inductances, General idea of gating circuits, Single phase and Three phase dual converters.

UNIT-III

DC-DC Converters (Chopper/SMPS): Introduction, elementary chopper with an active switch and diode, concepts of duty ratio, average inductor voltage, average capacitor current. Buck converter -Power circuit, analysis and waveform at steady state, duty ratio control of output voltage. Boost converter-Power circuit, analysis and Wave forms at steady state, relation between duty ratio and average output voltage. Buck-Boost converter-Power circuit, analysis and wave forms at steady state, relation between duty ratio and average output voltage.

UNIT-IV

AC-DC Inverters: Introduction, principle of operation ,performance parameters, single phase bridge inverters with R,RL loads, 3-phase bridge inverters - 120- and 180- degrees mode of operation, Voltage control of single-phase inverters–single pulse width modulation, multiple pulse width modulation, sinusoidal pulse width modulation.

UNIT-V

AC-AC Converters: Phase Controller (AC Voltage Regulator) - Introduction, modes of operation of Triac, principle of operation of single-phase voltage controllers for R, R-L loads and its applications. Cyclo-converter- Principle of operation of single phase cyclo-converters, relevant waveforms, circulating current mode of operation, Advantages and disadvantages.

TEXT BOOKS:

1. M.H.Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
2. N.Mohan and T.M.Underland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.

REFERENCES:

1. R.W. Erickson and D.Maksimovic, "Fundamentals of Power Electronics" Springer Science & Business Media, 2007.
2. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

POWER SYSTEM PROTECTION

III Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
23EE601	Core	L	T	P	3	CIE	SEE	TOTAL
		3	0	0		40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:48			

Pre-requisites: Power Systems-I, Power Systems-II

Course Objectives:

- To introduce all kinds of circuit breakers and relays for protection of Generators, Transformers and feeder bus bars from Over voltages and other hazards.
- To describe neutral grounding for overall protection.
- To understand the phenomenon of Over Voltages and its classification.

Course Outcomes: At the end of the course the student will be able to:

- Compare and contrast electromagnetic, static and microprocessor-based relays
- Apply technology to protect power system components.
- Analyze quenching mechanisms use air, oil and vacuum circuit breakers
- Evaluate fuse characteristics and the application of fuses
- Select relay settings of over current and distance relays

UNIT-I: Protective Relays: Introduction, Need for power system protection, effects of faults, evolution of protective relays, zones of protection, primary and backup protection, essential qualities of protection, classification of protective relays and schemes, current transformers, potential transformers, basic relay terminology.

Operating Principles and Relay Construction: Electromagnetic relays, thermal relays, static relays, microprocessor based protective relays.

UNIT-II: Over-Current Protection: Time-current characteristics, current setting, over current protective schemes, directional relay, protection of parallel feeders, protection of ring mains, Phase fault and earth fault protection, Combined earth fault and phase fault protective scheme, Directional earth fault relay. **Distance Protection:** Impedance relay, reactance relay, MHO relay, input quantities for various types of distance relays, Effect of arc resistance, Effect of power swings, effect of line length and source impedance on the performance of distance relays, selection of distance relays, MHO relay with blinders, Reduction of measuring units, switched distance schemes, auto re-closing.

UNIT-III: Pilot Relaying Schemes: Wire Pilot protection, Carrier current protection. AC Machines and Bus Zone Protection: Protection of Generators, Protection of transformers, Bus- zone protection, frame leakage protection.

UNIT-IV: Static Relays: Amplitude and Phase comparators, Duality between AC and DC, Static amplitude comparator, integrating and instantaneous comparators, static phase comparators, coincidence type of phase comparator, static over current relays, static directional relay, static differential relay, static distance relays, Multi input comparators, concept of Quadrilateral and Elliptical relay characteristics.

Microprocessor Based Relays: Advantages, over current relays, directional relays, distance relays.

UNIT-V: Circuit Breakers: Introduction, arcing in circuit breakers, arc interruption theories, re-striking and recovery voltage, resistance switching, current chopping, interruption of capacitive current, oil circuit breaker, air blast circuit breakers, SF6 circuit breaker, operating mechanism, selection of circuit breakers, high voltage DC breakers, ratings of circuit breakers, testing of circuit breakers.

Fuses: Introduction, fuse characteristics, types of fuses, application of HRC fuses, discrimination.

TEXT BOOKS:

1. Badriram and D.N. Vishwakarma, Power System Protection and Switchgear, TMH 2001.
2. U. A. Bakshi, M. V. Bakshi: Switchgear and Protection, Technical Publications, 2009.

REFERENCE BOOKS:

1. C. Russel Mason - "The art and science of protective relaying, Wiley Eastern, 1995
2. L. P. Singh "Protective relaying from Electromechanical to Microprocessors", New Age International

POWER SYSTEM OPERATION AND CONTROL

III Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
23EE602	Core	L	T	P	3	CIE	SEE	TOTAL
		3	0	0		40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:48			

Pre-requisites: Power System-I, Power System-II

Course Objectives:

- Understand the principles and significance of real power control, emphasizing the importance of frequency control in power systems.
- Analyze various methods for effective reactive power control in power systems.
- Grasp the concepts of unit commitment, economic load dispatch, and real-time control, highlighting their importance in power system operation.

Course Outcomes: At the end of the course the student will be able to:

- Understand operation and control of power systems.
- Analyze various functions of EMS functions and stability of machines.
- Understand power system deregulation and restructuring
- Analyze whether the machine is in stable or unstable position.
- Test the stability of the power system.

UNIT I

Load Flow Studies: Introduction, Bus classification -Nodal admittance matrix - Load flow equations - Iterative methods - Gauss and Gauss Seidel Methods, Newton-Raphson Method-Fast Decoupled Method-Merits and demerits of the above methods-System data for load flow study

UNIT II

Economic Operation Of Power Systems: Distribution of load between units within a plant-Transmission loss as a function of plant generation, Calculation of loss coefficients-Distribution of load between plants.

UNIT III

PF Control: Introduction, load frequency problem-Megawatt frequency (or P-f) control channel, MVAR voltages (or Q-V) control channel-Dynamic interaction between P-f and Q-V loops. Mathematical model of speed- governing system-Turbine models, division of power system into control areas, P-f control of single control area (the uncontrolled and controlled cases)-P-f control of two area systems (the uncontrolled cases and controlled cases).

UNIT IV Power System Stability: The stability problem-Steady state stability, transient stability and Dynamic Stability-Swing equation. Equal area criterion of stability-Applications of Equal area criterion, Step by step solution of swing equation-Factors affecting transient stability, Methods to improve steady state and Transient stability, Introduction to voltage stability

UNIT-V Computer Control of Power Systems: Need of computer control of power systems. Concept of energy control centre (or) load dispatch centre and the functions - system monitoring - data acquisition and control. System hardware configuration – SCADA and EMS functions. Network topology – Importance of Load Forecasting and simple techniques of forecasting

TEXT BOOKS:

1. C. L. Wadhwa, Electrical Power Systems, 3rd Edn, New Age International Publishing Co., 2001.
2. D. P. Kothari and I. J. Nagrath, Modern Power System Analysis, 4th Edn, Tata McGraw Hill Education Private Limited 2011.

REFERENCE BOOKS:

1. D. P. Kothari: Modern Power System Analysis-Tata Mc Graw Hill Pub. Co. 2003.
2. Hadi Sadat: Power System Analysis –Tata Mc Graw Hill Pub. Co. 2002.

DIGITAL SIGNAL PROCESSING

III Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EC607	Core	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:48			

Pre-requisites: Laplace Transforms, Numerical Methods and Complex variables, Control Systems

Course Objectives:

- Provide foundational knowledge for the analysis and processing of digital signals.
- Explore the relationships between continuous-time and discrete-time signals and systems, emphasizing time, frequency, and Z-plane analysis.
- Introduce real-world signal processing applications while studying the design and structures of digital filters, including IIR and FIR, and addressing finite word length effects.

Course Outcomes: At the end of this course, students will be able to:

- Carry out simulation of DSP system and abilities towards DSP processor-based implementation of DSP systems.
- Analyze Finite wordlength effect on DSP systems and applications of FFT to DSP.
- Implement adaptive filters for various applications of DSP.
- Perform and interpret frequency response analysis and power spectrum estimation of signals using appropriate tools.
- Develop and test DSP-based applications such as DTMF signal generation, noise removal, and audio signal analysis using MATLAB and DSP processors.

UNIT-I: Introduction: Realization of Digital Filters: Introduction to Digital Signal Processing: Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Normalized Frequency, Linear Shift Invariant Systems, Stability, and Causality, linear differential equation to difference equation, Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms.

UNIT-II: Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of DFT: Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and Z-Transform.

Fast Fourier Transforms: Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT, and FFT with General Radix-N

UNIT-III: IIR Digital Filters: Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations.

UNIT-IV:

FIR Digital Filters: Characteristics of FIR Digital Filters, Frequency Response, and Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR filters.

UNIT-V:

Multi-Rate Digital Signal Processing: Introduction, Down Sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion, Conversion of Band Pass Signals, Concept of Resampling, Applications of Multi Rate Signal Processing.

Finite Word Length Effects: Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round off Noise, Methods to Prevent Overflow, Tradeoff between Round Off and Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.

TEXT BOOKS:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009.

REFERENCE BOOKS:

1. Fundamentals of Digital Signal Processing – Loney Ludeman, John Wiley, 2009
2. Digital Signal Processing – Fundamentals and Applications – Li Tan, Elsevier, 2008
3. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling, Sandra L. Harris, Thomson, 2007
4. Digital Signal Processing - A Practical approach, Emmanuel C. Ifeachor and Barrie W. Jervis, 2nd Edition, Pearson Education, 2009

POWER SEMICONDUCTOR DRIVES

Professional Elective-II

III Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EC607	PE	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:48			

Prerequisite: Power Electronics, Electrical Machines – I, Electrical Machines – II

Course Objectives:

- To introduce the drive system and operating modes of drive and its characteristics
- To understand Speed – Torque characteristics of different motor drives by various power converter topologies
- To appreciate the motoring and braking operations of drive and differentiate DC and AC drives

Course Outcomes: After completion of this course the student is able to

- Identify the drawbacks of speed control of motor by conventional methods.
- Differentiate Phase controlled and chopper-controlled DC drives speed-torque characteristics merits and demerits
- Understand Ac motor drive speed–torque characteristics using different control strategies its merits and demerits and describe Slip power recovery schemes
- Analyze and compare the speed control methods of DC motors, including phase-controlled converters and chopper-controlled drives
- Explain the speed-torque characteristics and control strategies of AC motor drives

UNIT-I: Control of DC Motors : Introduction to Thyristor controlled Drives, Single Phase semi and fully controlled converters connected to DC separately excited and DC series motors – continuous current operation – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque Characteristics- Problems on Converter fed DC motors.

Three phase semi and fully controlled converters connected to DC separately excited and DC series motors – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque characteristics – Problems.

UNIT-II: Four Quadrant Operation of DC Drives: Introduction to Four quadrant operation – Motoring operations, Electric Braking – Plugging, Dynamic, and Regenerative Braking operations. Four quadrant operation of D.C motors by single phase and three phase dual converters – Closed loop operation of DC motor (Block Diagram Only)

Control of DC Motors by Choppers: Single quadrant, two quadrant and four quadrant chopper fed dc separately excited and series motors – Continuous current operation – Output voltage and current wave forms – Speed and torque expressions – speed-torque characteristics – Problems on Chopper fed D.C Motors – Closed Loop operation (Block Diagram Only)

UNIT-III: Control of Induction Motor: Variable voltage characteristics-Control of Induction Motor by Ac Voltage Controllers – Waveforms – speed torque characteristics.

Variable frequency characteristics-Variable frequency control of induction motor by Voltage source and current source inverter and cyclo-converters- PWM control – Comparison of VSI and CSI operations – Speed torque characteristics – numerical problems on induction motor drives – Closed loop operation of induction motor drives (Block Diagram Only)

UNIT-IV: Rotor Side Control of Induction Motor

Static rotor resistance control – Slip power recovery – Static Scherbius drive – Static Kramer Drive – their performance and speed torque characteristics – advantages, applications, problems.

UNIT-V: Control of Synchronous Motors: Separate control and self-control of synchronous motors – Operation of self-controlled synchronous motors by VSI, CSI and Cyclo-converters. Load commutated CSI fed Synchronous Motor – Operation – Waveforms – speed torque characteristics – Applications – Advantages and Numerical Problems – Closed Loop control operation of synchronous motor drives (Block Diagram Only), variable frequency control – Cyclo-converter, PWM based VSI& CSI.

TEXT BOOKS:

1. “G K Dubey”, Fundamentals of Electric Drives, CRC Press, 2002.
2. “Vedam Subramanyam”, Thyristor Control of Electric drives, Tata McGraw Hill Publications, 1987.

REFERENCE BOOKS:

1. “S K Pillai”, A First course on Electrical Drives, New Age International (P) Ltd. 2nd Edition. 1989
2. “P. C. Sen”, Thyristor DC Drives, Wiley-Blackwell, 1981
3. “B. K. Bose”, Modern Power Electronics, and AC Drives, Pearson 2015.
4. “R. Krishnan”, Electric motor drives - modelling, Analysis and control, Prentice Hall PTR, 2001

WIND AND SOLAR ENERGY SYSTEMS

Professional Elective-II

III Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE604	PE	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:48			

Prerequisite: Renewable Energy Systems

Course Objectives:

- To study the physics of wind power and energy, understanding the principles governing wind generator operation.
- To gain knowledge about solar power resources, analyze solar photovoltaic cells, and discuss solar thermal power generation.
- To identify and understand network integration issues associated with renewable energy sources like wind and solar power.

Course Outcomes: At the end of this course, students will be able to:

- Understand the energy scenario and the consequent growths of the power generate renewable energy sources.
- Understand the basic physics of wind and solar power generation.
- Understand the power electronic interfaces for wind and solar generation and grid-integration issues.
- Explain the basic principles and physics of wind and solar energy systems
- Analyze power electronic interfaces and grid integration challenges

UNIT-I:

Physics Of Wind Power: History of wind power, Indian and Global statistics, Wind physics, Betz limit ratio, stall and pitch control, Wind speed statistics-probability distributions, and Wind power-cumulative distribution functions.

UNIT-II:

Wind Generator Topologies: Review of modern wind turbine technologies, Fixed and Variable speed wind turbine, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent Magnet Synchronous Generators, Power electronics converters. Generator configurations, Converter Control.

UNIT-III:

The Solar Resource: Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

Solar Photovoltaic: Technologies-Amorphous, mono-crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power point Tracking (MPPT) algorithms. Converter Control.

UNIT-IV:

Network Integration Issues: Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.

UNIT-V:

Solar Thermal Power Generation: Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.

TEXT BOOKS:

1. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.
2. G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.

REFERENCE BOOKS:

1. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 1984.
2. H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems" John Wiley and Sons Ltd., 2006.
3. G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications, 2004.
4. J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley & Sons, 1991.

ENERGY MANAGEMENT AND AUDITING

Professional Elective-II

III Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE605	PE	3	0	0	3	40	60	100
		Practical Classes: Nil				Total Classes:48		
Contact Classes: 48	Tutorial Classes: 0							

Prerequisite: Power Systems

Course Outcomes: At the end of this course, students will be able to

- Acquire basic knowledge in the field of energy management and auditing process.
- Learn the basic concepts of economic analysis and load management.
- Design effective thermal utility system.
- Improve efficiency in Electrical Utilities such as Lighting System, Motor, Fans and Pumps.
- Acquire the fundamental concepts in the Building Energy Management System (BEMS), ECBC Code and Guidelines for Electrical power

UNIT I GENERAL ASPECTS OF ENERGY MANAGEMENT AND ENERGY AUDIT

Commercial and Non-commercial energy - Final Energy Consumption - Energy needs of growing economy - Energy Pricing - Energy Conservation and its importance - Energy Conservation versus Energy Efficiency- Energy Conservation Act 2001, Electricity Act 2003, Energy Conservation (Amendment) Act, 2010 and its features - Electricity Tariff - Schemes of Bureau of Energy Efficiency (BEE) - Need and Types of Energy Audit - Energy audit approach - understanding energy costs - maximizing system efficiencies - optimizing the input energy requirements - Instruments and metering for energy audit.

UNIT II MATERIAL AND ENERGY BALANCE Components of materials and energy balance - Basic principles - material and energy balance diagram - Energy policy and planning - roles and responsibilities of energy manager - employees training and planning- Financial Management: financial analysis technique - Simple Payback Period, Return on Investment, Net Present Value, Internal Rate of Return.

UNIT III ENERGY EFFICIENCY IN THERMAL UTILITIES Thermal energy basics - Introduction to fuels - properties of fuel oil, coal and gas - principles of combustion - combustion of oil, coal and gas - Boilers: Types and classification - performance and evaluation - energy conservation opportunities in boilers - Compressed Air System: Types of air compressors - Efficient Compressor Operation - Compressed air system components - Refrigeration System: Vapour Compression Refrigeration- Absorption Refrigeration - Common Refrigerants and Properties - Heat Pumps and their applications - Ventilation Systems - Standards and Labelling of Room Air Conditioners - Energy Savings Opportunities - Cogeneration: Need - Principle - Classification.

UNIT IV ENERGY EFFICIENCY IN ELECTRICAL UTILITIES Electrical Load Management and Maximum Demand Control - Power Factor Improvement and its benefit - selection and location of capacitors - Automatic Power Factor Controllers - Electric motors: Types - losses in induction motor - motor efficiency - factors affecting motor performance - rewinding and motor replacement issues - energy saving opportunities with energy efficient motors - soft starters with energy saver - Fans: Types - Performance Evaluation - Efficient System Operation - Energy saving opportunities - Pumps :Types - Efficient Pumping system operation- Lighting System: Light source, choice of lighting, luminance requirements - Energy Efficient Lighting Controls - Energy Saving Opportunities.

UNIT V BUILDING MANAGEMENT SYSTEM AND ECBC ON ELECTRICAL POWER Introduction - Energy Conservation Building Code (ECBC) - Building definition as in Energy Conservation (amendment) Bill 2010 - ECBC Guidelines for Electrical power - Lighting - Building water pumping system, Uninterruptible Power Supply - Escalators and Elevators, Building Energy Management System (BEMS) - Star rating of buildings - Energy Performance Index (EPI) - Energy Efficiency Measures.

REFERENCES:

1. Moncef Krarti, "Energy Audit of Building Systems: An Engineering Approach", Third Edition, CRC Press, 2020
2. Sonal Desai, "Handbook of Energy Audit", First Edition, McGraw Hill (India), 2015
3. Michael P. Deru, Jim Kelsey, "Procedures for Commercial Building Energy Audits", Second Edition, American Society of Heating, Refrigerating and Air-conditioning Engineers, 2011
4. T.D. Eastop, D.R. Croft, "Energy Efficiency for Engineers and Technologists", First Edition, Longman Scientific and Technical, 1990

RENEWABLE ENERGY SOURCES

Open Elective-I

III Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE606	OE	3	0	0	3	40	60	100
		Practical Classes: Nil				Total Classes:48		
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:48			

Course Objectives:

- To recognize the awareness of energy conservation in students
- To identify the use of renewable energy sources for electrical power generation
- To collect different energy storage methods and detect about environmental effects of energy conversion

Course Outcomes: At the end of the course the student will be able to:

- Understand the principles of wind power and solar photovoltaic power generation, fuel cells.
- Assess the cost of generation for conventional and renewable energy plants
- Design suitable power controller for wind and solar applications and analyze the issues involved in the integration of renewable energy sources to the grid
- Analyze the operation of induction generators including self-excitation, speed, and voltage control methods.
- Apply knowledge of power injection and control strategies for the integration of multiple renewable energy sources

UNIT-I:

Introduction Wind Power Plants: Renewable Sources of Energy-Grid-Supplied Electricity-Distributed Generation-Renewable Energy Economics-Calculation of Electricity Generation Costs –Demand side Management Options – Supply side Management Options-Modern Electronic Controls of Power Systems.

Appropriate Location -Evaluation of Wind Intensity -Topography -Purpose of the Energy Generated - General Classification of Wind Turbines-Rotor Turbines-Multiple-Blade Turbines Drag Turbines -Lifting Turbines-Generators and Speed Control used in Wind Power Energy Analysis of Small Generating Systems.

UNIT-II: Photovoltaic Power Plants: Solar Energy-Generation of Electricity by Photovoltaic Effect -Dependence of a PV Cell Characteristic on Temperature-Solar cell Output Characteristics-Equivalent Models and Parameters for Photovoltaic Panels-Photovoltaic Systems-Applications of Photovoltaic Solar Energy-Economical Analysis of Solar Energy. Fuel Cells: The Fuel Cell-Low and High Temperature Fuel Cells-Commercial and Manufacturing Issues Constructional Features of Proton Exchange-Membrane Fuel Cells –Reformers-Electrolyzer Systems and Related Precautions-Advantages and Disadvantages of Fuel Cells-Fuel Cell Equivalent Circuit- Practical Determination of the Equivalent Model Parameters -Aspects of Hydrogen as Fuel.

UNIT-III:

Induction Generators: Principles of Operation-Representation of Steady-State Operation-Power and Losses Generated-Self- Excited Induction Generator-Magnetizing Curves and Self-Excitation Mathematical Description of the Self-Excitation Process-Interconnected and Stand-alone operation -Speed and Voltage Control - Economical Aspects.

UNIT-IV:

Storage Systems: Energy Storage Parameters-Lead-Acid Batteries-Ultra Capacitors-Flywheels – Superconducting Magnetic Storage System-Pumped Hydroelectric Energy Storage - Compressed Air Energy Storage - Storage Heat -Energy Storage as an Economic Resource.

UNIT-V:

Integration of Alternative Sources of Energy: Principles of Power Injection-Instantaneous Active and Reactive Power Control Approach Integration of Multiple Renewable Energy Sources-Islanding and Interconnection Control-DG Control and Power Injection.

Interconnection Of Alternative Energy

Sources with the Grid:

Interconnection Technologies -Standards and Codes for Interconnection-Interconnection Considerations - Interconnection Examples for Alternative Energy Sources.

TEXT BOOKS:

1. Felix A. Farret, M. Godoy Simoes, "Integration of Alternative Sources of Energy", John Wiley & Sons, 2006.
2. Solanki: Renewable Energy Technologies: Practical Guide For Beginners, PHI Learning Pvt. Ltd., 2008.

REFERENCE BOOKS:

1. D. Mukherjee: Fundamentals of Renewable Energy Systems, New Age International publishers, 2007.
2. Remus Teodorescu, Marco Liserre, Pedro Rodríguez: Grid Converters for Photovoltaic and Wind Power Systems, John Wiley & Sons, 2011.
3. Gilbert M. Masters: Renewable and Efficient Electric Power Systems, John Wiley & Sons, 2004.

FUNDAMENTAL OF ELECTRIC VEHICLES

Open Elective-I

III Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE607	OE	3	0	0	3	40	60	100
		Practical Classes: Nil				Total Classes:48		
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:48			

Pre-requisites: None; Interest in electric Vehicles

Course Objectives:

- To understand the fundamentals of Electric Vehicles (EVs), especially in Indian Context.
- To examine technology associated with each element of EV drive-train;
- To get into the economics of EVs in India vis-à-vis petrol vehicles.

Course Outcomes: At the end of the course the student will be able to:

- Understand the fundamentals of Electric Vehicles.
- Design of batteries, EV motors and Power electronic controllers for EV systems.
- Analyze the economics of EV market and EV data using Analytical tools
- Explain the fundamentals of electric vehicles, including battery technologies, EV subsystems, and vehicle dynamics, to understand their design and operation
- Analyze and design key components of electric vehicles such as batteries, motors, and power electronic controllers

UNIT-I:

Introduction: Overview of Electric Vehicles in India, India's EV program, Charging and Swapping Infrastructure, brief introduction of batteries, Lithium for batteries, EV Subsystems.

UNIT-II:

Vehicle Dynamics: Forces acting when a vehicle move, Aerodynamic drag, Rolling Resistance and Uphill Resistance, Power and Torque to accelerate.

Drive Cycle: Concept of Drive Cycle, Drive Cycles and Energy used per km.

UNIT-III:

EV Powertrain: Design of EV Drive Train, Introduction to Battery Parameters, Why Lithium Ion Battery? Batteries in Future, Li-Ion Battery Cells, SoH and SoC estimation and Self Discharge, Battery Pack Development, Computation of Effective cost of battery, Charging Batteries

Fundamentals of EV Battery Pack design: Mechanical, Thermal and Electrical Design, BMS Design of Electric Vehicle.

UNIT-IV:

EV Motors and Controllers: Fundamentals and Design, Understanding Flow of Electricity, Magnetism and Heat, Power and Efficiency, Torque Production, Speed and Back EMF, the d-q Equivalent circuit, Field-oriented Control, Understanding Three phase AC and DC to AC conversion systems, Understanding the thermal design of the motors, Engineering Considerations, Future Frontiers.

UNIT-V EV Charging: Introduction, Slow or Fast EV Chargers, Battery Swapping, Standardization and On board Chargers, Public Chargers, Bulk Chargers/Swap Stations, Economics of Public Chargers in context, Analytics and Tools for EV systems.

TEXT BOOKS:

1. Electric Powertrain - Energy Systems, Power electronics and drives for Hybrid, electric and fuel cell vehicles by John G. Hayes and A. Goodarzi, Wiley Publication
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004
3. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003

REFERENCE BOOKS:

1. James Larminie, John Lowry, *Electric Vehicle Technology Explained*, Wiley, 2003
2. Chris Mi, M. Abul Masrur, David Wenzhong Gao, *Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives*, John Wiley & Sons Ltd., 2011
3. Fundamentals of Electric Vehicles: technology and economics
https://onlinecourses.nptel.ac.in/noc20_ee99/preview
<https://archive.nptel.ac.in/courses/108/106/108106170/>

POWER SYSTEMS LABARATORY

III Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
23EE608	Core	L	T	P	1	CIE	SEE	TOTAL
		0	0	2		40	60	100
Contact Classes: 0	Tutorial Classes: 0	Practical Classes: 32			Total Classes:32			

Prerequisite: Power System-I, Power System-II, Power System Protection, Power System Operation and Control, Electrical Machines

Course Objectives:

- To perform testing of CT, PT's and Insulator strings
- To find sequence impedances of 3- Φ synchronous machine and Transformer
- To perform fault analysis on Transmission line models and Generators.

Course Outcomes: At the end of this course, students will be able to

- Perform various load flow techniques
- Understand Different protection methods
- Analyse the experimental data and draw the conclusions.
- Formulate and analyze the YBUS and ZBUS matrices for power system network modeling.
- Simulate compensated transmission lines and evaluate their performance under different loading conditions.

The following experiments are required to be conducted as compulsory experiments:

Part - A

1. Characteristics of IDMT Over-Current Relay.
2. Differential protection of 1- Φ transformer.
3. Characteristics of Micro Processor based Over Voltage/Under Voltage relay.
4. A, B, C, D constants of a Long Transmission line
5. Finding the sequence impedances of 3- Φ synchronous machine.
6. Finding the sequence impedances of 3- Φ Transformer.

In addition to the above six experiments, at least any four of the experiments from the following list are required to be conducted.

Part - B

1. Formation of YBUS.
2. Load Flow Analysis using Gauss Seidel (GS) Method.
3. Load Flow Analysis using Fast Decoupled (FD) Method.
4. Formation of ZBUS.
5. Simulation of Compensated Line

TEXT BOOKS:

1. C.L. Wadhwa: Electrical Power Systems –Third Edition, New Age International Pub. Co., 2001.
2. Hadi Sadat: Power System Analysis –Tata Mc Graw Hill Pub. Co. 2002.

REFERENCE BOOK:

1. D. P. Kothari: Modern Power System Analysis-Tata Mc Graw Hill Pub. Co. 2003.

CONTROL SYSTEMS LAB

III Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
23EE609	Core	L	T	P	1	CIE	SEE	TOTAL
		0	0	2		40	60	100
Contact Classes: 0	Tutorial Classes: 0	Practical Classes: 32			Total Classes:32			

Prerequisite: Control Systems

Course Objectives:

- Understand system representations like transfer function and state space, and assess system dynamic response.
- Evaluate system performance using both time and frequency domain analyses, identifying methods to enhance performance.
- Design controllers and compensators to improve system performance based on the assessments from time and frequency domain analyses.

Course Outcomes: At the end of this course, students will be able to:

- Improve system performance by skillfully selecting appropriate controllers and compensators tailored to specific applications.
- Apply diverse time domain and frequency domain techniques to effectively assess and enhance system performance.
- Demonstrate the application of various control strategies to different systems such as power systems and electrical drives, showcasing adaptability and versatility in control applications.
- Design and analyze compensators (lag, lead, lead-lag) and controller responses (P, PI, PD, PID) for dynamic systems using software tools.
- Perform stability analysis of linear time-invariant systems using Bode plot, Root Locus, and Nyquist criteria with simulation tools.

The following experiments are required to be conducted compulsory experiments:

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions, and application of speed control of motor.
4. Effect of feedback on DC servo motor
5. Transfer function of DC motor
6. Transfer function of DC generator
7. Characteristics of AC servo motor
8. Lag and lead compensation – Magnitude and phase plot

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

1. Temperature controller using PID
2. Effect of P, PD, PI, PID Controller on a second order systems
3. (a) Simulation of P, PI, PID Controller.
(b) Linear system analysis (Time domain analysis, Error analysis) using suitable software
4. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using suitable software
5. State space model for classical transfer function using suitable software -Verification.
6. Design of Lead-Lag compensator for the given system and with specification using suitable software

TEXT BOOKS:

1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

REFERENCE BOOKS:

1. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009

DIGITAL SIGNAL PROCESSING LAB

III Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EC610	Core	0	0	2	1	40	60	100
Contact Classes: 0	Tutorial Classes: 0	Practical Classes: 32			Total Classes:32			

Pre-requisites: Digital Signal Processing

Course Objectives:

- To implement Linear and Circular Convolution.
- To implement FIR and IIR filter and architecture of DSP processor.
- To demonstrate Finite word length effect.

Course Outcomes: At the end of this course, students will be able to:

- Carry out simulation of DSP system and abilities towards DSP processor-based implementation of DSP systems.
- Analyze Finite wordlength effect on DSP systems and applications of FFT to DSP.
- Implement adaptive filters for various applications of DSP.
- Perform and interpret frequency response analysis and power spectrum estimation of signals using appropriate tools.
- Develop and test DSP-based applications such as DTMF signal generation, noise removal, and audio signal analysis using MATLAB and DSP processors.

List of Experiments (programs):

1. Generation of Sinusoidal Waveform / Signal based on Recursive Difference Equations
2. To find DFT / IDFT of given DT Signal
3. To find Frequency Response of a given System given in Transfer Function/ Differential equation form.
4. Implementation of FFT of given Sequence
5. Determination of Power Spectrum of a given Signal(s).
6. Implementation of LP FIR Filter for a given Sequence/Signal.
7. Implementation of HP FIR Filter for a given Sequence/Signal
8. Implementation of LP IIR Filter for a given Sequence/Signal
9. Implementation of HP IIR Filter for a given Sequence/Signal
10. Generation of Sinusoidal Signal through Filtering
11. Generation of DTMF Signals
12. Implementation of Decimation Process
13. Implementation of Interpolation Process
14. Implementation of I/D Sampling Rate Converters
15. Audio application such as to plot a Time and Frequency display of Microphone plus a Cosine using DSP. Read a .wav file and match with their respective spectrograms.
16. Noise Removal: Add noise above 3 KHz and then remove, interference suppression using 400 Hz tone.
17. Impulse Response of First order and Second Order Systems.

(The above Programs shall be implemented in Software (Using MATLAB / Lab View / C Programming/ Equivalent) and Hardware (Using TI / Analog Devices / Motorola / Equivalent DSP processors)

Note: - Minimum of 12 experiments has to be conducted.

LIST OF MAJOR EQUIPMENTS & SOFTWARE

- MATLAB with Simulink
- TMS 320C50 DSP Processors (Kit & Add-on Cards)
- Signal Processing Tool Box
- Function Generators (1MHz)
- Cathode Ray Oscilloscope (30MHz)

TEXT BOOKS:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009.

REFERENCE BOOKS:

1. Fundamentals of Digital Signal Processing – Loney Ludeman, John Wiley, 2009
2. Digital Signal Processing – Fundamentals and Applications – Li Tan, Elsevier, 2008
3. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling, Sandra L. Harris, Thomson, 2007
4. Digital Signal Processing - A Practical approach, Emmanuel C. If each orand Barrie W. Jervis, 2nd Edition, Pearson Education, 2009

ONLINE RESOURCES:

1. NPTEL DSP Course: Lectures, notes, and lab assignments for DSP ([NPTEL DSP Course](#))
2. DSP Course on edX: Video lectures, lab assignments, and quizzes ([DSP Course on edX](#))
3. <https://sjce.ac.in/wp-content/uploads/2021/11/dsp-lab-manual-2021-22.pdf>

ENVIRONMENTAL SCIENCE

III Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks	
		L	T	P		TOTAL	
MC6001	MC	3	0	0	0	100	
		Practical Classes: 0				Total Classes:32	
Contact Classes: 48	Tutorial Classes: 0						

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations

Course Outcomes: Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

UNIT – I Ecosystems: Definition, Scope and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits

UNIT - II Natural Resources: Classification of Resources: Living and Non-Living resources, water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, Land resources: Forest resources, Energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT – III Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act

UNIT – IV Environmental Pollution and Control Technologies: Environmental Pollution:

Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient airquality standards. Water pollution: Sources and types of pollution, drinking water quality standards. Soil Pollution: Sources and types, Impacts of modern agriculture, degradation of soil. Noise Pollution: Sources and Health hazards, standards, Solid waste: Municipal Solid Waste management, composition and characteristics of e-Waste and its management. Pollution control technologies: Wastewater Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation. Global Environmental Problems and Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

UNIT – V Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio- economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP).

Towards Sustainable Future: Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.

POWER ELECTRONIC APPLICATIONS TO RENEWABLE ENERGY SYSTEMS

IV Year B.Tech. I-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE701	Core	3	1	0	4	40	60	100
Contact Classes: 48	Tutorial Classes: 16	Practical Classes: Nil			Total Classes:64			

Prerequisite: Power Electronics, Renewable Energy Sources

Course Objectives:

- To impart knowledge on different types of renewable energy systems.
- To analyze the operation of electrical generators used for the wind energy conversion Systems.
- To know the operation of power converters and PV systems operation

Course outcomes:

- Proficiently demonstrate various renewable energy technologies utilized for electrical power generation.
- Explain the structure and function of multi string and module integrated inverters.
- Analyze the operating principles of different types of wind generators and identify suitable converters (AC-DC, DC-DC, AC-AC) for renewable energy systems.
- Explain the operating principles of DFIG's and also describe modern control methods for DFIG Based WECS.
- Interpret and analyze various wind and photovoltaic (PV) systems, including stand-alone, grid-connected, and hybrid configurations, showcasing a comprehensive understanding of renewable energy applications.

UNIT-I Solar cell characteristics and their measurement: PV Module, PV array, Partial shading of a solar cell and a module, the diode, Power conditioning unit, maximum power point tracker, Implementation of Perturb and Observe Method, Incremental Conductance Method, Battery charger/discharge controller.

UNIT-II : Centralized Inverters, String Inverters: Multi-string Inverters, Module Integrated Inverter/Micro-inverters, Inverter Topology, Model of Inverter, Sizing Batteries and Inverters for a Solar PV System.

Types of PV Systems: Grid-Connected Solar PV System, Stand-Alone Solar PV System

UNIT-III: Introduction to wind: Characteristics, Wind Turbine: Fixed and Variable-Speed Wind Turbines, Components of WECS, Description of Components, Types of Wind Turbine Generators, Economics of Wind Energy Conversion Systems, Linking Wind Turbines onto the Grid, Power Converter Topologies for Wind Turbine Generators.

UNIT-IV: Modeling of Permanent Magnet Synchronous Generators: Doubly Fed Induction Generators, Squirrel cage Induction Generators wind turbine, Control of Power converters for WEC.

UNIT-V: Hybrid Energy Systems: Need for Hybrid Energy Systems, Range and types of Hybrid systems, Hybrid Solar PV/Wind Energy System, Architecture of Solar-Wind Hybrid System and Grid connected issues

TEXTBOOKS:

1. S. N. Bhadra, D. Kastha, S. Banerjee, "Wind Electrical Systems", Oxford University Press, 2005.
2. S. N. Bhadra, D. Kastha, & S. Banerjee "Wind Electrical Systems", Oxford University Press, 2009.
3. Rashid. M. H, "Power Electronics Hand book", Academic Press, 2001.

REFERENCE BOOKS:

1. Rai. G. D, "Non-conventional energy sources", Khanna Publishers, 1993.
2. Rai. G.D," Solar energy utilization", Khanna Publishes, 1993.
3. Gray, L. Johnson, "Wind energy system", Prentice Hall of India, 1995.
4. B.H.Khan "Non-conventional Energy sources", Mc Graw-hill, 2nd Edition, 2009

MOBILE APPLICATION DEVELOPMENT
Professional Elective-III

IV Year B.Tech. I-Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE702	Core	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:48			

Prerequisites

- Acquaintance with JAVA programming
- A Course on DBMS

Course Objectives

- To demonstrate their understanding of the fundamentals of Android operating systems
- To improve their skills of using Android software development tools
- To demonstrate their ability to develop software with reasonable complexity on mobile platform
- To demonstrate their ability to deploy software to mobile devices
- To demonstrate their ability to debug programs running on mobile devices

Course Outcomes

- Understand the working of Android OS Practically.
- Develop Android user interfaces
- Effectively design and implement responsive, modular android interfaces
- Design and implement effective android inter-component communication.
- Create and manage structured data storage in android-establishing and opening data bases.

UNIT-I : Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes.

UNIT-II: Android UserInterface: Measurements – Device and pixel density independent measuring unit - s Layouts – Linear, Relative, Grid and Table Layouts User Interface (UI) Components –Editable and non-editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers Event Handling – Handling clicks or changes of various UI components Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities

UNIT-III: Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity Notifications – Creating and Displaying notifications, Displaying Toasts.

UNIT-IV: Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference.

UNIT-V: Database – Introduction to SQLite database: Creating and opening a database, creating tables, inserting retrieving and etindelg data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

TEXT BOOK:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012.

REFERENCE BOOKS:

1. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.
2. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

UTILIZATION OF ELECTRIC ENERGY

Professional Elective-III

IV Year B.Tech. I-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE703	Core	3	0	0	3	40	60	100
		Practical Classes: Nil				Total Classes:48		
Contact Classes: 48	Tutorial Classes: 0							

Pre-requisites: Electrical Machines-I and Electrical Machines-II

Course Objectives: Objectives of this course are

- To understand the fundamentals of illumination and good lighting practices
- To understand the methods of electric heating and welding.
- To understand the concepts of electric drives and their application to electrical traction systems.

Course Outcomes: At the end of this course, students will be able to

- Explain basic principle of electric heating and welding.
- Prepare the lighting requirements for flood lighting, house hold and industrial needs.
- Calculate heat developed in induction furnace.
- Sketch the speed time curves for traction.
- Develop the systems of train lighting methods.

UNIT-I: Electrical Heating: Advantages and methods of electric heating, resistance heating, induction heating and dielectric heating.

UNIT-II: Electric Welding: Electric welding equipment, resistance welding and arc welding, comparison between AC and DC welding. Electrolysis process: principle of electrolysis, electroplating, metal extraction and metal processing, electromagnetic stirs.

UNIT-III: Illumination: Terminology, Laws of illumination, coefficient of Utilization and depreciation, Polar curves, Photometry, integrating sphere, sources of light, fluorescent lamps, compact fluorescent lamps, LED lamps discharge lamps, mercury vapor lamps, sodium vapor lamps and neon lamps, comparison between tungsten filament lamps and fluorescent tubes. Basic principles of light control, Types and design of lighting scheme, lighting calculations, factory lighting, streetlighting and flood lighting.

UNIT-IV: Electric Traction: Systems of electric traction and track electrification- DC system, single phase and 3-phase low frequency and high frequency system, composite system, kando system, comparison between AC and DC systems, problems of single-phase traction with current unbalance and voltage unbalance. Mechanics of traction movement, speed-time curves for different services, trapezoidal and quadrilateral speed time curves, tractive effort, power, specific energy consumption, effect of varying acceleration and braking, retardation, adhesive weight and braking retardation, coefficient of adhesion

UNIT-V: Systems of Train Lighting: special requirements of train lighting, methods of obtaining unidirectional polarity constant output- single battery system, Double battery parallel block system, coach wiring, lighting by making use of 25KV AC supply.

TEXT BOOKS:

1. H. Partab: Modern Electric Traction, Dhanpat Rai & Co, 2007.
2. E. Openshaw Taylor: Utilisation of Electric Energy, Orient Longman, 2010.

REFERENCE BOOKS:

1. H. Partab: Art & Science of Utilization of Electric Energy, Dhanpat Rai & Sons, 1998.
2. N.V. Suryanarayana: Utilization of Electrical power including Electric drives and Electric Traction, New Age Publishers, 1997.

ELECTRIC AND HYBRID VEHICLES

Professional Elective-III

IV Year B.Tech. I-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE704	Core	3	0	0	3	40	60	100
		Practical Classes: Nil				Total Classes:48		
Contact Classes: 48	Tutorial Classes: 0							

Prerequisite: Power Semiconductor Drives, Electrical Drives and Control, Utilization of Electric Energy.

Course Objectives:

- To understand the fundamental concepts, principles, analysis and design of hybrid and electric vehicles.
- To know the various aspects of hybrid and electric drive train such as their configuration, t
- To have a knowledge on types of electric machines that can be used energy storage devices, etc.

Course Outcomes :At the end of this course, students will be able to:

- Understand the models to describe hybrid vehicles and their performance.
- Understand the history of hybrid electric vehicles
- Understand the different possible ways of energy storage.
- Understand and analyze electric traction fundamentals
- Understand the different strategies related to energy storage systems.

UNIT-I : Introduction: Conventional Vehicles: Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance

UNIT-II: Introduction to Hybrid Electric Vehicles& Hybrid Electric Drive-Trains:

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis

UNIT-III: Electric Trains: Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Electric Propulsion Unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT-IV: Energy Storage: Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

UNIT-V: Energy Management Strategies: Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

TEXT BOOKS:

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.

REFERENCE BOOKS:

1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.

HVDC TRANSMISSION
Professional Elective-IV

IV Year B.Tech. I-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE705	Core	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:48			

Prerequisite: Power System-I, Power System-II, Power System Protection, Power System Operation and Control, Power Electronics

Course Objectives:

- To compare EHV AC and HVDC and understand Graetz circuit with 6 and 12 pulse operation
- To control HVDC systems with various methods and to perform power flow analysis in AC/DC systems
- To describe various protection methods for HVDC systems and Harmonics

Course Outcomes : At the end of this course, students will be able to:

- Explain the fundamentals and economics of hvdc transmission.
- Compare EHVAC and HVDC system and to describe various types of DC links.
- Describe various methods for the control of HVDC systems and to perform power flow analysis in AC/DC systems.
- Identify and analyze converter faults.
- Describe various protection methods for HVDC systems and classify Harmonics and design different types of filters

UNIT- I Basic Concepts Necessity of HVDC systems : Necessity of HVDC systems, Economics and Terminal equipment of HVDC transmission systems, Types of HVDC Links, Apparatus required for HVDC Systems, Comparison of AC and DC Transmission, Application of DC Transmission System, Planning and Modern trends in D.C. Transmission.

Analysis of HVDC Converters: Choice of Converter Configuration, Analysis of Graetz circuit, Characteristics of 6 Pulse and 12 Pulse converters, Cases of two 3 phase converters in Y/Y mode – their performance.

UNIT-II Converter and HVDC System Control: Principle of DC Link Control, Converters Control Characteristics, Firing angle control, Current and extinction angle control, Effect of source inductance on the system, Starting and stopping of DC link, Power Control.

Reactive Power Control in HVDC: Introduction, Reactive Power Requirements in steady state, sources of reactive power- Static VAR Compensators, Reactive power control during transients

UNIT-III: Power Flow Analysis in AC/DC Systems: Modelling of DC Links, DC Network, DC Converter, Controller Equations, Solution of DC load flow, P.U. System for DC quantities, solution of AC-DC Power flow- Simultaneous Method-Sequential method.

UNIT-IV: Converter Faults and Protection: Converter faults, protection against over current and over voltage in converter station, surge arresters, smoothing reactors, DC breakers, Audible noise, space charge field, corona effects on DC lines, Radio interference.

UNIT-V: Harmonics: Generation of Harmonics, Characteristics harmonics, calculation of AC Harmonics, Non-Characteristics harmonics, adverse effects of harmonics, Calculation of voltage and Current harmonics, Effect of Pulse number on harmonics

Filters: Types of AC filters, Design of Single tuned filters –Design of High pass filters.

TEXT BOOKS:

1. “K. R. Padiyar”, HVDC Power Transmission Systems: Technology and system Interactions, New Age International (P) Limited, and Publishers, 1990.
2. “S K Kamakshiah, V Kamaraju”, HVDC Transmission, TMH Publishers, 2011

REFERENCE BOOKS:

1. “S. Rao”, EHVAC and HVDC Transmission Engineering and Practice, Khanna publications, 3rd Edition 1999.
2. “Jos Arrillaga”, HVDC Transmission, The institution of electrical engineers, IEE power & energy series 29, 2nd edition 1998.
3. “E. W. Kimbark”, Direct Current Transmission, John Wiley and Sons, volume 1, 1971.
4. “E. Uhlmann”, Power Transmission by Direct Current, B. S. Publications, 2009

POWER SYSTEM RELIABILITY
Professional Elective-IV

IV Year B.Tech. I-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE706	Core	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:48			

Prerequisite: Reliability Engineering, Power System-I, Power System-II, Power System Operation and Control

Course Objectives:

- To describe the generation system model and recursive relation for capacitive model building
- To explain the equivalent transitional rates, cumulative probability and cumulative frequency
- To develop the understanding of risk, system and load point reliability indices.

Course Outcomes: At the end of this course, students will be able to

- Apply the fundamental probability concepts.
- Analyze generation system models and evaluate reliability through loss of load indices.
- Estimate loss of load and energy indices for generation systems model
- Apply various indices for distribution system and evaluate reliability of interconnected systems.
- Analyze the effects of short circuits and breaker operations

UNIT-I: Basic Probability Theory: Elements of probability, probability distributions, Random variables, Density and Distribution functions- Binomial distribution- Expected value and standard deviation - Binomial distribution, Poisson distribution, normal distribution, exponential distribution, Weibull distribution. Definition of Reliability: Definition of terms used in reliability, Component reliability, Hazard rate, derivation of the reliability function in terms of the hazard rate. Hazard models - Bath tub curve, Effect of preventive maintenance. Measures of reliability: Mean Time to Failure and Mean Time between Failures

UNIT-II: Generating System Reliability Analysis: Generation system model – capacity outage probability tables – Recursive relation for capacitive model building – sequential addition method – unit removal – Evaluation of loss of load and energy indices – Examples. Frequency and Duration methods – Evaluation of equivalent transitional rates of identical and non-identical units – Evaluation of cumulative probability and cumulative frequency of non-identical generating units – 2-level daily load representation - merging generation and load models – Examples.

UNIT-III: Operating Reserve Evaluation: Basic concepts - risk indices – PJM methods – security function approach – rapid start and hot reserve units – Modeling using STPM approach.

Bulk Power System Reliability Evaluation:

Basic configuration – conditional probability approach – system and load point reliability indices – weather effects on transmission lines – Weighted average rate and Markov model – Common mode failures.

Interconnected System Reliability Analysis

Probability array method – Two inter connected systems with independent loads – effects of limited and unlimited tie capacity - imperfect tie – Two connected Systems with correlated loads – Expression for cumulative probability and cumulative frequency.

UNIT-IV: Distribution System Reliability Analysis: Basic Techniques – Radial networks –Evaluation of Basic reliability indices, performance indices – load point and system reliability indices – customer oriented, loss and energy-oriented indices – Examples. Basic concepts of parallel distribution system reliability.

UNIT-V: Substations and Switching Stations: Effects of short-circuits - breaker operation – Open and Short-circuit failures – Active and Passive failures–switching after faults – circuit breaker model– preventive maintenance–exponential maintenance times.

TEXT BOOKS:

1. Reliability Evaluation of Power systems by R. Billinton, R. N. Allan, BS Publications, 2007.
2. Reliability Modeling in Electric Power Systems by J. Endrenyi, John Wiley and Sons, 1978

REFERENCE BOOKS:

1. Reliability Engineering: Theory and Practice by Alessandro Birolini, Springer Publications.
2. An Introduction to Reliability and Maintainability Engineering by Charles Ebeling, TMH Publications.
3. Reliability Engineering by E. Balaguruswamy, TMH Publications.
4. Reliability Engineering by Elsayed A. Elsayed, Prentice Hall Publications

EMBEDDED SYSTEMS APPLICATIONS

Professional Elective-IV

IV Year B.Tech. I-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE707	Core	3	0	0	3	40	60	100
		Practical Classes: Nil				Total Classes:48		
Contact Classes: 48	Tutorial Classes: 0							

Prerequisite: C Language, I/O, Analog and Digital interfacing, and peripherals.

Course Objectives:

- To equip with the basic concepts of embedded system, applications in which they are used,
- To describe tools and methodologies needed for embedded system design.
- To know RTOS concepts and familiar with the characteristics of latency in real-time systems.
-

Course Outcomes: At the end of this course, students will be able to:

- Understanding embedded system attributes, processor architectures, memory organization, and interrupt handling.
- Write the 8051-assembly language code and Embedded 'C' code for interfacing various devices.
- Understand the microprocessor architecture and its components used in embedded systems
- Develop simple embedded systems for real time operations
- Design and manage inter task communication in RTO's.

UNIT-I: Embedded Systems Basics: Introduction to Embedded systems, Examples of embedded systems, Typical Hardware, Gates, Timing Diagrams, Memory, Microprocessors, Buses, Direct Memory Access, Interrupts, Microprocessor Architecture, and Interrupt Basics.

UNIT-II: The8051Architecture: Introduction, 8051 Micro controller Hardware, Input/output Pin Ports and Circuits, External Memory, Serial data Input/output, Interrupts

UNIT-III: Embedded C Programming: Overview of the C standard library, Embedded System Oriented Topics, MISRA C — Designing Safer C Programs, Basics of event driven programming.

Basic Assembly Language Programming Concepts: The Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051.

UNIT-IV: Moving Data: Introduction, Addressing Modes, External Data Moves, Code Memory Read Only Data Moves, Push and Pop Opcodes, Data Exchanges.

Basic Design Using a Real-Time Operating System: Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment

UNIT-V: Applications: Introduction, keyboards, Human Factor, Key Switch Factors, Keyboard Configurations, Displays, Seven-Segment Numeric Display, D/A and A/D Conversions.

Embedded Software Development Tools: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System; Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, An Example System

TEXT BOOKS:

1. An Embedded Software Primer, David E. Simon, Pearson Education.
2. The 8051 Microcontroller, Third Edition, Kenneth J.Ayala, Thomson.

REFERENCE BOOKS:

1. Embedded Microcomputer Systems Real Time Interfacing, Jonathan W.Valvano, Cengage Learning.
2. 8051 Microcontrollers, Satish Shah, Oxford Higher Education.
3. Micro Controllers, Ajay V Deshmukhi, TMH.
4. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley.
5. Microcontrollers, Raj kamal, Pearson Education. a. <http://nptel.ac.in/courses.php> b. <http://jntuk-coeerd.in>

SIGNALS AND SYSTEMS

Open Elective-II

IV Year B.Tech. I-Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE708	OE	3	0	0	3	40	60	100
		Practical Classes: Nil				Total Classes:48		
Contact Classes: 48	Tutorial Classes: 0							

Prerequisite: Digital Signal Processing, Control Systems, Laplace Transforms, Numerical Methods and Complex variables.

Course Objectives:

- To develop ability to analyze linear systems and signals
- To develop critical understanding of mathematical methods to analyze linear systems and signals
- To know the various transform techniques and sampling principles

Course Outcomes: At the end of this course, students will be able to:

- Classify wide range of real world signals
- Understand the concepts of continuous time and discrete time systems.
- Analyze both periodic and aperiodic signals using Fourier series and Fourier transforms.
- Apply the Laplace transform to continuous-time signals and systems.
- Apply the sampling theorem to design effective sampling and reconstruction strategies.

UNIT-I: Introduction to Signals and Systems: Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability. Examples.

UNIT-II: Behaviour of Continuous and Discrete-Time LTI Systems: Impulse response and step response, convolution, input-output behaviour with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi- output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response

UNIT-III: Fourier Transforms: Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.

UNIT-IV: Laplace and Z- Transforms: Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis

UNIT-V: Sampling and Reconstruction: The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems

TEXT BOOKS:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.
2. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.

REFERENCE BOOKS:

1. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
2. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.
3. A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall, 2009.
4. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
5. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

ENERGY STORAGE SYSTEMS
Open Elective-II

IV Year B.Tech. I-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE709	OE	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:48			

Course Objectives: to prepare the students to

- To introduce generalized storage techniques and analyze the different features of storage systems
- To know the management and applications of energy storage technologies
- To know about electrical energy storage market potential by different forecasting methods

Course Outcomes: At the end of this course, students will be able to:

- To understand the Electrical Energy Storage Technologies.
- To understand the need of Electrical Energy Storage.
- To understand the features of energy storage systems.
- To know the types of energy storage systems.
- To understand the various applications of energy storage systems

UNIT-I: The Roles of Electrical Energy Storage Technologies in Electricity Use

Characteristics of electricity, Electricity and the roles of EES, High generation cost during peak-demand periods, Need for continuous and flexible supply, Long distance between generation and consumption, Congestion in power grids, Transmission by cable, Emerging needs for EES, More renewable energy, less fossil fuel, Smart Grid uses, The roles of electrical energy storage technologies, The roles from the viewpoint of a utility, The roles from the viewpoint of consumers, The roles from the viewpoint of generators of renewable energy.

UNIT-II: Types and Features of Energy Storage Systems: Classification of EES systems, Mechanical storage systems, Pumped hydro storage (PHS), Compressed air energy storage (CAES), Flywheel energy storage (FES), Electrochemical storage systems, Secondary batteries, Lead-Acid Batteries, Lithium-Ion Batteries, Flow batteries, Other Batteries in Development, Chemical energy storage, Hydrogen (H₂), Synthetic natural gas (SNG), Electrical storage systems, Double-layer capacitors (DLC), Superconducting magnetic energy storage (SMES), Thermal storage systems, Standards for EES, Technical comparison of EES technologies.

UNIT-III .Applications of EES: Present status of applications, Utility use (conventional power generation, grid operation & service), Consumer use (uninterruptable power supply for large consumers), EES installed capacity worldwide, new trends in applications, Renewable energy generation, Smart Grid, Smart Micro grid, Smart House, Electric vehicles

UNIT-IV: Management and Control Hierarchy Of EES: Internal configuration of battery storage systems, External connection of EES systems, Aggregating EES systems and distributed generation (Virtual Power Plant), "Battery SCADA" – aggregation of many dispersed batteries.

Demand For Energy Storage: Growth in Variable Energy Resources, Relationship between balancing services and variable energy resources, Energy Storage Alternatives, Variable Generator Control, Demand Management, Market Mechanisms, and Longer-Term Outlook.

Valuation Techniques: Overview, Energy Storage Operational Optimization, Market Price Method, Power System Dispatch Model Method, Ancillary Service Representation, Energy Storage Representation, Survey of Valuation Results.

UNIT-V: Forecast Of EES Market Potential By 2030: EES market potential for overall applications, EES market estimation by Sandia National Laboratory (SNL), EES market estimation by the Boston Consulting Group (BCG), EES market estimation for Li-ion batteries by the Panasonic Group, EES market potential estimation for broad introduction of renewable energies, EES market potential estimation for Germany by Fraunhofer, Storage of large amounts of energy in gas grids, EES market potential estimation for Europe by Siemens, EES market potential estimation by the IEA, Vehicle to grid concept, EES market potential in the future.

TEXT BOOKS:

1. Power System Energy Storage Technologies, 1st Edition by Paul Breeze, Academic Press
2. Energy Storage: Systems and Components, by Alfred Rufer, CRC Press, 2017

REFERENCE BOOKS:

1. Energy Storage Fundamentals, Materials and Applications, by Huggins and Robert, Springer.

FUNDAMENTALS OF MANAGEMENT FOR ENGINEERS

IV Year B.Tech. I-Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23MB710	HS	2	0	0	2	40	60	100
Contact Classes: 32	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:32			

Course Objective: To understand the Management Concepts, applications of Concepts in Practical aspects of business and development of Managerial Skills for Engineers.

Course Outcome:

- 1.The students understand the significance of Management in their Profession.
- 2.The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course.
- 3.The students can explore the Management Practices in their domain area.
- The students can explore leadership qualities
- 5.The students able learn Strategies for Control.

UNIT-I: Introduction to Management: Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of Management- Classical Approach-Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach

UNIT-II: Planning and Decision Making: General Framework for Planning - Planning Process, Types of Plans, Management by Objectives; Production Planning and Control. Decision making and Problem Solving - Programmed and Non Programmed Decisions, Steps in Problem Solving and Decision Making; Bounded Rationality and Influences on Decision Making; Group Problem Solving and Decision Making, Creativity and Innovation in Managerial Work.

UNIT-III; Organization and HRM: Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization, Recentralization; Organizational Culture; Organizational Climate and Organizational Change. Human Resource Management & Business Strategy: Job Satisfaction, Job Enrichment, Job Enlargement, Talent Management, Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

UNIT-IV: Leading and Motivation: Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Leadership. Motivation - Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.

UNIT-V: Controlling: Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non-Budgetary Controls. Characteristics of Effective Controls, Establishing control systems, Control frequency and Methods.

TEXT BOOKS:

1. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.
2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.

REFERENCE BOOKS:

1. Essentials of Management, Koontz Kleihrich, Tata Mc - Graw Hill.
2. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
3. Industrial Engineering and Management: Including Production Management, T. R. Banga, S.C Sharma, Khanna Publishers

SIMULATION OF RENEWABLE ENERGY SYSTEMS LAB

IV Year B.Tech. I-Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE711	CORE	0	0	4	2	40	60	100
Contact Classes: 0	Tutorial Classes: 0	Practical Classes: 32			Total Classes:32			

Prerequisite: Renewable Energy Systems, Power Electronics

Course Objectives:

- Develop proficiency in modeling the steady-state and dynamic characteristics of photovoltaic (PV), fuel cell, and wind energy sources.
- Understand and analyze power converter topologies for stand-alone and grid-connected PV, fuel cell, and wind energy systems.
- Explore advanced topics in power electronics, including maximum power point tracking, power factor correction, switched capacitor DC-DC converters, ZVS/ZCS configurations, compensation schemes, and new power converter topologies.

Course Outcomes: At the end of this course, students will be able to:

- Demonstrate the ability to model and analyze the steady-state and dynamic characteristics of PV, fuel cell, and wind energy sources.
- Apply knowledge to understand, design, and analyze power converter topologies for both stand-alone and grid-connected PV, fuel cell, and wind energy systems.
- Acquire advanced expertise in power electronics, covering topics such as maximum power point tracking, power factor correction, switched capacitor converters, ZVS/ZCS configurations, compensation schemes, and new power converter topologies.

List of experiments:

1. Modelling the steady state and dynamic characteristics of the following
 - (i) PV,
 - (ii) Fuel cell and
 - (iii) Wind energy sources
2. Power converter topologies for stand -alone and grid connected
 - (i) PV,
 - (ii) Fuel cell and
 - (iii) Wind energy sources
3. Maximum Power Point Tracking Schemes
4. Power factor correction techniques for AC to DC systems
5. Switched capacitor DC – DC power converters
6. ZVS, ZCS configurations
7. Compensation Schemes for VAR, harmonics and phase imbalance Power conversion and Electric Drives
8. New power converter topologies and their analysis, modelling and simulation
9. High frequency link power conversion
10. Radiation effects on power electronic systems and components EMI/EMC
11. Analysis, measurement and mitigation of EMI in Electronic and power electronic systems
12. Microgrid Power Quality

***Note:** Perform the simulation of the above list of experiments with MATLAB/any Simulation software

TEXTBOOKS:

1. S. N. Bhadra, D.Kastha, S.Banerjee, "Wind Electrical Systems", Oxford University Press, 2005.
2. S.N.Bhadra, D. Kastha, & S. Banerjee "Wind Electrical Systems", Oxford University Press, 2009.
3. Rashid.M. H, "Power Electronics Hand book", Academic Press, 2001.

REFERENCE BOOKS:

1. Rai. G.D, "Non-conventional energy sources", Khanna Publishers, 1993.
2. Rai. G.D," Solar energy utilization", Khanna Publishes, 1993.
3. Gray, L. Johnson, "Wind energy system", Prentice Hall of India, 1995.
4. B.H.Khan "Non-conventional Energy sources", Mc Graw-hill, 2nd Edition, 2009

POWER QUALITY & FACTS
Professional Elective-V

IV Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE801	CORE	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: 0			Total Classes:48			

Prerequisite: Power Electronics, Power System Operation and Control , HVDC Transmission

Course Objectives:

- Define power quality and explore various terms associated with it. Study voltage-related power quality issues, focusing on short and long interruptions.
- Conduct a detailed study on characterizing voltage sags, with a specific emphasis on magnitude and three-phase unbalanced voltage sags. Understand how power quality issues affect the behaviour of power electronics loads and rotating machinery.
- Gain an understanding of FACTS controllers, their controllable parameters, and types. Explore the importance of shunt and series compensation, focusing on the control and comparison of STATCOM and SVC, and the functioning and regulation of other FACTS devices like GCSC, TSSC, and TCSC

Course Outcomes : At the end of this course ,students will be able to:

- Develop an awareness of the severity of power quality issues in distribution systems, focusing on their impact and challenges.
- Understand the concept of transforming voltage sags from upstream (higher voltages) to downstream (lower voltage) in the distribution system.
- Demonstrate competence in selecting controllers based on specific applications and system requirements. Thoroughly understand various systems and their requirements, including the control circuits of shunt controllers (SVC & STATCOM)
- Analyze the operation and control of series FACTS controllers such as GCSC, TSSC, and TCSC
- Explain the operating principles of the Unified Power Flow Controller (UPFC) and analyze its role in the independent control of real and reactive power.

UNIT-I: Power Quality Problems in Distribution Systems: Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement.

UNIT-II: Transmission Lines and Series/Shunt Reactive Power Compensation: Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Passive Reactive Power Compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation.

UNIT-III: Static Shunt Compensators: Objectives of shunt compensation, Methods of controllable VAR generation, Static Var Compensator, its characteristics, TCR, TSC, FC-TCR configurations, STATCOM, basic operating principle, control approaches and characteristics.

UNIT-IV: Static Series Compensators: Objectives of series compensator, variable impedance type of series compensators, TCSC, TSSC-operating principles and control schemes, SSSC, Power Angle characteristics, Control range and VAR rating, Capability to provide reactive power compensation, external control.

UNIT-V: Combined Compensators: Introduction to Unified Power Flow Controller, Basic operating principles, Conventional control capabilities, independent control of real and reactive power

TEXT BOOKS:

1. Electrical Power Systems Quality, Dugan Roger C, Santoso Surya, Mc Granaghan, Marks F. Beaty and H. Wayre, Mc Graw Hill
2. Power Systems Quality Assessment, J. Arillaga, N.R. Watson, S.Clon, John Wiley.

REFERENCE BOOKS:

1. Power Quality, C.Sankaran, CRC Press 4. Understanding power quality problems, Math H. Bollen, IEEE press.
2. “Understanding FACTS –Concepts and Technology of Flexible AC Transmission Systems” Narain G. Honorani, Laszlo Gyugyi

SOLAR POWER BATTERIES

Professional Elective-V

IV Year B.Tech. II-Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE802	CORE	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: 0			Total Classes:48			

Prerequisite: Renewable Energy Sources, Energy Storage Systems

Course Objectives:

- To understand the PV systems and the solar power batteries operation
- To analyze the solar PV system storage with batteries.
- To understand Grid Tie vs. Off-Grid Solar Battery System

Course Outcomes: At the end of this course, students will be able to:

- Know operating principles of different types of solar power batteries
- Use the batteries for effective storage of solar PV.
- Gain the knowledge on environmental impacts of solar power batteries.
- Analyze the degradation mechanisms affecting battery life and performance.
- Design battery systems for solar PV applications by considering cost, performance factors, safety standards, and user-specific requirements.

UNIT-I: Introduction to solar PV systems, basics of Storage for solar PV systems, Storage for solar PV systems: the batteries, Introduction to Solar Power Batteries, terminology associated, understanding Solar Battery Specifications, working principle, Series Vs. Parallel, Charging parameters, cycle life, Temperature effects, Battery Design and Construction, Important components in battery construction.

UNIT-II: Primary and Secondary batteries, Classification of Secondary batteries, i.e Lead-Acid, Lead-Antimony, Lead-Calcium, Lead-Acid Battery Chemistry, Nickel-Cadmium Batteries and their types.

UNIT-III: AC Coupled Storage vs. DC Coupled Storage, working of Solar Batteries with a Solar Power System and Hybrid Inverter, Main Degradation mechanisms of Solar Batteries, Battery Strengths and Weaknesses, Battery System Design and Selection Criteria, Life Expectancy, Battery standards, Safety precautions,

UNIT-IV: Solar Battery Costs, Declining Cost, factors contribute to the performance of solar battery, selection of suitable batteries based on the application, Grid Tie vs. Off-Grid Solar Battery System, Benefits and disadvantages of using solar batteries,

UNIT-V: The environmental impacts of batteries: Introduction, Service life of the components, Energy requirements for production and transport of the PV-battery system components, Contributing components, Influence of different user conditions, Uncertainties, Future research, Energy return factor, The overall battery efficiency, Different efficiency measures and battery design, The Future of Solar Battery Storage.

TEXT BOOKS:

1. S. Sumathi and L. Ashok Kumar, Solar PV and Wind Energy Conversion Systems: An Introduction to Theory, Modeling with MATLAB/SIMULINK, and the Role of Soft Computing Techniques, Springer 2011
2. H.A. Kiehne, "Battery Technology Handbook" by Publisher: CRC Press 2003
3. <https://core.ac.uk/download/pdf/30044842.pdf>
4. Handbook on Battery Energy Storage System

REFERENCE BOOKS:

1. Cristina Archer and S. Lovejoy, Battery Technology for Electric Vehicles: Public Science and Private Innovation, Springer 2015
2. Soteris A. Kalogirou, "Solar Energy Engineering: Processes and Systems" by, Academic Press, Year: 2009
3. https://files.bregroup.com/bre-co-uk-file-librarycopy/filelibrary/nsc/Documents%20Library/NSC%20Publications/88031-BRE_Solar-ConsumerGuide-A4-12pp.pdf
4. <https://www.sunwize.com/tech-notes/solar-battery-basics/>
5. <https://palmetto.com/learning-center/blog/how-does-a-solar-battery-work>
6. <https://www.letsgosolar.com/faq/what-is-a-solar-battery/>
7. <https://www.purevolt.ie/domestic-solar/equipment/solar-storage-batteries.php>

AI TECHNIQUES IN ELECTRICAL ENGINEERING

Professional Elective-V

IV Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
23EE803	CORE	L	T	P	3	CIE	SEE	TOTAL
		3	0	0		40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: 0			Total Classes:48			

Pre-requisites: Power Systems Operation and Control

Course Objectives:

- To locate soft commanding methodologies, such as artificial neural networks, Fuzzy logic and genetic Algorithms.
- To observe the concepts of FFN and concept of fuzziness involved in various systems and comprehensive knowledge of fuzzy logic control and to design the fuzzy control
- To analyze genetic algorithm, genetic operations and genetic mutations

Course Outcomes: At the end of this course, students will be able to:

- Understand the fundamental concepts, structure, and learning mechanisms of Artificial Neural Networks and their role in intelligent systems.
- Analyze different paradigms of Artificial Neural Networks such as feed forward, feedback, and competitive networks, and understand their architectures and learning algorithms.
- Understand the principles of fuzzy logic and fuzzy set theory, and apply fuzzy reasoning techniques for modeling and control of uncertain systems.
- Understand the concepts and operators of Genetic Algorithms and apply them to solve optimization and search problems in engineering and intelligent systems.
- Apply various Artificial Intelligence techniques such as Neural Networks, Fuzzy Logic, and Genetic Algorithms to solve real-world engineering and decision-making problems.

UNIT-I: Artificial Neural Networks: Introduction, Models of Neuron Network-Architectures –Knowledge representation, Artificial Intelligence and Neural networks–Learning process-Error correction learning, Hebbian learning –Competitive learning-Boltzmann learning, supervised learning-Unsupervised learning–Reinforcement Learning-Learning tasks.

UNIT-II: ANN Paradigms: Multi-layer perceptron using Back propagation Algorithm (BPA), Self –Organizing Map (SOM), Radial Basis Function Network-Functional Link Network (FLN), Hopfield Network.

UNIT-III: Fuzzy Logic: Introduction –Fuzzy versus crisp, Fuzzy Sets-Membership function –Basic Fuzzy set operations, Properties of Fuzzy sets –Fuzzy Cartesian Product, Operations on Fuzzy relations –Fuzzy logic–Fuzzy Quantifiers, Fuzzy Inference-Fuzzy Rule based system, Defuzzification methods.

UNIT-IV: Genetic Algorithms: Introduction-Encoding –Fitness Function-Reproduction operators, Genetic Modeling –Genetic Operators-Cross over-Single site cross over, two points cross over –Multi point cross over Uniform cross over, Matrix cross over-Cross over Rate-Inversion & Deletion, Mutation operator –Mutation –Mutation Rate-Bit-wise operators, Generational cycle-convergence of Genetic Algorithm.

UNIT-V: Applications Of AI Techniques: Load forecasting, Load flow studies, Economic load dispatch, Load frequency control, Single area system and two area system, Reactive power control, Speed control of DC and AC Motors.

TEXT BOOKS:

1. S. Rajasekaran and G.A.V.Pai Neural Networks, Fuzzy Logic & Genetic Algorithms, PHI, New Delhi, 2003.
2. Rober J. Schalkoff, Artificial Neural Networks, Tata McGraw Hill Edition, 2011.

REFERENCE BOOKS:

1. P. D. Wasserman; Neural Computing Theory & Practice, Van Nostrand Reinhold, New York, 1989.
2. Bart Kosko; Neural Network & Fuzzy System, Prentice Hall, 1992
3. D. E. Goldberg, Genetic Algorithms, Addison-Wesley 1999.

SMART GRID TECHNOLOGIES

Professional Elective-VI

IV Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
23EE804	CORE	L	T	P	3	CIE	SEE	TOTAL
		3	0	0		40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: 0			Total Classes:48			

Course Objectives:

- To defend smart grid design to meet the needs of a utility
- To select issues and challenges that remain to be solved
- To analyze basics of electricity, electricity generation, economics of supply and demand, and the various aspects of electricity market operations in both regulated and deregulated environment.

Course Outcomes: At the end of the course the student will be able to:

- Understand the features of small grid in the context of Indian grid.
- Understand the role of automation in transmission and distribution.
- Apply evolutionary algorithms for smart grid and understand operation, maintenance of PMUs, PDCs, WAMs, and voltage and frequency control in micro grid
- Analyze the integration of distributed generation technologies
- Evaluate the environmental, economic, and operational impacts of Smart Grid technologies

UNIT-I: Introduction To Smart Grid: What is Smart Grid? Working definitions of Smart Grid and Associated Concepts –Smart grid Functions-Traditional Power Grid and Smart Grid –New Technologies for Smart Grid – Advantages –Indian Smart Grid –Key Challenges for Smart Grid.

UNIT- II: Smart Grid Architecture: Components and Architecture of Smart Grid Design –Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid designs – Transmission Automation – Distribution Automation –Renewable Integration

UNIT- III: Tools And Techniques For Smart Grid: Computational Techniques –Static and Dynamic Optimization Techniques –Computational Intelligence Techniques –Evolutionary Algorithms –Artificial Intelligence techniques.

UNIT-IV: Distribution Generation Technologies: Introduction to Renewable Energy Technologies –Micro grids – Storage Technologies –Electric Vehicles and plug –in hybrids –Environmental impact and Climate Change –Economic Issues. Communication Technologies and Smart Grid: Introduction to Communication Technology – Synchro-Phasor Measurement Units (PMUs) –Wide Area Measurement Systems (WAMS).

UNIT-V: Control Of Smart Power Grid System Load Frequency Control (LFC) in Micro Grid System –Voltage Control in Micro Grid System – Reactive Power Control in Smart Grid. Case Studies and Test beds for the Smart Grids.

TEXT BOOKS:

1. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press, 2013
2. Gil Masters, Renewable and Efficient Electric Power System, Wiley-IEEE Press, 2004.

REFERENCE BOOKS:

1. A.G. Phadke and J.S. Thorp, “Synchronized Phasor Measurements and their Applications”, Springer Edition, 2010.
2. T. Ackermann, Wind Power in Power Systems, Hoboken, NJ, USA, John Wiley, 2005.

**INTRODUCTION TO PLC/
SCADA PROGRAMMING
Professional Elective-VI**

IV Year B.Tech. II-Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE805	CORE	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: 0			Total Classes:48			

Prerequisite: Embedded C programming

Course Objectives:

- Introduction, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application.
- The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).
- Processor Memory Organization, Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of Operation.

Course Outcomes: At the end of the course the student will be able to:

- Discuss history of PLC and describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming.
- Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module.
- Analyze PLC timer and counter ladder logic programs and describe the operation of different program control instructions
- Discuss the execution of data transfer instructions, data compare instructions and the basic operation of PLC closed-loop control system.
- Describe the operation of mechanical sequencers, bit and word shift registers, processes and structure of control systems and communication between the processes.

UNIT-I; Programmable Logic Controllers: Introduction, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application.

PLC Hardware Components:

The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).

UNIT-II: Developing Fundamental PLC Wiring Diagrams and Ladder Logic Program: Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-In Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description

UNIT-III: Counter Instructions: Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions.

Program Control Instructions: Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction

UNIT-IV; . Data Manipulation Instructions: Data Manipulation, Data Transfer Operations, Data Compare Instructions, Data Manipulation Programs, Numerical Data I/O Interfaces, Closed-Loop Control.

UNIT-V: Sequencer and Shift Register Instructions: Mechanical Sequencers, Sequencer Instructions, Sequencer Programs, Bit Shift Registers, Word Shift Operations.

Process Control, Network Systems, and SCADA:

Types of Processes, Structure of Control Systems, On/Off Control, PID Control, Motion Control, Data Communications, Supervisory Control and Data Acquisition (SCADA).

TEXTBOOKS:

1. "Programmable Logic Controllers and Industrial Automation: An Introduction 2nd Edition" by Madhuchhanda Mitra and Samarjit Sengupta
2. "Fundamentals of Automation and Industrial Control Systems Using Plc" by Ayman Aly El-Naggar

REFERENCEBOOKS:

1. "PLC Programming for Industrial Automation 2016" by Kevin Collins
2. "PLC Programming using RSLogix 500: Basic Concepts of Ladder Logic Programming!: Volume 1 (Plc Programming Basics)" by Gary D Anderson
3. "Programmable Logic Controller (Plc) Tutorial" by Stephen Philip Tubbs

MACHINE LEARNING APPLICATIONS TO ELECTRICAL ENGINEERING

Professional Elective-VI

IV Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE806	CORE	3	0	0	3	40	60	100
		Practical Classes: 0				Total Classes:48		
Contact Classes: 48	Tutorial Classes: 0							

Prerequisites: Mathematics, Python

Course Objectives:

- To develop a foundational understanding of machine learning principles and techniques.
- To explore and understand how machine learning can be integrated into various electrical engineering applications.
- To gain hands-on experience in implementing machine learning algorithms to solve real-world electrical engineering problems.

Course Outcomes: At the end of this course, students will be able to:

- Demonstrate proficiency in applying machine learning algorithms to solve real-world problems in electrical engineering
- Integrate machine learning principles effectively into electrical engineering applications
- Enhance problem-solving skills by successfully addressing complex issues in electrical engineering through machine learning.
- Pre process and engineer electrical engineering data through techniques
- Evaluate and compare different machine learning models

UNIT-I: Introduction to Machine Learning: Definition and types of machine learning, Historical perspective, Basic concepts: supervised learning, unsupervised learning, reinforcement learning

UNIT-II: Fundamentals of Electrical Engineering Relevant to ML: Overview of electrical circuits and systems, Signal processing basics, Introduction to control systems

UNIT-III: Data Preprocessing and Feature Engineering: Data cleaning and handling missing values, Feature scaling and normalization, Feature extraction and selection

UNIT-IV: Machine Learning Algorithms for Electrical Engineering Applications Regression and classification algorithms, Decision trees and ensemble methods, Neural networks and deep learning, Support vector machines, Clustering algorithms for pattern recognition

UNIT-V: Case Studies and Applications in Electrical Engineering Power system optimization using ML, Fault detection and diagnostics in electrical systems, Smart grid applications, Signal processing with ML, Control system optimization and adaptive control using ML.

TEXT BOOKS:

1. C. Aldrin Renold and Sumathi S., Pattern Recognition and Machine Learning, Wiley India, 2015.
2. S. Rajasekaran and G. Aghila, Machine Learning: An Algorithmic Perspective, Chapman and Hall/CRC, 2018
3. Chandra Shekhar Yadav, S. Ramakrishnan, and U. Rajendra Acharya, Machine Learning: Concepts, Methodologies, Tools and Applications, Springer 2018.

REFERENCE BOOKS:

1. Ethem Alpaydin, Introduction to Machine Learning, MIT Press 2010
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
3. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press 2012.

CHARGING INFRASTRUCTURE FOR ELECTRIC VEHICLES

Open Elective-III

IV Year B.Tech. II-Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE807	CORE	3	0	0	3	40	60	100
		Practical Classes: 0				Total Classes:48		
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: 0			Total Classes:48			

Prerequisite: None, Interest in Electric Vehicles

Course Objectives:

- Gain understanding of the various components involved in an electric vehicle charging system.
- Comprehend the different types of electric vehicle chargers, along with the applicable standards governing their design and operation.
- Interpret the diverse communication protocols utilized in electric vehicle charging systems and stay familiar with the latest trends in this evolving field.

Course Outcomes: At the end of this course, students will be able to:

- Understand the various components of Electric vehicle charging system
- Comprehend the different types of Electric vehicle chargers and their standards
- Interpret the various communication protocols and recent trends in Electric vehicle charging
- Analyze the design, planning, and implementation aspects of public EV charging infrastructure
- Evaluate future trends in EV charging

UNIT-I: Introduction to EV charging: Electric Vehicle Charging; Charging Modes; Electric Vehicle Supply Equipment (EVSE): Types, Components of EV Battery Chargers; Challenges in Electric Vehicle Charging.

UNIT-II: Charger sizing and standards: Charger Classification; Slow Charging and Fast Charging; DC Charging and AC Charging; Selection and Sizing of Chargers: Charger Connectors and Cables; Charging Standards: Connectors, Supply Equipment; EMI/EMC; Testing Methods for Chargers and EVSE

UNIT-III: EV charger communications protocols: Open Charge Point Protocol (OCPP); Open System Interconnection Layer Model (OSI); Adapted PWM Signal based Low-level Communication; PLC based High-level Communication; CAN Communication; Billing and Authentication

UNIT-IV: Public charging infrastructure: Location, Planning and Implementation of Public Charging Stations; Components; Selection and Sizing - HT/LT Equipment & Cables; Protection; Safety Standards: Policy and Regulatory Aspects; EV Charging Station and their Business Models; Economic Aspects; Major Challenges

UNIT-V: Future frontiers in EV charging: Bulk Charging; Battery Swapping; Wireless Charging; EVs as Distributed Storage Resources: Grid to Vehicle (G2V) and Vehicle to Grid (V2G), V2X Concept, Integration of Charging Station with Renewable Sources and its Impact on the Grid

TEXT BOOKS:

1. Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals", 3rd Edition, CRC Press, 2021
2. Code of Practice for Electric Vehicle Charging Equipment Installation, 4th Edition, IET, 2020.

REFERENCE BOOKS:

1. Sheldon S. Williamson, “Energy Management Strategies for Electric and Plug-in Hybrid
2. Electric Vehicles”, 1st Edition, Springer, 2013.
3. Tom Denton, “Automotive Electrical and Electronic Systems”, 5th Edition, Routledge, 2018.
4. Wolfhard Lawrenz, “CAN System Engineering: From Theory to Practical Applications”, Springer, 2nd Edition, 2013.

ELECTRICAL SAFETY ENGINEERING
Open Elective-III

IV Year B.Tech. II-Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIE	SEE	TOTAL
23EE808	CORE	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: 0	Practical Classes: 0			Total Classes:48			

Prerequisite: Basic Electrical Engineering

Course Objectives:

- To impart knowledge about safety requirements
- To provide guidance on prevention of electrical shocks
- To study about various first aid methods
- To create awareness about various Hazardous areas
- To familiarize with safety management

Course Outcomes: At the end of the course, the student will be able to

- Explain the objectives and precautions of Electrical safety, effects of shocks and their prevention.
- Summarize the safety aspects during installation of plant and equipment.
- Describe the electrical safety in residential, commercial and agricultural installations.
- Describe the various Electrical safety in hazardous areas, Equipment earthing and system neutral earthing.
- State the electrical systems safety management and IE rules.

UNIT-I: INTRODUCTION TO ELECTRICAL SAFETY, SHOCKS AND THEIR PREVENTION

Terms and definitions, objectives of safety and security measures, Hazards associated with electric current, and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety. 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/ Sparkover's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shops

UNIT-II: SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT

Introduction, preliminary preparations, preconditions for start of installation work, during, risks during installation of electrical plant and equipment, safety aspects during installation, field quality and safety during erection, personal protective equipment for erection personnel, installation of a large oil immersed power transformer.

UNIT-III: ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL INSTALLATIONS

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.

UNIT-IV: ELECTRICAL SAFETY IN HAZARDOUS AREAS

Hazardous zones – class 0,1 and 2 – spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipment is for hazardous locations – Classification of equipment enclosure for various hazardous gases and vapors – classification of equipment/enclosure for hazardous locations.

Equipment earthing and system neutral earthing:

Introduction, Distinction between system grounding and Equipment Grounding, Equipment Earthing, Functional Requirement of earthing system, description of a earthing system, , neutral grounding (System Grounding), Types of Grounding, Methods of Earthing Generators Neutrals.

UNIT-V: SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS

Principles of Safety Management, Management Safety Policy, Safety organization, safety auditing, Motivation to managers, supervisors, employees.

Review of IE rules and acts and their significance:

Objective and scope – ground clearances and section clearances – standards on electrical safety - safe limits of current, voltage –Rules regarding first aid and firefighting facility. The Electricity Act, 2003, (Part1, 2, 3, 4 &5).

TEXT BOOK:

S.Rao, Prof.H.L.Saluja,“ Electrical safety ,fire safety Engineering and safety management”, 1st edition
Khanna Publishers. New Delhi, 2016 Reprint.

REFERENCE:

Pradeep Chaturvedi,“*Energy management policy, planning and utilization*”,Concept Publishing
company, New Delhi, 1997.