

**ACADEMIC REGULATIONS (BH25)
COURSE STRUCTURE
AND
DETAILED SYLLABUS**

**ELECTRICAL AND ELECTRONICS
ENGINEERING**

for

B.Tech. Four Year Degree Course

(Applicable for the batches admitted from AY 2025-26 onwards)



BVRIT HYDERABAD College of Engineering for Women

(UGC Autonomous Institution | Approved by AICTE | Affiliated to JNTUH)
(NAAC Accredited – A Grade | NBA Accredited B.Tech. (EEE, ECE, CSE and IT))

Bachupally, Hyderabad -500 090

www.bvrithyderabad.edu.in

BVRIT HYDERABAD College of Engineering for Women

VISION

To emerge as the best among the institutes of technology and research in the country dedicated to the cause of promoting quality technical education.

MISSION

At BVRITH, we strive to

- Achieve academic excellence through innovative learning practices.
- Enhance intellectual ability and technical competency for a successful career.
- Encourage research and innovation.
- Nurture students towards holistic development with emphasis on leadership skills, life skills and human values.

CORE VALUES

1. Holistic Development
2. Excellence in Education
3. Women Empowerment
4. Integrity
5. Social Responsibility
6. Accountability and Transparency
7. Freedom of Expression

Department of Electrical & Electronics Engineering

VISION

To develop comprehensively trained and socially responsible women electrical and electronics engineers with competencies and capabilities to adapt to new challenges.

MISSION

M1: To empower the students adept at latest technologies by providing innovative learning environment.

M2: To cultivate interdisciplinary research mindset and outlook to develop engineering solutions.

M2: To inculcate ethical behaviour and professional attitude in order to embrace holistic concept of living.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

After three to six years of graduation, the graduates of this program will be able to

PEO-1: Propose effective solutions for complex electrical and electronics engineering problems using modern techniques.

PEO-2: Excel in their career and compete with their global peers in Techno-Scientific fields.

PEO-3: Exhibit good communication skills, ethical behaviour & social perception.

PEO-4: Stimulate economic growth and job opportunities through entrepreneurship.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO-1: Apply fundamental knowledge to analyse and implement solutions for societal challenges through enhanced experience.

PSO-2: Attain competence in using novel tools for the design and analysis of grid connected renewable energy systems towards research activities.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to

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.



Academic Regulations (BH25) for B.Tech. Regular Students with effect from Academic Year 2025-26

The B. Tech degree of Jawaharlal Nehru Technological University Hyderabad (JNTUH) shall be conferred on candidates admitted to the programme and fulfills all the requirements for the award of the Degree

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

BVRIT HYDERABAD College of Engineering for Women (Autonomous) – BVRITHCEW (A) offers new regulations termed as BH25 for four Year (8 Semesters) Bachelor of Technology (B.Tech.) Degree Programme, under Choice Based Credit System (CBCS) with effect from the Academic Year 2025-26 onwards, in the following Branches of Engineering

S. No	Branch Code	Branch Name
1	02	Electrical and Electronics Engineering (EEE)
2	04	Electronics and Communication Engineering (ECE)
3	05	Computer Science and Engineering (CSE)
4	66	Computer Science and Engineering (AI & ML)

2.0 Eligibility for Admission

2.1 Admissions to the undergraduate (UG) programme shall be made either on the basis of the merit rank obtained by the qualified students at the entrance test conducted by Telangana Government (TG EAPCET) or the University or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the government from time to time.

2.2 The medium of instruction for the entire undergraduate programme in Engineering & Technology will be in **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 and a maximum period of **Eight** academic years starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech. Course. Each student has to secure a minimum of 160 credits out of 164 credits for successful 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.

3.2.1 Semester Scheme

Each undergraduate programme is of four academic years and there shall be two semesters in each academic year. There shall be a minimum of 15 weeks of instruction, excluding the mid- term and semester – end exams. Around 15 instruction hours, 30 instruction hours and 45 hours of learning need to be followed per one credit of theory course, practical course and project / field – based learning respectively. In each semester, there shall be ‘Continuous Internal Evaluation (CIE)’ and ‘Semester End Examination (SEE)’ under Choice Based Credit System (CBCS). The curriculum / course structure suggested by AICTE and JNTUH is followed as a reference document.

3.2.2 Credit Courses

All courses offered in each semester are to be registered by the student. Against each course in the course structure, the L: T: P: C (Lecture Periods: Tutorial Periods: Practical Periods: Credits) pattern has been defined.

- One credit is allocated for one hour per week in a semester for lecture (L) or Tutorial (T) session.
- One credit is allocated for two hours per week in a semester for Laboratory / Practical (P) session.
- One credit is allocated for three hours per week in a semester for Project / Mini Project session.

For example, a theory course with three credit weightage requires three hours of classroom instruction per week, totaling approximately 45 hours of instruction over the entire semester.

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.

S. No.	Broad Course Classification	Course Group / Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes Mathematics, Physics and Chemistry courses
2		ES - Engineering Sciences	Includes Fundamental Engineering Courses
3		HS – Humanities and Social Sciences	Includes courses related to Humanities, Social Sciences and Management

4	Core Courses (CoC)	PC – Professional Core	Includes core courses related to the parent branch of Engineering.
5	Elective Courses (ElC)	PE – Professional Electives	Includes elective courses related to the parent branch of Engineering.
6		OE – Open Electives	Elective courses which include inter-disciplinary courses or courses in an area outside the parent branch of Engineering.
7	Project Core	Project Work	B.Tech. Project Work
8	Other Core Courses (OCC)	Industry Training / Internship / Industry Oriented Mini- project / Skill Development Courses	Industry Training / Internship / Industry Oriented Mini- Project / Skill Development Courses
9		Seminar	Seminar based on core contents related to parent branch of Engineering.
10	Skill Development Courses (SDC)	-	Courses designed to help individuals gain, improve, or refine specific skills
11	Value Added Courses (VAC)	-	Courses to build professional values, traditional knowledge and sensitization of societal issues

4.0 Mandatory Induction Programme

An induction program of one week duration for the UG students entering the institution, right at the start shall be implemented. Normal classes commence only after the induction programme is conducted. Following activities could be part of the induction programme:

i) Physical Activity, ii) Creative Arts, iii) Imparting Universal Human Values, iv) Literary Activities, v) Lectures by Eminent People, vi) Visits to Local Areas and vii) Familiarization to department as well as entire institute and viii) Making students understand Innovative practices at the college premises etc.

5.0 Course Registration

5.1 A faculty advisor / mentor shall be assigned to a group of around 20 students, who will advise the students about the undergraduate programme, its course structure and curriculum, choices / options of the courses, based on their competence, progress, pre-requisites and interest.

5.2 The academic section of the college invites ‘registration forms’ from students at the beginning of the semester.

- 5.3 A student can apply for registration, by consulting faculty advisor / mentor, 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.
- 5.4 A student shall register for all the courses offered in a semester as specified in the course structure.
- 5.5 Course options exercised through registration are final and **cannot** be changed; further, alternative choices also will not be considered. However, if the 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 alternative choice either for a new course (subject to offering of such a course), or for another existing course. Such alternative arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within **a week**, but before the commencement of class- work of the semester.
- 5.6 The Head of the Department / Course Coordinator should review vacant slots in the Time table of each section once in every week or fortnight. The vacant slots in the time-table may be allocated to the subject teachers who could not take classes in proportion to the number of weeks completed from the commencement of the semester.
- 5.7 Two faculty members may be allocated for the tutorial session of Mathematics-1 course for better interaction / practice and to minimize the failures in the subject.
- 5.8 **Professional Electives:** The students have to choose six Professional Electives (PE-I to PE-VI) from the six baskets of professional electives given.
Students have the flexibility to choose from the list of professional electives offered by the Institute or opt to register for the equivalent Massive Open Online Courses (MOOCs) as listed from time to time by the College.
- 5.9 **Open Electives:** Students have to choose three Open Electives (OE - I, II & III) from three baskets of Open Electives given by other than the parent department. However, the student can opt for an Open Elective course offered by her parent department, if the student has not studied that course so far. Similarly, Open Elective courses being studied should not match with any courses of the forthcoming semesters.
- 5.10 **Provision for Early Registration of MOOCs:**
For a professional elective in a semester, students are allowed to register for an equivalent MOOCs course listed from time to time by the College one semester in advance. For example, a Professional Elective of III Year II Sem shall be allowed to register under MOOCs platform in III year I Sem.
The credits earned in one semester in advance can be submitted in the subsequent semester for the assessment.

The students, who have registered in advance in an equivalent MOOCs course and fail to secure any pass grade in the MOOCs course, can register for the regular course offered in the following semester of their course structure

5.11 Conversion of Marks Secured in MOOCs into Grades: Marks secured in the internal and external evaluations of a MOOCs course shall be scaled to 40 and 60 marks respectively. The sum of these two components shall be considered as the total marks out of 100. The corresponding grade shall then be determined as per the marks-to-grades conversion rules specified in Clause 10.3

5.12 MOOCs are allowed only for professional elective courses and for a few Minors & Honors courses

5.13 Additional learning resources:

Students are encouraged to acquire additional course - related knowledge by auditing learning resources from MOOCs platforms for each course offered in their course structure. These additional courses are not meant for earning credits but are intended to enhance knowledge. The College shall notify such courses from time to time through their portals for the benefit of students. They are categorized into three types: prerequisite, reinforcement, and aspirational. Prerequisite courses help students gain familiarity and provide sufficient background. Reinforcement courses aim to offer different perspectives on learning, while aspirational courses focus on next-level or advanced learning.

6.0 Rules to offer Elective courses

6.1 An elective course may be offered to the students, only if a minimum of 25% of class strength opts for it.

6.2 Same elective course for different sections may be offered by different faculty members. The selection of elective course by students will be based on first come first serve and / or CGPA criterion.

6.3 If the numbers of student's registrations are more than the strength of one section, then it is choice of the concerned Department to offer the same course for more than one section based on the resources available in the department.

7.0 Attendance requirements

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

7.2 Shortage of attendance in aggregate upto 10% (securing 65% and above but 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.

- 7.3 A stipulated fee shall be payable for condoning of shortage of attendance as notified by the college.
- 7.4 **Two hours** of attendance for each theory course shall be considered, if the student appears for the mid-term examination of that course.
- 7.5 Shortage of attendance below 65% in aggregate shall in **no** case be condoned.
- 7.6 Students, whose shortage of attendance is not condoned in any semester, are not eligible to take their semester-end examinations of that semester. They get detained and will not be promoted to the next semester. Their registration for that semester shall stand cancelled, including internal marks. They may seek re-registration for that semester in the next academic year.
- 7.7 A student fulfilling the attendance requirement in the present semester shall not be eligible for re-admission into the same semester.
- 8.0 Criteria for Earning of Credits in a Course**
- 8.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course, if the student secures 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 course.
- 8.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Field Based Research Project / Industry Oriented Mini Project / Internship, 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 she (i) does not submit a report on Field-Based Research Project / 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 Field-Based Research Project / Industry Oriented Mini Project / Internship evaluations.
- 8.3 A student eligible to appear in the semester-end examination for any course, is absent from it or failed (there by failing to secure ‘C’ grade or above) may re-appear for that course in the supplementary examination as and when it is conducted. In such cases, internal marks assessed in continuous internal evaluation (CIE) earlier for that course will be carried over, and added to the marks obtained in the SEE supplementary / make-up examination. If the student secures sufficient marks for passing, ‘C’ grade or above shall be awarded as specified in clause 10.3.

9.0 Distribution of Marks and Evaluation

9.1 The performance of a student in every course (including Value Added Courses and Skill Development Courses, Laboratory / Practical and Project Work) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination), irrespective of the credits allocated.

9.2 Continuous Internal Evaluation (CIE)

9.2.1 6.2 Theory Courses:

For theory courses, 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, totaling to 30 marks. Total duration of mid-term examination is two hours.

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, fill-in the blanks and match the following type of questions for a total of 10 marks.

The descriptive paper shall contain 6 questions out of which, the student has to answer 4 questions, each carrying 5 marks. The **average of the two Mid Term Examinations** shall be taken as the final marks for Mid Term Examination (for 30 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. Questions will be drawn from the mid-term exam syllabus, ensuring uniform coverage of all topics.

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

2. Five marks for the assignment. Student shall submit two assignments and the **average of 2 Assignments** each for 5 marks shall be taken. 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.
3. Five marks for the Viva-Voce / PPT / Poster Presentation / Case Study on a topic in the concerned subject. This assessment shall be completed before II Mid-Term Examination. Respective Teachers schedule these sessions in their semester plan.

9.2.2 Engineering Drawing and Computer Aided Drafting Course:

For this course, 20 marks will be allocated for day-to-day assessments conducted during drawing practice sessions, and another 20 marks will be allocated for the mid-term examination. In the mid-term examination, students shall attempt any four out of six given questions. The first mid-term exam will be conducted in the conventional mode using a

drawing board, while the second mid-term exam will be conducted using a CAD package.

9.3 A Computer-Based Test (CBT) in each course is available for students who either:

1. Missed one of the two mid-term examinations due to unavoidable circumstances, or
2. Attended both mid-term examinations but wish to improve their internal marks.

The CBT will be conducted at the end of the semester and will carry a total of 30 marks. The marks obtained in the CBT will be considered equivalent to those obtained in one mid-term examination. Zero marks will be awarded to students who are absent for the mid-term examination. The average of the best two scores from the three exams (the two mid-term exams and the CBT), combined with other internal assessment components, will constitute the Continuous Internal Improvement (CII) marks for that specific course. CBT exams shall be conducted by the Exam Branch of the College.

9.4 Semester End Examination for theory courses

9.4.1 Theory Courses:

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

- Part-A is compulsory, consists of five short answer questions covering all units of syllabus; each question carries two marks.
- Part-B consists of five questions carrying 10 marks each. There shall be two questions asked in the question paper from each unit with either-or choice and the student should answer either of the two questions. The student shall answer one question from each of five units

9.4.2 Engineering Drawing and Computer Aided Drafting Course:

Question paper consists of five questions carrying 12 marks each. There shall be two questions asked in the question paper from each unit with either - or choice and the student should answer either of the two questions. The student shall answer one question from each of five units. **There shall be no section with short answer questions.**

9.4.3 Duration of SEE:

The duration of Semester End Examination of theory and drawing courses is 3 hours.

9.5 Semester End Examination for Practical Courses

For practical courses there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and semester-end examination for 60 marks. The breakup of the continuous internal evaluation for 40 marks is as follows:

1. 10 marks for a write-up on day-to-day experiments in the laboratory (in terms of aim, components / procedure, expected outcome).
2. 10 marks for viva-voce (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
3. 10 marks for the internal practical examination conducted by the laboratory teacher concerned.
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 submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

The Semester End Examination for practical courses shall be conducted with an external examiner and the laboratory course teacher. The external examiner shall be appointed by the Controller of Examinations / Chief Superintendent on the recommendation of BoS Chairman of the concerned department

In the Semester End Examination for practical courses held for 3 hours, rubrics of evaluation for 60 marks are as given 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.

For any change of experiment, 5 marks will be deducted from the total of 60 marks. If second time change of experiment is requested, another five marks will be deducted from the 60 marks. No third change will be permitted.

9.6 Field-based Research Project:

There shall be a Field – based Research Project in the intervening summer between II-II and III- I Semesters. Students will register for their project immediately after II Year II Semester examinations and pursue it during summer vacation. The Field-based Research Project shall be submitted in a report form and presented before the committee in III year I semester. It shall be evaluated for 100 external marks. The evaluation committee shall consist of an External Examiner, Head of the Department, Supervisor of the Project and a Senior Faculty Member of the department. There shall be no internal marks for Field-based Research Project. Student shall have to earn 40% marks, i.e 40 marks out of 100 marks. The student is

deemed to have failed, if she (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the committee as per schedule, or (iii) secures less than 40% marks in this course.

9.7 Internship / Industry Oriented Mini Project:

There shall be an Internship / Industry Oriented Mini Project in collaboration with an industry from their specialization. Students shall register for their project immediately after III Year II Semester Examinations and pursue it during summer vacation. Internship should be carried out at an organization (or) Industry. The Industry Oriented Mini Project shall be submitted in a report form and presented before the committee in IV Year I Semester before the semester end 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 / Internship, and a Senior Faculty Member of the Department.

9.7.1 For evaluating industry - oriented mini-projects, it is preferable to appoint an external examiner from the industry, ideally from one of the organizations / industries with which the institute has established / proposing to establish collaborations.

9.8 UG Project Work:

9.8.1 The UG project work shall be initiated at the beginning of the IV Year II Semester and the duration of the project work is one semester. The student must present in consultation with her supervisor, the title, objective and plan of action of her Project work to the departmental committee for approval within two weeks from the commencement of IV Year II Semester. Only after obtaining the approval of the departmental committee, the student can start her project work.

9.8.2 Student has to submit project work report at the end of IV Year II Semester. The project work shall be evaluated for 100 marks. Out of which 40 marks and 60 marks are allocated for CIE and External Evaluation respectively.

9.8.3 For internal evaluation, the departmental committee consisting of Head of the Department, Project Supervisor and a Senior Faculty Member shall evaluate the project work for 40 marks.

The distribution of marks is as follows:

- Objective(s) of the work done - 05 Marks
- Methodology adopted - 15 Marks
- Results and Discussions - 15 Marks
- Conclusions and Outcomes - 05 Marks

Total - 40 Marks

- 9.8.4** The External Evaluation shall be conducted by the external examiner for a total of 60 marks. It shall comprise the presentation of the work, communication skills, and viva-voce, with a Weightage of 20 marks, 15 marks, and 25 marks respectively.

The topics for main Project shall be different from the topic of Industry Oriented Mini Project / Internship / SDC. The student is deemed to have failed, if she (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.

- 9.8.5** For conducting viva-voce exam of project work, controller of examinations / chief superintendent selects an external examiner from the list of experts in the relevant branch submitted by the BoS chairman of the concerned department.

- 9.8.6** A student, who has failed, may re-appear once for the above evaluation, when it is scheduled again; if student fails in such 'one re-appearance' evaluation also, she has to appear for the same in the next subsequent year, as and when it is scheduled.

9.9 Skill Development Courses:

Four Skill Development Courses are included in the Curriculum in II-I, II-II, III-I and III-II semesters. Each Skill Development Course carries one credit. The evaluation pattern will be same as that of a laboratory course including the internal and external assessments.

The objective of Skill Courses is to develop the cognitive skills as well as the psycho-motor skills.

9.10 Value Added Courses:

The evaluation of Value Added Courses shall be similar to that of theory courses. However, the scheduling of these mid-term exams and semester-end examinations may not be combined with main-stream examinations. One hour /45 mins proctored mid-term examination shall be conducted in the regular class by the same subject teacher. It should not impact the conduct of other classes on that day. The scheduling of the semester-end examinations shall also be intimated by the Exam Branch time to time.

10.0 Grading Procedure

- 10.1** Absolute grading system is followed for awarding the grades to each course.

- 10.2** Grades will be awarded to indicate the performance of students in each Theory, Laboratory, Industry - Oriented Mini Project / Internship / Skill development course and Project Work. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester

End Examination, both taken together) as specified in clause 8 above, a letter grade shall be given as explained in the following clause.

- 10.3** To measure the performance of a student, a 10-point grading system is followed. The mapping between the percentage of marks secured and the corresponding letter grade is as follows:

Range of % of Marks Secured in a Course	Letter Grade	Grade Points (GP)
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

- 10.4** A student shall be declared successful or ‘passed’ in a semester, if she secures ‘C’ grade or above in every course (ie $GP \geq 5$)
- 10.5** A student who has obtained an ‘F’ grade in any course shall be deemed to have ‘failed’ and is required to re-appear for a supplementary exam as and when conducted. In such cases, internal marks in those courses will remain the same as those obtained earlier.
- 10.6** To a student who has not appeared for an examination in any course, ‘Ab’ grade will be allocated in that course, and she is deemed to have ‘Failed’. Such student will be required to re-appear for supplementary / make-up exam as and when conducted. The internal marks in those courses will remain the same as those obtained earlier.
- 10.7** The students earn a Grade Point (GP) in each course, on the basis of letter grade secured in that course. Every student who pass a course will receive grade point $GP \geq 5$ (‘C’ grade or above).
- 10.8** The ‘Credit Points’ (C) are computed by multiplying the grade point with credits for a given course.

$$\text{Credit Points (C)} = \text{Grade Point (GP)} \times \text{Credits}$$

- 10.9** The Semester Grade Point Average (SGPA) is calculated only when all the courses offered in a semester are cleared by a student. It is calculated by dividing the sum of credit points ($\sum C_i$) secured from all courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to two decimal places. SGPA for each

semester is thus computed as

$$SGPA = \{ \sum_{i=1}^N C_i G_i \} / \{ \sum_{i=1}^N C_i \}$$

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

10.10 If a student earns more than 160 credits, only the courses corresponding to the best 160 credits shall be considered for the computation of CGPA of B.Tech. Degree.

10.11 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 for the courses corresponds to best 160 credits out of **all** registered courses in **all** semesters, and the total number of credits corresponds to those selected courses. CGPA is rounded off to **two** decimal places. CGPA is thus computed at the end of each semester, from the I year II semester onwards, as per the formula

$$CGPA = \{ \sum_{j=1}^M C_j G_j \} / \{ \sum_{j=1}^M C_j \}$$

where 'M' is the total no. of courses corresponding to the best 160 credits from the courses registered in all eight semesters, 'j' is the course indicator index (takes into account all courses from 1 to 8 semesters), C_j is the no. of credits allotted to the j^{th} course, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} course.

Illustration of the Calculation of SGPA:

Course	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	4 x 8 = 32
Course 2	3	O	10	3 x 10 = 30
Course 3	3	C	5	3 x 5 = 15
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A	8	3 x 8 = 24
Course 6	2	A+	9	2 x 9 = 18
Course 7	1	C	5	1 x 5 = 5
Course 8	1	O	10	1 x 10 = 10
	20			152

$$SGPA = 152/20 = 7.6$$

The CGPA of the entire B.Tech. programme shall be calculated considering the best 160 credits earned by the student.

10.12 For merit ranking or comparison purposes or for any other listing, **only the ‘rounded off’** values of the CGPAs will be used.

10.13 SGPA of a semester will be mentioned in the semester Memorandum of Grades if all courses of that semester are cleared in first attempt. Otherwise, the SGPA shall be mentioned only on the Memorandum of Grades in which sitting she passed her last exam in that semester.

11.0 Declaration of Results and issue of Grade Memo

11.1 While declaring the results, the web-version should display the marks earned by the student with the internal and external marks break-up. However, in the memorandum of grades, the marks need not be shown.

11.2 After the completion of each semester, a certificate of memorandum of grades shall be issued to all the registered students, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, course title, no. of credits), letter grade and credits earned.

12.0 With holding of Results

12.1 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.

13.0 Supplementary Examinations:

13.1 At the end of each semester, along with regular semester examinations, supplementary examinations shall be conducted for the students who have back-log subjects.

13.2 Advanced supplementary examinations in IV Year II Semester courses maybe conducted for those who failed in any course offered in IV Year II Semester. It may enable the students to receive their B.Tech. Provisional certificate at an early date. Advanced supply examinations may be scheduled within one month period after the declaration of the final semester results. There shall be no supplementary examination in the successive semester. The students who could not secure any pass grade in advance supplementary examinations have to wait for regular series examination of next batch to write their back-log examination.

14.0 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 and fulfillment of attendance requirement.
2	First year second semester to Second year first semester	i) Regular course of study of first year second semester and fulfillment of attendance requirement ii) Must have secured at least 25% of the total 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 and fulfillment of attendance requirement.
4	Second year second semester to Third year first semester	i) Regular course of study of second year second semester and fulfillment of attendance requirement. ii) Must have secured at least 25% of the total 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 and fulfillment of attendance requirement.
6	Third year second semester to Fourth year first semester	Regular course of study of third year second Semester and fulfillment of attendance requirement.
7	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester and fulfillment of attendance requirement.

Re-admission after Detention

- 15.0
- i) A student detained due to lack of credits, shall be promoted to the next academic year only after acquiring the required number of credits.
 - ii) A student detained due to shortage of attendance shall be admitted in the same semester in the successive academic years.
 - iii) When a student is readmitted in the following academic years, the academic regulations under which the student seeks re-admission shall only be applicable to this student, not the academic regulations in which she got admitted in her first year of study.

16.0 Credit Exemption

A student (i) shall register for all courses covering 164 credits as specified and listed in the Course structure and (ii) earn 160 or more credits to successfully complete the undergraduate programme.

- Best 160 credits shall be considered for CGPA computation. The student can avail exemption of courses totaling up to 4 credits other than Professional core courses, Laboratory Courses, Seminars, Project Work and Field Based Research Project / Industry Oriented Mini Project / Internship, for optional drop out from these 164 credits registered;
- The semester grade point average (SGPA) of each semester shall be mentioned at the bottom of the grade card, when all the subjects in that semester have been passed by the student.
- Credits earned by the student in either a Minor or Honors program cannot be counted towards the required 160 credits for the award of the B.Tech. degree.

17.0 Award of degree

17.1 A student, who registers for all the courses specified in the course structure and secures the required number of 160 credits 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.

17.2 A student who qualifies for award of the degree as listed in item 17.1 shall be placed in the following classes

17.3 A student with final CGPA (at the end of the under graduate programme) ≥ 7.5 , and fulfilling the following conditions - shall be placed in 'First Class with Distinction':

- i) Should have passed all the courses in 'First Appearance'.
- ii) 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 ≥ 7.5 shall be placed in 'First Class'.

17.4 Students with final CGPA (at the end of the under graduate programme) ≥ 6.5 but < 7.5 shall be placed in '**First Class**'.

17.5 Students with final CGPA (at the end of the undergraduate programme) ≥ 5.5 but < 6.5 , shall be placed in '**Second Class**'.

17.6 All other students who qualify for the award of the degree (as per item 17.1), with final CGPA (at the end of the under graduate programme) ≥ 5.00 but < 5.5 , shall be placed in '**Pass class**'.

17.7 Grace Marks

- Grace marks shall be given to those students who complete the course work of four-year B. Tech. degree, not secured pass grade in not more than three subjects and adding a specified grace marks enables the student to pass the subject(s) as well as gets eligibility to receive the provisional degree certificate.
- Grace marks for students admitted under the BH25 Academic Regulations should not exceed 0.15% of the total maximum marks in all eight semesters (excluding the marks allocated for value added courses and skill development courses).

18.0 Award of Gold Medals

18.1 Students fulfilling the conditions listed under item 17.3 alone will be eligible for award of 'Gold Medal'.

18.2 If more than one student secures the same highest CGPA, then the following tie resolution criteria, in the same order of preference shall be followed for selecting the Gold Medal winner, until the tie is resolved:

- i) More number of times secured highest SGPAs,
- ii) More number of O and A+ grades in that order and
- iii) Highest SGPA in the order of first semester to eight semester.

19.0 Conversion of CGPA into equivalent Percentage of Marks

19.1 The following formula shall be used for the conversion of CGPA into equivalent marks, Whenever it is necessary

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

20.0 Honours and Minor Degree Programs

Honours and Minor Degree programs will be available in all branches of B.Tech. Degree. Minor Degree programs will commence from II Year II Semester and continue till IV Year I semester and Honours Degree programs will commence from III Year I Semester and continue till IV Year II semester.

University shall under take the responsibility of assessing the infrastructure requirements during FFC visits. Only the University approved Minors and Honors shall be offered at the respective affiliated colleges.

21.0 Multiple Entry Multiple Exit Scheme (MEME)

21.1 Exit Option after Second Year:

Students enrolled in the 4-Year B.Tech. Program is permitted to exit the program after successful completion of the second year (B.Tech. II Year II Semester). The students who desire to exit after the II year shall formally inform the exit plan one semester in advance i.e., at the commencement of II Year II Semester itself. Such students need to fulfill the additional requirements as specified in Clause 21.2 described below.

Upon fulfilling the requirements like earning all the credits up to II Year II Semester and successfully completing the additional requirements, the students will be awarded a 2-Year Undergraduate (UG) Diploma in the concerned engineering branch.

21.2 Additional Requirements for Diploma Award

To qualify for the diploma under the exit option, students must also complete 2 additional credits through one of the following University-prescribed pathways:

Work-based Vocational Course:

Participation in a practical, hands-on vocational training program relevant to the engineering field, typically conducted during the summer term.

Internship /Apprenticeship:

Complete a minimum 8-week internship or apprenticeship in their related field to gain practical industry exposure.

In addition, students must clear any associated course(s) and submit the internship / apprenticeship report as per the University's schedule and guidelines.

21.3 Re-entry into the B.Tech. Programme

Students who have exited the B.Tech. Programme with a 2-Year UG Diploma may apply for reentry into the Third Year (Fifth Semester) of the B.Tech. Program. Re-entry is subject to the following conditions:

- The student must surrender the awarded UG Diploma Certificate.
- Students who wish to rejoin in III Year must join the same B.Tech. Program from which the student exited. Before rejoining, students should check for continuation of the same branch at the college. If the specific branch is closed, should consult the University for the Possible Alternative solutions.
- Re-registered students will be governed by the academic regulations in effect at the time of re-entry, regardless of the original regulations under which they were admitted.
- If a student opts to continue her studies without a gap after being awarded the diploma, they must register for the third-year courses before the commencement of classwork.

21.4 Break in Study and Maximum Duration

Students are allowed to take a break of up to four years after completion of II Year II Semester with prior University permission through the Principal of the college.

Re-entry after such a break is subject to the condition that the student completes all academic requirements within twice the duration of the program (i.e., within 8 years for a 4-year B.Tech. Programme).

22.0 Transitory Regulations for the students re-admitted in BH25 Regulations:

22.1 Transitory regulations are applicable to the students detained due to shortage of attendance as well as detained due to the shortage of credits and seek permission to re-join the B.Tech. Programme, where BH25 regulations are in force.

22.2 A student detained due to shortage of attendance and re-admitted in BH25 regulations: Such students shall be permitted to join the same semester, but in BH25 Regulations.

22.3 A student detained due to shortage of credits and re-admitted in BH25 regulations: Such students shall be promoted to the next semester in BH25 regulations, only after acquiring the required number of credits as per the corresponding regulations of her previous semester.

22.4 A student who has failed in any course in a specific regulation has to pass those courses in the same regulations.

22.5 If a student is readmitted to BH25 Regulations and has any course with 80% of syllabus common with her previous regulations, that particular course in BH25 Regulations will be substituted by an equivalent course of BH23 regulations by the University. All these details are summarized in a set of look-up Table; one set for each B. Tech. branch.

22.6 Lookup Table of equivalence courses

22.6.1 A lookup table will be provided for the benefit of students. This look up table will include all the courses to be registered by students who have been re-admitted under the BH25 Academic Regulations from the BH23 Academic Regulations. Separate look up tables will be provided for the following categories of students:

1. Students re-admitted into the I Year II Semester of the BH-25 Regulations
2. Students re-admitted into the II Year I Semester of the BH-25 Regulations
3. Students re-admitted into the II Year II Semester of the BH-25 Regulations
4. Students re-admitted into the III Year I Semester of the BH-25 Regulations
5. Students re-admitted into the III Year II Semester of the BH-25 Regulations
6. Students re-admitted into the IV Year I Semester of the BH-25 Regulations
7. Students re-admitted into the IV Year II Semester of the BH-25 Regulations

Every B.Tech. Program shall have separate set of seven lookup tables.

22.6.2 Applicability of Lookup Table: The above look-up table shall be applicable for i) students who seek readmission from BH-23 regulations to BH-25 regulation and are going to be re-admitted in the same college. The principals need to inform in the specified format, the list of such students and equivalences derived from the transitory regulations.

22.6.3 These look-Up Tables are not applicable for the students who seek transfer from i) other Universities, ii) one autonomous to another autonomous colleges and iii) non-autonomous to autonomous colleges under JNTUH. Such students should consult the University regarding equivalent courses, as was in previous practice.

22.7 The BH25 Academic Regulations are applicable to a student from the year of re-admission. However, the student is required to complete the study of B.Tech. Degree within the stipulated period of eight academic years from the year of first admission.

23.0 Student Transfers

23.1 There shall be no branch transfers after the completion of admission process.

23.2 The students seeking transfer from various other Universities / Institutions is having backlogs at the previous University / Institute, have to pass the courses offered at the college which are equivalent to the failed courses at the previous University / Institute.

23.3 The transferred students from other Universities / Institutions shall be given a chance to write CBTs for getting CIE component in the equivalent course(s) as per the clearance letter issued by the University.

24.0 Value Added Courses

24.1 Faculty members who have received a certificate in Innovation and Entrepreneurship / Entrepreneurship / Intellectual Property Rights from a reputed foundation / organization may be given preference to teach the "Innovation and Entrepreneurship" course.

24.2 To ensure quality delivery and standardization in teaching the **Indian Knowledge System (IKS)** and other value-added courses, the following guidelines must be adhered to:

- i) faculty members must undergo a Faculty Development Program (FDP) organized by UGC – MMTTC (Malaviya Mission Teacher Training Centre), **or** any other recognized and competent institution / organization offering similar certified programs,
- ii) the total instructional duration of the FDP should be around 32 hours or more,
- iii) All sessions in the FDP must be conducted by certified and qualified resource persons with recognized expertise in the respective domains,
- iv) A formal assessment component must be included as part of the FDP.

25.0 Mapping with the Sustainable Development Goals

All the courses specified in the course structure of every programme are mapped with the one or more sustainable development goals.

26.0 Scope

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

26.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council (AC) is final.

26.3 The AC may change or amend the academic regulations (if any from university), 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 AC.





BVRIT HYDERABAD College of Engineering for Women

Bachupally, Hyderabad – 500090

ACADEMIC REGULATIONS FOR B.TECH. (LATERAL ENTRY SCHEME)

FROM THE AY 2026-27

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

1. 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 123/124 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 student can avail exemption of courses **totaling up to 3/4credits** other than Professional core courses, Laboratory Courses, Seminars, Project Work and Field Based Research Project / Industry Oriented Mini Project / Internship, for optional dropout.
4. The students, who fail to fulfill the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.
5. The attendance requirements of B.Tech. (Regular) shall be applicable to B.Tech. (LES).

6. 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 and fulfillment of attendance requirement.
2	Second year second semester to Third year first semester	i) Regular course of study of second year second semester and fulfillment of attendance requirement. ii) Must have secured at least 25% of the total credits upto 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 and fulfillment of attendance requirement.
4	Third year second semester to Fourth year first semester	Regular course of study of third year second Semester and fulfillment of attendance requirement.
5	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester and fulfillment of attendance requirement.

7. All the other regulations as applicable to B.Tech. 4 – Year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).
8. LES students are not permitted to exit the B.Tech. Program after completion of second year (B.Tech. II Year II Semester).

Academic Regulations for B.Tech - Acceleration of Course Work

Introduction

In order to allow the bright and motivated students, a provision is made to complete the final semester three elective subjects in advance. These subjects are offered through MOOCS / additional subjects and credit transfer is permitted

These credits are shown in the final semester grade card in order to calculate SGPA and CGPA. This provision is made to allow the students for industry internship or to undertake projects in industry in final semester

Eligibility

A Student is eligible to register for OE / PE in Third Year First Semester by having a CGPA of ≥ 6.5 without any active backlogs up to II Year – I Semester. Similarly, the eligibility to register for OE / PE, in the Third Year Second Semester by having CGPA of ≥ 6.5 without any active backlogs up to II Year II Semester and to register for OE /PE, in the Fourth Year First Semester by having a CGPA of ≥ 6.5 without any active backlogs up to III Year I Semester.

Course Registration

A Student Can register at most two additional PE / OE in a semester after approval from Faculty Advisor / Counselor / HoD.

These additional courses have to be completed either through regular class work / MOOCs as per the directions of College Academic Committee

The list of electives offered will be notified by the departments at the time of course work registration.

B.TECH. IN ELECTRICAL & ELECTRONICS ENGINEERING
COURSE STRUCTURE (BH25 Regulations)
Applicable from AY 2025-26 Batch

I YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.	EE100ES	Electrical Circuits - I	2	0	0	2
2.	MA101BS	Matrices and Calculus	3	1	0	4
3.	PH102BS	Advanced Engineering Physics	3	0	0	3
4.	CS103ES	Programming for Problem Solving	3	0	0	3
5.	ME104ES	Engineering Drawing and Computer Aided Drafting	2	0	2	3
6.	EN105HS	English for Skill Enhancement	3	0	0	3
7.	PH106BS	Advanced Engineering Physics Lab	0	0	2	1
8.	CS107ES	Programming for Problem Solving Lab	0	0	2	1
9.	EN108HS	English Language and Communication Skills Lab	0	0	2	1
		Induction Program				
		Total Credits	16	1	8	21

I YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.	MA201BS	Ordinary Differential Equations and Vector Calculus	3	0	0	3
2.	CH202BS	Engineering Chemistry	3	0	0	3
3.	EC203ES	Analog Electronics	3	0	0	3
4.	CS204ES	Python Programming	3	0	0	3
5.	EE205ES	Electrical Circuits - II	3	0	0	3
6.	CH206BS	Engineering Chemistry Lab	0	0	2	1
7.	ME207ES	Engineering Workshop	0	0	2	1
8.	EE208ES	Electrical Circuits Lab	0	0	2	1
9.	CS209ES	Applied Python Programming Lab	0	0	2	1
10.	EC210ES	Analog Electronics Lab	0	0	2	1
		Total Credits	15	0	10	20

II YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.	EE301PC	Electromagnetic fields	3	0	0	3
2.	EE302PC	Electrical Machines - I	3	0	0	3
3.	EE303PC	Power Systems - I	3	0	0	3
4.	CS304ES	Data Structures	3	0	0	3
5.	MA305BS	Numerical Methods and Complex Variables	3	0	0	3
6.	MS306HS	Innovation and Entrepreneurship	2	0	0	2
7.	EE307PC	Electrical Machines - I Lab	0	0	2	1
8.	CS308ES	Data Structures Lab	0	0	2	1
9.	EE309SD	Design of Electrical Systems using AutoCAD	0	0	2	1
10.	MA310BS	Computational Mathematics Lab	0	0	2	1
11.	VA300ES	Environmental Science	1	0	0	1
		Total Credits	18	0	8	22

II YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.	EE401PC	Electrical Measurements and Sensors	2	0	0	2
2.	EE402PC	Electrical Machines - II	3	0	0	3
3.	EE403PC	Control Systems	3	0	0	3
4.	EE404PC	Digital Electronics	3	0	0	3
5.	EE405PC	Power Systems - II	3	0	0	3
6.	EE406PC	Electrical Measurements and Sensors Lab	0	0	2	1
7.	EE407PC	Electrical Machines - II Lab	0	0	2	1
8.	EE408PC	Control Systems Lab	0	0	2	1
9.	EE409PC	Digital Electronics Lab	0	0	2	1
10.	EE410SD	PCB Design	0	0	2	1
		Total Credits	14	0	10	19

III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.	EE501PC	Power Electronics	3	0	0	3
2.	EE502PC	Power System Protection	3	0	0	3
3.	EE503PC	Microprocessors and Microcontrollers	3	0	0	3
4.		Professional Elective-I	3	0	0	3
5.		Open Elective-I	2	0	0	2
6.	EE504PC	Power Electronics Lab	0	0	2	1
7.	EE505PC	Power System Lab	0	0	2	1
8.	EE506PC	Microprocessors and Microcontrollers Lab	0	0	2	1
9.	EE507PC	Field-Based Project/Internship	0	0	4	2
10.	EE508SD	Robotics and Automation	0	0	2	1
11.	VA500HS	Indian Knowledge System	1	0	0	1
		Total Credits	15	0	12	21

III YEAR II SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1.	EE601PC	Power System Operation and Control	3	0	0	3
2.	EE602PC	Signals and Systems	3	0	0	3
3.	MS603HS	Business Economics and Financial Analysis	3	0	0	3
4.		Professional Elective-II	3	0	0	3
5.		Open Elective – II	2	0	0	2
7.	EE604PC	Power System Simulation Lab	0	0	2	1
6.	EE605PC	Signals and Systems Lab	0	0	2	1
8.	EE606PC	Electrical and Electronics Design Lab	0	0	2	1
9.	EN607HS	English for Employability Skills Lab	0	0	2	1
10.	EE608SD	Design of Solar Power System	0	0	2	1
11.	VA600HS/ VA601HS	Gender Sensitization*/ Human Values and Professional Ethics*	1	0	0	0.5+0.5
		Total Credits	15	0	10	20

*Note: For the courses Gender Sensitization and Human Values and Professional Ethics- one hour of instruction will be conducted on alternate weeks. For example, if a one-hour class for Gender Sensitization is conducted this week, then a one-hour class for Constitution of India will be conducted in the following week.

IV YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.	EE701PC	Power Electronics for Renewable Energy Systems	3	0	0	3
2.	EE702PC	Hybrid and Autonomous Electric Vehicles	3	0	0	3
3.	MS703HS	Fundamentals of Management for Engineers	3	0	0	3
4.		Professional Elective - III	3	0	0	3
5.		Professional Elective – IV	3	0	0	3
6.		Open Elective – III	2	0	0	2
7.	EE704PC	Power Electronics for Renewable Energy Systems Lab	0	0	2	1
8.	EE705PC	Electric Vehicles Lab	0	0	2	1
9.	EE706PC	Industry Oriented Mini Project/ Internship	0	0	4	2
		Total Credits	17	0	08	21

IV YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.		Professional Elective – V	3	0	0	3
2.		Professional Elective – VI	3	0	0	3
3.	EE801PC	Project Work	0	0	42	14
		Total Credits	06	0	42	20

*Note: Students who wish to exit after II Year II Semester has to register for this optional course and acquire the credits allotted by doing 6 weeks Work-based Vocational Course/ Internship or Apprenticeship. Please refer BH25 Academic Regulations for more information.

PROFESSIONAL ELECTIVES**Professional Elective - I**

EE511PE	Utilization of Electrical Energy
EE512PE	Renewable Energy Systems
EE513PE	VLSI Design
EE514PE	IoT Applications in Electrical Engineering

Professional Elective - II

EE611PE	Power Semiconductor Drives
EE612PE	High Voltage Engineering
EE613PE	Programmable Logic Controllers
EE614PE	Special Machines

Professional Elective-III

EE711PE	Energy Storage Systems
EE712PE	Power Quality
EE713PE	DSP Controller and Applications
EE714PE	Computer aided Electrical Machine Design

Professional Elective-IV

EE721PE	Battery Management Systems
EE722PE	Smart Grid Technologies
EE723PE	AI and ML for Electrical Engineering Applications
EE724PE	Electrical Distribution Systems

Professional Elective-V

EE811PE	EV Charging Infrastructure
EE812PE	HVDC Transmission
EE813PE	Embedded Systems
EE814PE	Flexible AC Transmission Systems

Professional Elective-VI

EE821PE	Electrical Distribution and Automation
EE822PE	Smart Metering and Communication Protocols
EE823PE	Energy Conservation and Audit
EE824PE	Cyber Physical Systems

OPEN ELECTIVES**Open Elective-I**

EE500OE	Fundamentals of Electric Vehicles
EE501OE	Industrial Automation and Control
EE502OE	Renewable Energy Sources

Open Elective-II

EE600OE	Digital Energy
EE601OE	Energy Audit
EE602OE	Principles of Power Systems

Open Elective-III

EE700OE	Sustainable Energy
EE701OE	Smart Grid Systems
EE702OE	Basics of Power Plant Engineering

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
EE100ES	ELECTRICAL CIRCUITS - I	2	0	0	2

Prerequisites: Nil

Course Description: This course introduces the fundamentals of electrical circuit analysis, covering active and passive elements, energy storage, and key circuit laws and theorems. It emphasizes DC, single-phase, and three-phase AC circuit analysis, including power, resonance, and power factor. Students will develop analytical and problem-solving skills using classical methods and simulation tools for circuit verification and visualization.

Course Outcomes: After completion of this course, the students will be able to

- C100.1:** Understand and apply fundamental laws and transformations in electrical circuits involving active and passive elements
- C100.2:** Analyze electrical networks systematically using node–voltage and mesh–current methods.
- C100.3:** Apply network theorems to simplify and analyze DC circuits
- C100.4:** Evaluate 1- ϕ ac circuit parameters under steady state condition
- C100.5:** Apply network theorems to simplify and analyze AC circuits
- C100.6:** Understand the behavior and applicability of 3- ϕ networks

Unit – I Network Elements & Laws

Active elements – Independent and dependent sources, Passive elements – R, L and C, Energy stored in Inductance and Capacitance, Kirchhoff's laws, Source transformation, Star-Delta transformation, Node voltage method, and Mesh current method.

Unit – II Network Theorems (DC)

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Tellegen's theorem, Compensation theorem, Millman's theorem, and Reciprocity theorem.

Unit -III Single-Phase Circuits

RMS and average values of periodic sinusoidal and non-sinusoidal waveforms, Phasor representation, j-Notation, Steady-state analysis of series and parallel circuits. Impedance, Admittance, Active and Reactive Powers, Complex Power & power factor.

Resonance: Series and parallel resonance, Bandwidth and Q-factor.

Unit – IV Network Theorems (AC)

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Tellegen's theorem, Compensation theorem, Millman's theorem, and Reciprocity theorem.

Unit – V Three-Phase Circuits

Analysis of balanced and unbalanced three-phase circuits, Star and delta connections, Measurement of three-phase power for balanced and unbalanced loads.

TEXT BOOKS

1. Van Valkenburg M.E, Network Analysis, 3rd Edition, 2000, Prentice Hall of India.

2. Ravish R Singh, Network Analysis and Synthesis, 2nd Edition, 2019, McGraw Hill.

REFERENCE BOOKS

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

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
MA101BS	MATRICES AND CALCULUS (Common to all)	3	1	0	4

Pre – Requisite **Intermediate Mathematics**

Course Description: The course contains various topics related to Rank of the Matrix and their related properties, Echelon form, Normal form, Solving linear system of equations, Eigen values and Eigen vectors, Reduction of Quadratic form to canonical forms. Mean value theorems, Generalized Mean value theorems and Curve tracing. Partial Differentiation, Total Derivatives, Jacobian of functions, Maxima and minima of functions of two variables and three variables, Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration, Evaluation of triple Integrals.

Course Outcomes: After completion of this course, the students will be able to

- C101.1:** Apply matrix techniques to solve system of linear equations.
- C101.2:** Apply the concept of Eigenvalues and Eigenvectors to reduce the Quadratic form to canonical form.
- C101.3:** Examine the Mean value theorems for a single variable function.
- C101.4:** Trace the curve by applying properties of geometry.
- C101.5:** Analyze the given function of several variables for maxima and minima.
- C101.6:** Evaluate the multiple integrals to find areas and volumes for the given regions.

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: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

Unit – II EIGEN VALUES AND EIGEN VECTORS

Linear Transformation and Orthogonal Transformation: Eigenvalues, 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 SINGLE VARIABLE CALCULUS

Limit and Continuous of functions and its properties. 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 (All the theorems without proof).
Curve Tracing: Curve tracing in cartesian coordinates.

Unit – IV MULTIVARIABLE CALCULUS (PARTIAL DIFFERENTIATION AND APPLICATIONS)

Definitions of Limit and continuity. Partial Differentiation: Introduction to 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) – Change of variables for double integrals (Cartesian to polar). Evaluation of Triple Integrals – Change of variables for Triple Integrals (Cartesian to Spherical & cylindrical polar coordinates) - Applications: Areas by double integrals and volumes by Triple integrals.

TEXT BOOKS:

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

REFERENCES:

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, 2006, John Wiley & Sons.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Reprint, 2002, Pearson.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Reprint, 2008, Laxmi Publications.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, 3rd Edition, 2014, S Chand and Company Limited, New Delhi.
5. Gilbert Strang, Introduction to Linear Algebra, 5th Edition, 2019, Wellesley-Cambridge Press.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
PH102BS	ADVANCED ENGINEERING PHYSICS (Common to ECE, EEE and CSE(AI&ML))	3	0	0	3
Pre-Requisites	10+2 Physics				

Course Description: This course covers advanced engineering physics concepts, including crystallography, nanomaterials, and materials characterization. It explores quantum mechanics, quantum computing, and energy band theory, along with magnetic, dielectric, laser, and fibre optics in engineering applications. It connects core physics with modern technologies for research and innovation in advanced materials and quantum systems.

Course Outcomes: After successful completion of the course, students will be able to

- C102.1:** Understand the crystal structures and characterize materials using XRD and SEM techniques.
- C102.2:** Apply quantum mechanics principles to explain particle behaviour and energy band formation in solids.
- C102.3:** Utilize quantum computing concepts to demonstrate the operation of quantum gates and basic quantum algorithms.
- C102.4:** Classify magnetic and dielectric materials and explain their properties, synthesis, and applications.
- C102.5:** Apply laser concepts to practical devices like barcode scanners and LIDAR systems.
- C102.6:** Make use of the principles of fibre optics to analyze applications in communication.

Unit – I Crystallography & Materials Characterization

Introduction: Unit cell, space lattice, basis, lattice parameters; crystal structures, Bravais lattices, packing factor: SC, BCC, FCC; Miller indices, inter-planar distance; defects in crystals (Qualitative): point defects, line defects, surface defects and volume defects. concept of nanomaterials: surface to volume ratio, X -ray diffraction: block diagram, working principle, calculation of average crystallite size using Debye Scherrer's formula, scanning electron microscopy (SEM): block diagram, working principle.

Unit – II Quantum Mechanics

Introduction, de-Broglie hypothesis, Heisenberg uncertainty principle, physical significance of wave function, postulates of quantum mechanics: operators in quantum mechanics, eigen values and eigen functions, expectation value; Schrödinger's time independent wave equation, particle in a 1D box, Bloch's theorem (qualitative), Kronig-Penney model (qualitative): E-k diagram, formation of energy bands, origin of bandgap, classification of solids, concept of discrete energy levels and quantum confinement in nanomaterials.

Unit – III Quantum Computing

Introduction, linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Bloch's sphere, concept of quantum computer, classical bits, Qubits, multiple Qubit system, quantum computing system for information processing, evolution of quantum systems, quantum measurements, entanglement, quantum gates, challenges and advantages of quantum computing over classical computation, quantum algorithms: Deutsch-Jozsa, Shor, Grover.

Unit – IV Magnetic and Dielectric Materials

Introduction to magnetic materials, origin of magnetic moment-classification of magnetic materials, Weiss domain theory of ferromagnetism, hysteresis, soft and hard magnetic materials, synthesis of ferrimagnetic materials using co-precipitation method, applications: magnetic hyperthermia for cancer treatment, magnets for EV.

Introduction to dielectric materials, types of polarization (qualitative): electronics, ionic & orientation; ferroelectric, piezoelectric, pyroelectric materials and their applications: Ferroelectric Random-Access Memory (Fe-RAM) and load cell.

Unit – V Laser and Fibre Optics

Introduction to laser, characteristics of laser, Einstein coefficients and their relations, metastable state, population inversion, pumping, lasing action, Ruby laser, He-Ne laser, CO₂ laser, applications: Bar code scanner, LIDAR for autonomous vehicle.

Introduction to fibre optics, total internal reflection, construction of optical fibre, acceptance angle, numerical aperture, classification of optical fibres, losses in optical fibre, application: optical fibre for communication system.

TEXT BOOKS:

1. Walter Borhardt-Ott, Crystallography: An Introduction, 3rd Edition, 2011, Springer.
2. Charles Kittel, Introduction to Solid State Physics, 8th Edition, 2004, John Wiley & Sons, Inc.
3. Thomas G. Wong, Introduction to Classical and Quantum Computing, 2022, Rooted Grove.
4. B. K. Pandey, S. Chaturvedi, M. Venkanna, Advanced Engineering Physics, 2025, Cengage.

REFERENCE BOOKS:

1. Jozef Gruska, Quantum Computing, 1999, McGraw Hill.
2. Michael A. Nielsen & Isaac L. Chuang, Quantum Computation and Quantum Information, 2010, Cambridge University Press.
3. John M. Senior, Optical Fiber Communications Principles and Practice, 3rd Edition, 2014, Pearson Education Limited.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
CS103ES	PROGRAMMING FOR PROBLEM SOLVING (Common to all)	3	0	0	3

Course Description: This course contains C programming concepts. Discuss control structures, arrays, pointers. Implementing modular programming, file I/O operations.

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

- C103.1:** Understand the elements of the C programming language.
- C103.2:** Implement control structures using the C programming language.
- C103.3:** Develop reusable code using the concept of modular programming.
- C103.4:** Illustrate fundamentals, basic operations on arrays and strings with suitable examples.
- C103.5:** Demonstrate the purpose and usage of user defined data types like structures, unions.
- C103.6:** Explore File handling functions using C.

Unit – I

Overview of C: C Language Elements, Variable Declarations and Data Types, Executable Statements, General Form of a C Program, Operators, Type conversions, Arithmetic Expressions, Formatting Numbers in Program Output.

Selection Structures: Control Structures, Conditions, Conditional operator, if Statement, if Statements with Compound Statements, Nested if Statements and Multiple Alternative Decisions, Switch statement.

Case study on Decision Steps in Algorithms.

Unit – II

Repetition and Loop Statements: Repetition in Programs, Counting Loops and the while Statement, computing a Sum or Product in a Loop, for Statement, Conditional Loops, Loop Design, Nested Loops, do-while Statement.

Top-Down Design with Functions: Building Programs from Existing Information, Library Functions, Case study on Top-Down Design and Structure Charts, Functions without Arguments, Functions with Input Arguments, Storage classes, Macros.

Unit – III

Pointers and Modular Programming: Pointers and the Indirection Operator, Functions with Output Parameters, Multiple Calls to a Function with Input/ Output Parameters, Scope of Names, Formal Output Parameters as Actual Arguments. Dynamic memory allocation.

Arrays: Declaring and Referencing Arrays, Array Subscripts, Using for Loops for Sequential Access, Using Array Elements as Function Arguments, Array Arguments, Searching and Sorting an Array, Parallel Arrays and Enumerated Types, Multidimensional Arrays.

Unit – IV

Strings: String Basics, String Library Functions: Assignment and Substrings.

Longer Strings: Concatenation and Whole-Line Input, String Comparison, Arrays of Pointers. **Recursion:** The Nature of Recursion, Tracing a Recursive Function, Recursive Mathematical

Functions, Recursive Functions with Array and String Parameters.

Unit – V

Structure and Union Types: User-Defined Structure Types, Structure Type Data as Input and Output Parameters, Functions with Structured Result Values, Union Types.

Text and Binary Files: File Operations.

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, 3rd Edition, Cengage Learning.

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2nd Edition, Prentice Hall.
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, Low Price Edition, Pearson Education.
5. Programming in C, Stephen G. Kochan, 4th Edition, Pearson Education.
6. Herbert Schildt, C: The Complete Reference, 4th Edition, McGraw Hill.
7. Byron Gottfried, Schaum's Outline of Programming with C, 2nd Edition, McGraw Hill.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
ME104ES	ENGINEERING DRAWING AND COMPUTER AIDED DRAFTING (Common to ECE, EEE, CSE(AI&ML))	2	2	2	3

Pre-Requisite Nil

Course Description: To acquire computer-aided drafting skill set and to build the ability to visualize various objects through traditional drawing practice in order to communicate concepts and ideas in the design of engineering products.

Course Outcomes: After completion of this course, the students will be able to

- C104.1:** Construct different types of non-circular curves and scales used in engineering applications.
- C104.2:** Demonstrate the principles of orthographic projections for points and lines.
- C104.3:** Apply the projections of planes by conventional mode and the projection of solids with CAD.
- C104.4:** Interpret the interior features of the objects by means of sectional planes.
- C104.5:** Develop the surfaces to fabricate the objects.
- C104.6:** Analyze orthographic and isometric projections using CAD.

UNIT-I Introduction to Engineering Graphics (Conventional)

Principles of Engineering Graphics and their Significance, Geometrical Constructions.

Scales: Plain & Diagonal,

Conic Sections: Conic Sections including the Rectangular Hyperbola – General method only.

Cycloidal Curves: Cycloid, Epicycloids, and Hypocycloid.

UNIT-II Orthographic Projections (Conventional)

Principles of orthographic projections – conventions. Projections of points in all positions.

Projection of straight lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane, and parallel to the other reference plane, inclined to one reference plane, and parallel to the other reference plane. Projections of a Straight Line Inclined to both the reference planes.

UNIT-III Projections of Planes & Solids

Projections of Planes (Conventional): Projections of Plane geometric figures. Surface parallel to one and perpendicular to the other reference plane. Surface perpendicular to both reference planes. Surface inclined to one reference plane and perpendicular to the other reference plane.

Projections of Regular Solids (Conventional and Computer-Aided): Projections of right regular solids (Prism, Pyramid, Cylinder, and Cone) in simple position and axis inclined to one reference plane. Computer-aided projections of solids.

UNIT-IV Sections of Solids & Development of Surfaces

Sections of Solids (Conventional and Computer-Aided): Sectional views and the true shape of sections of solids. Solid positions considered: Axis perpendicular to HP and parallel to VP; Axis perpendicular to VP and parallel to HP. Sectional planes: Horizontal, vertical, and inclined sectional planes. Computer-aided projections of sectional views.

Development of Surfaces of Right Regular Solids (Conventional): Prism, Pyramid,

Cylinder, and Cone.

UNIT-V Isometric Projections (Conventional and Computer-Aided)

Principles of Isometric Projection, Isometric Scale, Isometric Views, Conventions, Conversion of Isometric views to Orthographic views. Conversion of Orthographic views to Isometric views (for simple planes, solids, and compound solids)

TEXT BOOKS:

1. Bhatt, N. D., V. M. Panchal, and Pramod R. Ingle, Engineering Drawing, 53rd Edition, 2016, Charotar Publishing House Pvt. Limited.
2. Agrawal, Basant, and C. M. Agrawal, Engineering Drawing, 3rd Edition, 2020, Tata McGraw Hill Education (India).
3. Venugopal, K., Sreekanjana, G, Engineering Drawing, 2nd Edition, 2011, New Age International.
4. Jeyapoovan, T., Engineering drawing & Graphics Using AutoCAD, 3rd Edition, 2010, Vikas Publishing House.

REFERENCE BOOKS:

1. Bethune, James D., Engineering Graphics with Auto CAD, 2nd Edition, 2020, Pearson Education, Inc.
2. Parthasarathy, N. S and Vela Murali, Engineering drawing, 1st Edition, 2015, Oxford University Press.
3. Balaveera Reddy, K., Computer Aided Engineering Drawing, 2nd Edition, 2015, CBS Pvt.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
EN105HS	ENGLISH FOR SKILL ENHANCEMENT (Common to CSE, ECE, EEE)	3	0	0	3

Pre - Requisite Intermediate English

Course Description: English for Skill Enhancement aligns with the objectives of the National Education Policy (NEP) 2020 by fostering linguistic competence, communication skills, and value-based learning. The course emphasizes the use of English for academic, professional, and social communication through the development of Listening, Speaking, Reading, and Writing (LSRW) skills. It builds on learners' existing knowledge of grammar, vocabulary, and comprehension to promote clarity and precision in expression. The course aims to prepare students for lifelong learning and effective communication in diverse contexts.

Course Outcomes: After completion of this course, the students will be able to

C105.1: Choose appropriate vocabulary in their oral and written communication.

C105.2: Demonstrate their understanding of the rules of functional grammar and sentence structures.

C105.3: Develop comprehension skills from known and unknown passages.

C105.4: Compose paragraphs, essays, précis and draft letters.

C105.5: Write abstracts and reports in various contexts.

C105.6: Develop key competencies to hone the humane traits.

Unit – I Theme: Perspectives

Lesson on ‘The Generation Gap’ by Benjamin M. Spock from the prescribed textbook titled English for the Young in the Digital World published by Orient Black Swan Pvt. Ltd.

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

Grammar: Identifying Common Errors in Writing with Reference to Parts of Speech particularly Articles and Prepositions – Degrees of Comparison

Reading: Reading and Its Importance- Sub Skills of Reading – Skimming and Scanning.

Writing: Sentence Structures and Types -Use of Phrases and Clauses in Sentences-Importance of Proper Punctuation- Techniques for Writing Precisely –Nature and Style of Formal Writing.

Unit – II Theme: Digital Transformation

Lesson on ‘Emerging Technologies’ from the prescribed textbook titled English for the Young in the Digital World published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Homophones, Homonyms and Homographs.

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

Reading: Reading Strategies-Guessing Meaning from Context – Identifying Main Ideas – Exercises for Practice

Writing: Paragraph Writing – Types, Structures and Features of a Paragraph – Creating Coherence – Linkers and Connectives - Organizing Principles in a Paragraph –Defining- Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence - Essay Writing - Writing Introduction and Conclusion.

Unit – III Theme: Attitude and Gratitude

Poems on ‘Leisure’ by William Henry Davies and ‘Be Thankful’ – Unknown Author from the prescribed textbook titled English for the Young in the Digital World published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Words Often Confused - 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 – Identifying Topic Sentence and Providing Supporting Ideas –Exercises for Practice.

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

Unit – IV Theme: Entrepreneurship

Lesson on ‘Why a Start-Up Needs to Find its Customers First’ by Pranav Jain from the prescribed textbook titled English for the Young in the Digital World published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Standard Abbreviations in English – Inferring Meanings of Words through Context – Phrasal Verbs – Idioms.

Grammar: Redundancies and Clichés in Written Communication – Converting Passive to Active Voice and Vice-Versa.

Reading: Prompt Engineering Techniques– Comprehending and Generating Appropriate Prompts - Exercises for Practice

Writing: Writing Practices- Note Making-Précis Writing.

Unit – V Theme: Integrity and Professionalism

Lesson on ‘Professional Ethics’ from the prescribed textbook titled English for the Young in the Digital World published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Technical Vocabulary and their Usage– One Word Substitutes – Collocations.

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

Reading: Survey, Question, Read, Recite and Review (SQ3R Method) – Inferring the Meaning and Evaluating a Text- Exercises for Practice

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

TEXT BOOKS:

1. Board of Editors, English for the Young in the Digital World, 2025, Orient Black Swan Pvt. Ltd.

REFERENCE BOOKS:

1. Swan, Michael, Practical English Usage, 2016, Oxford University Press, Oxford.
2. Karal, Rajeevan, English Grammar Just for You, 2023, Oxford University Press, New Delhi.
3. Cengage India, Empowering with Language: Communicative English for Undergraduates, 2024, Cengage Learning India Pvt. Ltd., New Delhi.
4. Sanjay Kumar & Pushp Lata, Communication Skills – A Workbook, 2022, Oxford University Press, New Delhi
5. Wood, F.T, Remedial English Grammar, 2007, Macmillan.
6. Vishwamohan, Aysha, English for Technical Communication for Engineering Students, 2013, Mc Graw-Hill Education India Pvt. Ltd.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
PH106BS	ADVANCED ENGINEERING PHYSICS LAB (Common to ECE, EEE and CSE(AI&ML))	0	0	2	1

Pre-Requisites : 10+2 Physics

Course Description: This lab course offers hands-on training in advanced physics experiments on nanomaterials, semiconductors, magnetism, and optics. Students synthesize nanomaterials, study semiconductor and magnetic properties, and explore laser and fibre optic characteristics. It enhances experimental, analytical, and problem-solving skills essential for research, materials characterization, and modern technological applications.

Course Outcomes: After successful completion of the course, students will be able to

C106.1: Synthesize and analyze nanomaterials using chemical methods.

C106.2: Determine key electrical, magnetic, and optical properties of semiconductors and other functional materials.

C106.3: Characterize semiconductors using Hall effect and energy gap measurement techniques.

C106.4: Demonstrate working knowledge of photoelectric effect, laser systems and optical fiber parameters through experimental study.

LIST OF EXPERIMENTS

1. Synthesis of nanomaterial using co-precipitation method.
2. Determination of energy gap of a semiconductor.
3. Determination of Hall coefficient and carrier concentration of a given semiconductor.
4. Determination of magnetic moment of a bar magnet and horizontal earth magnetic field.
5. Study of B-H curve of a ferro magnetic material.
6. Determination of the work function of metal and Planck's constant using the photoelectric effect.
7. Determination of dielectric constant of a given material.
8. Determination of Curie's temperature of a given ferroelectric material.
9. a) Determination of wavelength of a laser using diffraction grating.
b) Study of V-I & L-I characteristics of a given laser diode.
10. a) Determination of numerical aperture of a given optical fibre.
b) Determination of bending losses of a given optical fibre.

Reference Book:

1. S. Balasubramanian & M.N. Srinivasan, A Text book of Practical Physics, 2017, S Chand.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
CS107ES	PROGRAMMING FOR PROBLEM SOLVING LAB (Common to all)	0	0	2	1

Course Description: This Course introduces applying various C programming concepts. Develop reusable code using modular programming. Explore various predefined functions on strings. Handling file operations.

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

- C107.1:** Build programs using control structures to solve simple mathematical problems.
- C107.2:** Handle arrays and strings with pointers for efficient memory usage and faster operations.
- C107.3:** Utilize modular programming techniques to improve program readability and maintainability.
- C107.4:** Implement programs involving file handling operations for effective data processing.

LIST OF PROGRAMS**CYCLE 1:****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 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:
 - 5 x 1 = 5
 - 5 x 2 = 10
 - 5 x 3 = 15
- d) Write a program that shows the binary equivalent of a given positive number between 0 to 255.

Expression Evaluation:

- a) 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).
- b) Write a program that finds if a given number is a prime number.
- c) Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.
- d) 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.
- e) Write a C Program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

f) Write a C program to find the roots of the Quadratic equation.

Arrays, Pointers and Functions:

a) Write a C program to find the minimum, maximum and average in an array of integers.

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

i. Addition of Two Matrices

ii. Multiplication of Two Matrices

c) Write a program for reading elements using a pointer into an array and display the values using the array.

d) Write a program for display values reverse order from an array using a pointer.

CYCLE 2:

Recursion:

Write C programs that use both recursive and non-recursive functions.

i) To find the factorial of a given integer

ii) To GCD (greatest common divisor) of two given integers

iii) To generate Fibonacci series

Arrays (Contd.)

e) Write a C program that uses recursive and non-recursive functions to search for a Key value in a given list of integers using linear search method.

f) Write a C program that uses recursive and non-recursive function sorts the given array of integers using selection sort in descending order

Strings:

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

i. To insert a sub-string into a given main string from a given position.

ii. To delete n Characters from a given position in a given string.

b) 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.)

c) Write a C program that displays the position of a character ch in the string S or – 1 if S doesn't contain ch.

d) Write a C program to count the lines, words and characters in a given text.

Files:

a) Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.

b) 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).

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, 3rd Edition, Cengage Learning.

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2nd Edition, Prentice Hall.
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, Low Price Edition, Pearson Education.
5. Programming in C, Stephen G. Kochan, 4th Edition, Pearson Education.
6. Herbert Schildt, C: The Complete Reference, 4th Edition, McGraw Hill.
7. Byron Gottfried, Schaum's Outline of Programming with C, 2nd Edition, McGraw Hill.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
EN108HS	ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB (Common to CSE, ECE, EEE)	0	0	2	1

Pre - Requisite Intermediate English

Course Description: The English Language and Communication Skills (ELCS) Lab focuses on listening and speaking skills, particularly 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 Outcomes: After completion of this course, the students will be able to

C108.1: Listen and interpret important information from spoken text and speeches.

C108.2: Use neutralized accent for intelligibility

C108.3: Speak fluently with clarity and confidence in professional and social spaces.

C108.4: Write appropriately and creatively for the given prompt.

Listening Skills**Objectives**

1. To enable students develop their active listening skills
2. To equip students with necessary training in listening, so that they can comprehend the speech of people from different linguistic backgrounds

Speaking Skills**Objectives**

1. To improve their pronunciation and neutralize accent
2. To enable students express themselves fluently and appropriately
3. To practice speaking in social and professional contexts

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

- a. Computer Assisted Language Learning (CALL) Lab which focusses on listening skills**
- b. Interactive Communication Skills (ICS) Lab which focusses on speaking skills**

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

Exercise-1**CALL Lab:**

Instruction: Speech Sounds-Listening Skill - Importance – Purpose - Types- Barriers- Active Listening Practice: Listening to Distinguish Speech Sounds (Minimal Pairs) - Testing Exercises

ICS Lab:**❖ Diagnostic Test – Activity titled ‘Express Your View’**

Instruction: Spoken and Written language - Formal and Informal English - Greetings - Introducing Oneself and Others

Practice: Any Ice-Breaking Activity and creating LinkedIn Profile

Exercise II**CALL Lab:**

Instruction: Listening vs. Hearing - Barriers to Listening

Practice: Listening for General Information - Multiple Choice Questions - Listening Comprehension Exercises (It is essential to identify a suitable passage with exercises for practice.)

ICS Lab:

Instruction: Features of Good Conversation – Strategies for Effective Communication-Chat Etiquette

Practice: Role Play Activity - Situational Dialogues –Expressions used in Various Situations – Making Requests and Seeking Permissions – Taking Leave - Telephone Etiquette

Exercise-III**CALL Lab:**

Instruction: Errors in Pronunciation – Tips for Neutralizing Mother Tongue Influence (MTI)

Practice: Differences between British and American Pronunciation –Listening Comprehension Exercises

ICS Lab:

Instruction: Picture Description

Practice: Looking at a Picture and Describing Objects, Situations, Places, People and Events (A wide range of Materials / Handouts are to be made available in the lab.)

Exercise-IV**CALL Lab:**

Instruction: Techniques for Effective Listening

Practice: Listening for Specific Details - Listening - Gap Fill Exercises - Listening Comprehension Exercises (It is essential to identify a suitable passage with exercises for practice.)

ICS Lab:

Instruction: How to Tell a Good Story - Story Star- Sequencing-Creativity

Practice: Activity on Telling and Retelling Stories – Collage.

Exercise-V**CALL Lab:**

Instruction: Identifying the literal and implied meaning

Practice: Listening for Evaluation - Write the Summary –Listening Comprehension Exercises

(It is essential to identify a suitable passage with exercises for practice.)

ICS Lab:

Instruction: Understanding Non-Verbal Communication

Practice: Silent Speech - Dumb Charades Activity

❖ **Post-Assessment Test on ‘Express Your View’**

REFERENCE BOOKS:

1. Shobha, KN & Rayen, J. Lourdes, Communicative English – A workbook, 2019, Cambridge University Press.
2. Board of Editors, ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities, 2016, Orient BlackSwan Pvt. Ltd.
3. Mishra, Veerendra et al., English Language Skills: A Practical Approach, 2020, Cambridge University Press.
4. Cengage, English Language Communication Skills – Lab Manual cum Workbook, 2022, Cengage Learning India Pvt. Ltd.
5. Ur, Penny and Wright, Andrew, Five Minute Activities – A Resource Book for Language Teachers, 2022 Cambridge University Press.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
MA201BS	ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS	3	0	0	3

(Common to all)**Pre - Requisite** Intermediate Mathematics

Course Description: The course contains various topics related to Exact differential equations, Orthogonal trajectories, Newton's law of cooling, Natural growth and decay. Second order linear differential equations with constant coefficients and their models. Laplace Transforms and their application. Vector point functions and scalar point functions, Vector Differentiation, Vector Integral theorems and their applications.

Course Outcomes: After completion of this course, the students will be able to

- C201.1:** Apply first-order and first-degree differential equations in solving real-time and Engineering problems.
- C201.2:** Solve higher-order linear differential equations with constant coefficients using appropriate techniques.
- C201.3:** Utilize Laplace transforms and inverse Laplace transforms to solve initial value problems in engineering applications.
- C201.4:** Analyze the vector fields with respect to the vector differentiation.
- C201.5:** Solve the line, surface and volume integrals.
- C201.6:** Analyze the relation between the vector integral theorems.

Unit – I FIRST ORDER AND FIRST-DEGREE ORDINARY DIFFERENTIAL EQUATIONS

Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's linear equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling-Law of natural growth and decay – Applications to Electrical Circuits: LR Circuit.

Unit – II ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER

Higher order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax} , $\sin ax$, $\cos ax$, polynomials in x , $e^{ax}(x)$ and $xV(x)$ - Method of variation of parameters. Applications to Electrical Circuits: LCR Circuits

Unit– III LAPLACE TRANSFORMS

Laplace Transforms: Laplace Transform of standard functions – First shifting theorem – Laplace transforms of functions multiplied by 't' 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 – 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, 36th Edition, 2010, Khanna Publishers.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, 5th Edition, 2016, Narosa Publications.

REFERENCE BOOKS:

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, 2006, John Wiley & Sons.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Reprint, 2002, Pearson.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Reprint, 2008, Laxmi Publications.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, 3rd Edition, 2014, S Chand and Company Limited, New Delhi.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
CH202BS	ENGINEERING CHEMISTRY (Common to ECE, EEE, CSE(AI&ML))	3	0	0	3
Pre - Requisite	Intermediate Chemistry				

Course Description: Engineering Chemistry is a fundamental course designed to provide students with a solid foundation in the principles and applications of chemistry relevant to engineering disciplines. The course aims to equip students with the knowledge and skills necessary to understand the chemical properties of materials, analyse chemical reactions, and apply chemical concepts in engineering practice.

Course Outcomes: After completion of this course, the students will be able to

- C202.1:** Understand the basic properties of waters and their applications in both domestic and industrial purpose.
- C202.2:** Acquire the fundamental knowledge of electrochemistry and relate the electrochemical reactions for corrosion and its control.
- C202.3:** Analyse the synthesis, working mechanisms, and significance of batteries and electronic materials, exploring their applications in various fields.
- C202.4:** Illustrate the concepts, properties of advanced engineering polymers, functional materials and their applications in various industries.
- C202.5:** Propose and interpret solutions for the challenges related to green and sustainable technologies.
- C202.6:** Comprehend and apply the working principles of spectroscopy in analyzing pollutants in dye industries and biomedical field.

Unit – I Water and its Treatment

Introduction- Hardness, types, degree of hardness and units. Estimation of hardness of water by complexometric method - Numerical problems. Potable water and its specifications (WHO) - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and break-point chlorination. Defluoridation - Nalgonda technique. **Boiler troubles:** Scales, Sludges 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 brackish water – Reverse osmosis.

Unit – II Electrochemistry and Corrosion

Introduction- Electrode potential, standard electrode potential, Nernst equation (no derivation), electrochemical cell - Galvanic cell, cell representation, EMF of cell - Numerical problems. Types of electrodes, reference electrodes - Primary reference electrode - Standard Hydrogen Electrode (SHE), Secondary reference electrode - Calomel electrode. Construction, working and determination of pH of unknown solution using SHE and Calomel electrode.

Corrosion: Introduction- Definition, causes and effects of corrosion – Theories of corrosion, chemical and electrochemical theories of corrosion, Types of corrosion: galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion - Nature of the metal, Nature of the corroding environment. Corrosion control methods - Cathodic protection Methods - Sacrificial anode and impressed current methods.

Unit– III Energy storage and Electronic Materials

Batteries: Introduction – Classification of batteries - Primary, secondary and reserve batteries with examples. Construction, working and applications of Zn-air and Lithium-ion battery. Fuel Cells – Differences between a battery and a fuel cell, Construction and applications of Direct Methanol Fuel Cell (DMFC).

RFID and IONT materials: Synthesis, properties and applications in logistic information, intelligent packaging systems (Graphene oxide, carbon nanotubes (CNTs) and polyaniline).

Sensors: Introduction-Definition, Basic principle, and components, Classification of sensors, Examples – Piezoelectric - quartz, electrochemical- Gas sensor, and Biosensor - Amperometric Glucose monitor and their engineering applications

Unit – IV Functional Materials and Green Chemistry

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

Biodegradable polymers: Synthesis, Properties and applications of Polylactic acid

Smart materials: Introduction, Classification with examples - Shape Memory Alloys – Nitinol

Green Chemistry: Introduction, 12 principles with real life examples, validation of greenness.

E-waste: Hazards and toxicity, segregation and recycling (Hydrometallurgy, pyrometallurgy and direct recycling). Extraction of valuable metals from E-waste. Battery waste management and recycling, circular economy – case studies.

Unit – V Principles of Spectroscopy and Analysis

Basic Principles and selection rules of UV-Visible, IR spectroscopy, Raman spectroscopy, **Interpretative spectroscopic applications:** UV-Visible spectroscopy for Analysis of pollutants in dye industry, IR spectroscopy in night vision-security, Pollution Under Control-CO sensor (Passive Infrared detection), Raman spectroscopy (application) - Tumour detection in medical applications.

TEXT BOOKS:

1. P.C. Jain and M. Jain, Engineering Chemistry, 16th Edition, 2010, Dhanpatrai Publishing Company.
2. Shashi Chawla, A textbook of Engineering Chemistry, 3rd Edition, 2011, Dhanpatrai and Company (P) Ltd. Delhi.
3. Shikha Agarwal, Engineering Chemistry-Fundamentals and Applications, 2nd Edition, 2015, Cambridge University Press, Delhi.
4. B. Rama Devi, P. Aparna, Prasanta Rath, Engineering Chemistry, 1st Edition, 2025, Cengage learning.

REFERENCE BOOKS:

1. Thirumala Chary Laxminarayana & Shashikala, Engineering Chemistry, 2020, Pearson Publications
2. Donald J. Leo, Engineering Analysis of Smart Material Systems, 2007, Wiley.
3. Singh, Paramvir, Avinash Kumar Agarwal, Anupma Thakur, and Ravindra Kumar Sinha, eds. Challenges and Opportunities in Green Hydrogen Production, 2024, Springer.
4. Chander Prakash, Sunpreet Singh, J. Paulo Davim, Functional and smart materials, 2020, CRC Press.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
EC203ES	ANALOG ELECTRONICS	3	0	0	3

Course Description: This course provides in-depth knowledge on diodes, BJTs and FETs their switching characteristics, Applications, analysis of transistors. To understand of various types of feedback amplifier circuits and some special function ICs.

Course Outcomes: After completion of this course, the students will be able to

C203.1: Illustrate the characteristics of PN junction diode and its applications

C203.2: Analyze the construction, characteristics and small signal model of BJT and FET.

C203.3: Analyze the amplifier configurations of BJT and FET.

C203.4: Examine the characteristics of different feedback amplifiers

C203.5: Describe the operation of various sinusoidal oscillator circuits.

C203.6: Design simple analog circuits using Op-Amp.

Unit – I Diode and its applications

P-N junction diode, I-V characteristics of a diode, half-wave and full-wave rectifiers, clamping and clipping circuits.

Unit – II Bipolar Junction Transistor

Transistor Structure, Input output characteristics of BJT, CB, CE and CC configurations, biasing circuits.

Transistor as a small signal amplifiers, CE and CB amplifier analysis using h-parameters.

Unit – III FET Circuits

FET Structure and V-I 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 – IV Feedback Amplifiers & Oscillators

Feedback Amplifiers: Concepts of feedback, Classification of feedback amplifiers, General characteristics of Negative feedback amplifiers and different topologies.

Oscillators: Condition for Oscillations, RC phase shift Oscillators, Wien-bridge Oscillators, Hartley and Colpitts Oscillators, crystal oscillator.

Unit – V Operational Amplifiers

Ideal op-amp, Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product, Adder and Subtractor, Inverting and non-inverting amplifier, Differentiator, Integrator, Square-wave and triangular- wave generators.

TEXT BOOKS:

1. Jacob Millman, Christos C Halkias, Integrated Electronics, 2nd Edition, 2010, McGraw Hill Education.
2. Boylestad, Robert L and Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, 2013, Pearson.
3. Ramakanth A. Gayakwad, Op-Amps & Linear ICs, 4th Edition, 2003, PHI.

REFERENCE BOOKS:

1. Thomas L. Floyd, Electronic Devices Conventional current version, 9th Edition, 2015, Pearson.
2. J. Millman and Arvin Grabel, Microelectronics, 1st Editon, 1988, McGraw Hill Education.
3. P. Horowitz and Winfield Hill, The Art of Electronics, 1st Edition, 1989, Cambridge University Press.
4. P. R. Gray, R. G. Meyer and S. Lewis, Analysis and Design of Analog Integrated Circuits, 5th Edition, 2009, Wiley.
5. Sedra Adel S and Kenneth C. Smith., Microelectronic Circuits, 7th Edition, 2014, Oxford University Press.
6. D. Roy Chowdhury, Linear Integrated Circuits ,2nd Edition, 2003, New Age International (P) Ltd.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
CS204ES	PYTHON PROGRAMMING (Common to ECE & EEE)	3	0	0	3

Course Description: This course introduces Python programming with fundamental concepts such as syntax, variables, operators, input/output, and control structures, and then progresses to data structures, including strings, lists, tuples, sets, and dictionaries for efficient data handling. Building on these foundations, it covers functions, modules, and packages, with practical applications on Raspberry Pi to enhance problem-solving skills. The course further addresses file handling, exception handling, and regular expressions are also introduced to create real-world applications.

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

- C204.1:** Understand Python programs using variables, operators, expressions, and control structures.
- C204.2:** Demonstrate the use of built-in data structures such as lists, tuples, sets, and dictionaries.
- C204.3:** Apply modular and reusable principles for designing Python programs.
- C204.4:** Analyze problems using file handling and Python libraries.
- C204.5:** Make use of custom exceptions to provide specific error information for different scenarios.
- C204.6:** Apply Python programming concepts and interface peripherals on a Raspberry Pi.

Unit – I Introduction to Python and Basics of Programming

Introduction to Python: Features, Applications, Installation, IDEs, Python Syntax, Indentation, Comments, Variables, Data Types, Type Casting, Operators: Arithmetic, Relational, Logical, Assignment, Membership, Identity, Bitwise, Input/Output functions (input(), print()), Control Structures: if, if-else, if-elif-else, Nested Conditions, Looping: for, while, Nested Loops, break, continue, pass.

Unit – II Data Structures in Python

Strings: Creation, Indexing, Slicing, Methods, String Formatting

Lists: Creation, Indexing, Slicing, List Comprehension, Methods

Tuples: Properties, Indexing, Methods, Sets: Creation, Operations, Methods

Dictionaries: Creation, Access, Methods, Dictionary Comprehension, Iterating over data structures.

Unit – III Functions

Functions: Defining, Calling, Parameters, Return Values, Types of Arguments: Positional, Keyword, Default, Variable Length, Scope of Variables: Local and Global, Lambda Functions, Map, Filter, Reduce, Recursion in Python

Unit – IV Modules and File Handling

Modules: Importing, Creating User-defined Modules, Standard Modules (math, random, datetime), Packages in Python.

Unit – V Exception Handling & Raspberry PI Programming

Exception Handling: try, except, else, finally, Built-in Exceptions, Raising Exceptions, Introduction to Regular Expressions (re module).

Introduction to Raspberry PI: Programming Raspberry PI with Python, Interfacing Raspberry Pi with basic peripherals.

TEXT BOOKS:

1. Reema Thareja, Python Programming – Using Problem Solving Approach, 1st Edition, Oxford University Press.
2. Eric Matthes, Python Crash Course, 2nd Edition, 2019, No Starch Press.
3. Mark Lutz, Learning Python, 4th Edition, O'Reilly.

REFERENCE BOOKS:

1. Gowrishankar S., Veena A, Introduction to Python Programming, 1st Edition, CRC Press.
2. David Beazley, Brian K. Jones, Python Cookbook, 3rd Edition, O'Reilly.
3. Luciano Ramalho, Fluent Python, 2nd Edition, O'Reilly.
4. AL Sweigart, Automate the Boring Stuff with Python, 2015, No Starch Press.
5. Arsheep Bahga, Vijay Madisetti, Internet of Things - A Hands-On Approach, 1st Edition, 2015, Orient Blackswan Private Limited.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
EE205ES	ELECTRICAL CIRCUITS - II	3	0	0	3

Prerequisites: Matrices and Calculus, Electrical Circuits - I

Course Description: This course offers an in-depth study of electrical circuit analysis, covering network topology, coupled circuits, and magnetic coupling. It introduces two-port network parameters and their practical applications. Students learn filter design principles, including constant-k and M-derived types, and analyze transient responses of RL, RC, and RLC circuits using classical and Laplace methods. The course builds strong analytical and problem-solving skills for advanced electrical engineering studies.

Course Outcomes: After completion of this course, the students will be able to

- C205.1:** Formulate various types of network matrices using graph theory.
- C205.2:** Analyze Magnetic circuits and form Dual Networks.
- C205.3:** Evaluate two-port network parameters and effect of their inter connections.
- C205.4:** Analyze the aspects to various types of passive filters.
- C205.5:** Analyze transient response of electrical networks using classical approach.
- C205.6:** Analyze transient response of the electrical networks using Laplace transforms.

Unit – I Network Topology and Coupled Circuits**Network Topology:**

Graph, tree, chord, Tie-set, cut-set, incident matrices, Problems on Tie-set and cut-set matrices.

Magnetic Coupled circuits and Duality:

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

Concept of Duality and Dual Networks

Unit – II Two Port Network Parameters

Open circuit impedance, short-circuit admittance, Hybrid, Transmission parameters & inter-relationships, Series, parallel and cascade connection of two port networks.

Unit -III Filters

Classification of filters – Low pass, High pass, Band pass and Band Elimination, Elementary treatment of Constant-k and m-derived filters-Low pass and High pass Filters.

Unit – IV Transient Analysis

Significance of Initial conditions of R, L and C elements

Transient response of series RL, RC and RLC circuits using integro-differential approach for DC and Sinusoidal excitations.

Transient response of parallel RL, RC and RLC circuits using integro-differential approach for DC and Sinusoidal excitations.

Unit – V Electrical Circuit Analysis Using Laplace Transforms

The Laplace transformed circuits.

Transient response of series RL, RC and RLC circuits using Laplace Transforms approach for Step, DC and Sinusoidal excitations.

Transient response of parallel RL, RC and RLC circuits using Laplace Transforms approach for Step, DC and Sinusoidal excitations.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
CH206BS	ENGINEERING CHEMISTRY LAB (Common to ECE, EEE, CSE(AI&ML))	-	-	2	1

Pre - Requisite **Intermediate Chemistry**

Course Description: The Engineering Chemistry Laboratory is a practical course designed to provide students with hands-on experience in conducting chemical experiments relevant to engineering applications. This laboratory-based course aims to reinforce the theoretical concepts learned in the engineering chemistry lecture course and develop students' practical skills in chemical analysis, synthesis, and material testing.

Course Outcomes: After completion of this course, the students will be able to

- C206.1:** To develop practical skills through hands-on chemistry experiments relevant to engineering.
- C206.2:** To analyze parameters related to water and the rate of corrosion of mild steel.
- C206.3:** To understand the working principle in the determination of concentrations or absorbance using different instrumentation techniques.
- C206.4:** To apply the principle of polymerization procedures in the synthesis of polymers.

LIST OF EXPERIMENTS**I. Water analysis:**

1. Estimation of Hardness of water by EDTA Complexometry method.
2. Determination of optimum dose of coagulants in water purification process.

II. Conductometry:

1. Estimation of the concentration of strong acid by Conductometry.
2. Estimation of the concentration of strong and weak acid in an acid mixture by Conductometry.

III. Potentiometry:

1. Estimation of concentration of Fe^{+2} ion by Potentiometry using KMnO_4 .
2. Estimation of concentration of strong acid with strong base by Potentiometry using quinhydrone.

IV. Colorimetry: Verification of Lambert-Beer's law using KMnO_4 .**V. Preparations:**

1. Preparation of Bakelite.
2. Preparation of starch-based biopolymers.

VI. Corrosion: Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.**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.

TEXT BOOKS:

1. B. Ramadevi, P. Aparna, Laboratory Manual in Engineering Chemistry, Special Edition, 2022, S. Chand Publishing
2. Vogel, Arthur I, A text book of practical organic chemistry, 5th edition, 1989, Pearson India.
3. S. S. Dhara, A Textbook on Experiments and Calculations in Engineering Chemistry, 9th Edition, 2015, S. Chand.
4. K. Mukkanti, Practical Engineering Chemistry, 1st Edition, 2009, BS Publications.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
ME207ES	ENGINEERING WORKSHOP (Common to ECE, EEE, CSE(AI&ML))	0	0	2	1

Course Description: Course Description: Engineering workshop demonstrates about how different working tools, machinery and equipment are operated, applied and used. Acquire the essential knowledge necessary to manufacture a variety of engineering products. To provide students with hands on practice using a variety of engineering materials, tools, equipment and processes that is widely utilized in the engineering field. To encourage optimism, cooperation, accuracy and safety at work. To gain knowledge of various hand-powered tools, their uses and how they function.

Course Outcomes: After completion of this course, the students will be able to

- C207.1:** Identify and distinguish basic manufacturing processes such as carpentry, fitting, and welding.
- C207.2:** Develop household and engineering components using metallic sheets through tin smithy practices.
- C207.3:** Apply fundamental electrical engineering concepts in house wiring, including the installation of switches and tube lights.
- C207.4:** Construct sand moulds using single and split patterns with foundry tools for casting applications.

1. Trades for Exercises

At least two exercises should be performed from each trade.

Cycle 1:

1. Carpentry – T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint
2. Fitting – V-Fit, L-Fit, Square Fit
3. Tin Smithy – Rectangular Tray, Conical Funnel, Open Scoop.

Cycle 2:

4. Foundry – Preparation of Green Sand Mould using Single Piece and Split Pattern
5. House Wiring – Parallel & Series Connections, Two-way Switch, Tube Light Connection
6. Welding Practice- Arc Welding and Gas Welding.

2. Trades for Demonstration & Exposure

The following trades will be demonstrated to provide students with practical insights into industrial applications and tools:

- Plumbing, Machine Shop, Metal Cutting, Power Tools in Construction, Wood working, Blacksmithy.

Text books:

- 1) Juneja, B. L., Workshop Practice, 1st Edition, 2015, Cengage Learning India.
- 2) Reddy, K. Venkata, Workshop Practice Manual, 6th Edition, Reprint 2025, BS Publications.

Reference books:

- 1) Kannaiah, P., and K. L. Narayana, Workshop Manual, 2nd Edition, 2009, Scitech Publications.
- 2) Venugopal, K., Workshop Manual, 2012, Anuradha Publications.

2. Ravish R Singh, Network Analysis and Synthesis, 2nd Edition, 2019, McGraw Hill.

REFERENCE BOOKS:

1. William Hayt H, Kimmerly Jack E. and Steven Durbin M, Engineering Circuit Analysis, 6th Edition, 2002, McGraw Hill.
2. Jagan N.C and Lakshminarayana C, Network Analysis, 3rd Edition, 2014, B.S. Publications.
3. Chakravarthy A., Circuit Theory, 1st Edition, 1999, Dhanpat Rai & Co.
4. James W Nilsson and Susan A. Riedel, Electric Circuits, 11th Edition, 2020, Pearson.
5. A Sudhakar and Shyammohan S Palli, Circuits and Networks: Analysis and Synthesis, 5th Edition, 2017, McGraw Hill.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
CS209ES	APPLIED PYTHON PROGRAMMING LAB (Common to ECE & EEE)	0	0	2	1

Course Description: This course covers installation procedure of python, packages and implementation of different control structures. This course also focuses on installation of OS on Raspberry Pi, importing packages and usage of GPIO pins for collecting sensor data.

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

C209.1: Build basic programs using fundamental programming constructs.

C209.2: Develop reusable code using standard library functions.

C209.3: Use different packages for processing data from files and plotting graphs.

C209.4: Implement applications on hardware boards using Python.

LIST OF PROGRAMS

Cycle 1:

1. Downloading and Installing Python and Modules
 - a. Python 3 on Linux
Follow the instructions given in the URL <https://docs.python-guide.org/starting/install3/linux/>
 - b. Python 3 on Windows
Follow the instructions given in the URL <https://docs.python.org/3/using/windows.html>
(Please remember that Windows installation of Python is harder!)
 - c. pip3 on Windows and Linux
Install the Python package installer by following the instructions given in the URL <https://www.activestate.com/resources/quick-reads/how-to-install-and-use-pip3/>
 - d. Installing numpy and scipy
You can install any python3 package using the command `pip3 install <packagename>`
 - e. Installing jupyterlab
Install from pip using the command `pip install jupyterlab`
2. Introduction to Python3
 - a. Printing your biodata on the screen
 - b. Printing all the primes less than a given number
 - c. Finding all the factors of a number and show whether it is a perfect number, i.e., the sum of all its factors (excluding the number itself) is equal to the number itself.
3. Defining and Using Functions
 - a. Write a function to read data from a file and display it on the screen.
 - b. Define a boolean function *is palindrome* (<input>).

- c. Write a function $collatz(x)$ which does the following: if x is odd, $x = 3x + 1$; if x is even, then $x = x/2$. Return the number of steps it takes for $x = 1$.
 - d. Write a function $N(m, s) = \exp(-(x-m)^2/(2s^2))/\sqrt{2\pi}s$ that computes the Normal distribution.
4. The package numpy
 - a. Creating a matrix of given order $m \times n$ containing random numbers in the range 1 to 99999.
 - b. Write a program that adds, subtracts and multiplies two matrices. Provide an interface such that, based on the prompt, the function (addition, subtraction, multiplication) should be performed.
 - c. Write a program to solve a system of n linear equations in n variables using matrix inverse.
 5. The package scipy and pyplot
 - a. Finding if two sets of data have the same *mean* value.
 - b. Plotting data read from a file.
 - c. Fitting a function through a set of data points using *polyfit* function.
 - d. Plotting a histogram of a given data set.
 6. The strings package
 - a. Read text from a file and print the number of lines, words and characters.
 - b. Read text from a file and return a list of all n letter words beginning with a vowel.
 - c. Finding a secret message hidden in a paragraph of text.
 - d. Plot a histogram of words according to their length from text read from a file.

Cycle 2:

7. Installing OS on Raspberry Pi
 - a. Installation using Pi Imager
 - b. Installation using image file
 - i. Downloading an Image.
 - ii. Writing the image to an SD card
 - iii. Using Linux.
 - iv. Using Windows.
 - v. Booting up.
8. Accessing GPIO pins using Python
 - a. Installing GPIO Zero library.
 - I. First, update your repositories list.
 - II. `sudo apt update`.
 - III. Then install the package for Python 3.
 - IV. `sudo apt install python3-gpiozero`.
 - b. Blinking an LED connected to one of the GPIO pin.
 - c. Adjusting the brightness of an LED.
 - d. Adjust the brightness of an LED (0 to 100, where 100 means maximum brightness) using the in-built PWM wavelength.

9. Collecting Sensor Data
 - a. DHT Sensor interface.
 - b. Connect the terminals of DHT GPIO pins of Raspberry Pi.
 - c. Import the DHT library using `import Adafruit_DHT`.
 - d. Read sensor data and display it on screen.

REFERENCE BOOKS:

1. Pethuru Raj, Anupama C. Raman, The Internet of Things: Enabling Technologies, Platforms and Use Cases, 1st Edition, CRC Press.
2. Arsheep Bahga, Vijay Madiseti, Internet of Things - A Hands-On Approach, 1st Edition, 2015, Orient Blackswan Private Limited.
3. Kenneth A. Lambert, Introduction to Python, 2nd Edition, 2019, Cengage.
4. Vamsi Kurama, Python Programming: A Modern Approach, 1st Edition, Pearson Education.
5. Mark Lutz, Learning Python, 4th Edition, O'Reilly.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
EC210ES	ANALOG ELECTRONICS LAB	0	0	2	1

Course Description: This course provides practical knowledge on characteristics and applications of diodes, BJT, FET and Op-Amp. It also provides design and analysis of various amplifiers and oscillators.

Course Outcomes: After completion of this course, the students will be able to

C210.1: Analyze the characteristics of PN Junction diode and rectifier circuits.

C210.2: Verify the characteristics of different configurations of BJT and JFET.

C210.3: Design various analog application circuits using Op-Amp.

C210.4: Analyze positive and negative feedback amplifiers.

List of Experiments (Twelve Experiments to be done):

1. Draw the V-I 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.
7. Voltage Series Feedback amplifier.
8. Current Shunt Feedback amplifier.
9. Design an RC phase shift oscillator circuit and derive the gain condition for oscillations practically for given frequency.
10. Design a Colpitts oscillator circuit for the given frequency and draw the output waveform.
11. Adder and Subtractor using Op Amp.
12. Inverting and Non-inverting Amplifiers using Op Amps
13. Integrator Circuit using IC 741.
14. Differentiator circuit using Op Amp.

TEXT BOOKS

1. Jacob Millman, Christos C Halkias, Integrated Electronics, 2nd Edition, 2010, McGraw Hill Education.
2. Ramakanth A. Gayakwad, Op-Amps & Linear ICs, 4th Edition, 2003, PHI.

REFERENCE BOOKS

1. Thomas L. Floyd, Electronic Devices Conventional current version, 9th Edition, 2015, Pearson.
2. J. Millman and Arvin Grabel, Microelectronics, 1st Editon, 1988, McGraw Hill Education.
3. D. Roy Chowdhury, Linear Integrated Circuits, 2nd Edition, 2003, New Age International (P) Ltd.

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EE301PC	ELECTROMAGNETIC FIELDS	3	0	0	3

Prerequisites Matrices and Calculus, Applied Physics, Numerical Methods and Complex Variables

Course Description: This course introduces the concepts of electric field and magnetic fields and their applications which will be utilized in the development of the theory for power transmission lines and electrical machines.

Course Outcomes: After completion of this course, the students will be able to

- C301.1:** Illustrate the concepts of electromagnetic field theory using fundamental laws
- C301.2:** Examine the influence of electric fields on conductors, insulators and dielectrics.
- C301.3:** Compute the Magnetostatic parameters using Biot Savart's and Ampere's circuital laws for different conductor configuration.
- C301.4:** Calculate Force, Torque and inductance in magnetic fields for electrical engineering applications.
- C301.5:** Interpret the concepts of Maxwell's equations from electromagnetic fields.
- C301.6:** Apply Maxwell's equation relating to transmission lines and uniform plane wave propagation.

Unit - I Static Electric Field

Rectangular, Cylindrical, Spherical Coordinate Systems-Transformations, Gradient and Laplacian of a Scalar field, Divergence and Curl of a Vector Field.

Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its 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, Ohm's Law in Point forms, Continuity equation, Boundary conditions of conductors and dielectric materials. Capacitance, Capacitance of a Spherical Conductor and Co-axial or Cylindrical Cable, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation (Cartesian Coordinate system)

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. Basic fundamentals of EMI and EMC in field theory.

Unit - IV Time Varying 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. Poynting theorem

TEXT BOOKS

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

REFERENCE BOOKS

1. A. Pramanik, Electromagnetism-Problems with solution, 2012, Prentice Hall India.
2. G. W. Carter, The Electromagnetic field in its engineering aspects, 1954, Longmans.
3. W. J. Duffin, Electricity and Magnetism, 1980, McGraw Hill Publication.
4. W. J. Duffin, Advanced Electricity and Magnetism, 1968, McGraw Hill.
5. A. Pramanik, Electromagnetism - Theory and applications, 2009, PHI Learning Pvt. Ltd., New Delhi.

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EE302PC	ELECTRICAL MACHINES-I	3	0	0	3

Prerequisites: Electrical Circuits -I & II

Course Description: This course introduces the fundamental principles and practical aspects of DC machines and transformers. It covers construction, operation, EMF equations, characteristics, losses, efficiency, and testing of DC generators and motors. The course also includes speed control methods, armature reaction, commutation, and excitation techniques. Single-phase and poly-phase transformers are studied with emphasis on equivalent circuits, regulation, efficiency, and testing. Overall, the course builds a strong foundation for understanding electrical machines used in power and industrial applications.

Course Outcomes: After completion of this course, the students will be able to

- C302.1:** Analyze EMF equation, armature reaction, and commutation in DC generators.
- C302.2:** Assess characteristics, starters, and speed control of DC motors.
- C302.3:** Evaluate losses and efficiency of DC machines using standard tests.
- C302.4:** Analyze equivalent circuit, losses, efficiency, and regulation of single-phase transformers.
- C302.5:** Predetermine transformer efficiency and regulation from various tests.
- C302.6:** Distinguish differences between poly-phase transformers based on connections and configurations.

Unit - I D.C. Generators:

Principle of operation – Action of commutator – constructional features – armature windings – lap and wave windings – simplex and multiplex windings (elementary treatment only) – EMF Equation. Concept of Armature reaction and commutation – Cross magnetizing and de-magnetizing AT/pole.

Methods of Excitation – separately excited and self-excited generators – build-up of EMF - critical field resistance and critical speed, causes for failure of self-excitation and remedial measures. Performance Characteristics of shunt, series and compound generators and applications.

Unit - II DC Motors:

Principle of operation – Back EMF. - Torque equation – characteristics and application of shunt, series and compound motors. Necessity of starters, 3-point starter.

Speed control of DC shunt and series motors - Armature voltage and field flux control methods.

Unit - III Losses & Testing of DC Machines

Losses – Constant & Variable losses – calculation of efficiency – condition for maximum efficiency.

Testing of DC Machines: Methods of Testing – Direct, Indirect, and Regenerative Testing – Brake Test – Swinburne’s Test – Hopkinson’s Test.

Unit - IV Single Phase Transformers:

Types - constructional details – Losses - Copper losses, Iron losses, minimization of core losses- EMF equation - operation on no-load and on load - phasor diagrams and Applications.

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

Unit – V Testing of Transformers & Poly-Phase Transformers:

Testing of 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 transformer operation - 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, Revised Edition, 2021.
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.
5. Theraja, B.L. (1997). A Textbook of Electrical Technology (Volume-ii).
6. S. K. Sahdev, *Electrical Machines*, 1st ed. Cambridge, UK: Cambridge University Press, 2018.

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EE303PC	POWER SYSTEMS - I	3	0	0	3

Prerequisites: Electrical Circuits I & II

Course Description: This course provides fundamental knowledge of conventional and renewable electric power generation systems and the economic aspects of power generation. It emphasizes the analysis of load characteristics, tariffs, and cost components for efficient operation. The course also introduces the layout of air-insulated and gas-insulated substations and explains transmission line parameters and corona effects. Finally, it develops the ability to apply DC and AC distribution concepts for voltage drop calculations and efficient power delivery.

Course Outcomes: After completion of this course, the students will be able to

- C303.1:** Understand the operating principles of conventional and renewable electric power generation systems.
- C303.2:** Analyze power system load characteristics, and economic aspects of power generation including tariffs and cost components.
- C303.3:** Explain the layout of air-insulated substations used in power systems.
- C303.4:** Explain the layout of gas-insulated substations used in power systems.
- C303.5:** Analyze overhead transmission line parameters and corona phenomena affecting power system performance and communication interference.
- C303.6:** Apply DC and AC distribution system concepts to compute voltage drops, compare distribution systems for efficient power delivery.

Unit – I Generation of Electric Power:

Operation of Hydel, Thermal, Nuclear and Gas Power plant with layouts - Description of components-Choice of site - advantages and disadvantages, Introduction and description of components- renewable energy sources and plants (solar and wind).

Unit – II Economics of Power Generation:

Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load curve, Load duration curve, number and size of generator units. Base load and peak load plants.

Cost of electrical energy-fixed cost, running cost, Tariffs.

Unit -III 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 – IV Overhead Transmission Line Parameters & Corona:

Overhead Transmission Lines: Line conductors, Composite conductor's transposition, bundled conductors, Inductance and capacitance of single phase and three phase lines with symmetrical spacing, and effect of earth on capacitance, skin and proximity effects.

Corona: Introduction, disruptive critical voltage, corona loss, Factors affecting corona loss and methods of reducing corona loss, Advantages and Disadvantages of corona, interference between power and Communication lines.

Unit – V Distribution System

DC Distribution: Classification of 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, Comparison of DC vs. AC. Single phase, 3-phase, 3 phase 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", 2nd Edition, New Age International, 2009.
2. 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.
3. J. B. Gupta, "A Course in Power Systems" Katson Books, 11th Edition, 2016.

REFERENCE BOOKS

1. C.L. Wadhwa, "Electrical Power Systems", 5th Edition, New Age International, 2009.
2. M.V. Deshpande, "Elements of Electrical Power Station Design", 3rd Edition, Wheeler Pub. 1998.
3. H. Cotton & H. Barber, "The Transmission and Distribution of Electrical Energy", 3rd Edition, 1970.
4. W. D. Stevenson, "Elements of Power System Analysis", 4th Edition, McGraw Hill, 1984.
5. V. K. Mehta and Rohit Mehta, "Principles of Power Systems", S. Chand & Company Ltd, New Delhi, 2004.

B. Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
CS304ES	Data Structures (Common to ECE and EEE)	3	0	0	3

Pre - Requisite Programming for Problem Solving

Course Description: This course covers linear data structures such as stack, queue and linked lists. Discuss various operations on non-linear data structures like trees and graphs. Introduces various sorting and searching techniques.

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

C304.1: Understand the significance of time and space complexity in data structures.

C304.2: Apply linked lists to perform operations relevant to real-world problems.

C304.3: Analyze the use of stacks and queues in solving real-world problems.

C304.4: Implement various kinds of trees and their operations.

C304.5: Describe graph representations and implement traversals.

C304.6: Identify problems where Hashing and Hash Tables can be applied.

Unit – I

Introduction to Computational Complexity: Introduction, Characteristics of algorithm, Performance analysis, Growth of Functions, Asymptotic notations.

Introduction to Data Structures: Basic Terminology, Classification of Data Structures, Operations on Data Structures, abstract data types, selecting a Data Structure, Linear list – Introduction, Singly linked list, Circular Linked Lists, Doubly Linked List.

Stacks: Operations, Stack algorithm, Stack ADT, Stack applications.

Unit – II

Queues: Operations, Queue Algorithm, Queue ADT, Circular Queue, Dequeue, Queue Applications.

Trees: Definition, Terminology, Binary trees-definition, Properties of Binary Trees, Binary Tree ADT, representation of Binary Trees- array and linked representations, Binary Tree traversals, Threaded binary trees.

Unit – III

Searching: Binary Search, Interpolation Search.

Binary Search Trees (BST): BST Operations-Searching, Insertion and Deletion, BST ADT, BST Application, AVL Trees.

Multi way Search Trees: Introduction, B Trees, B Trees ADT.

Unit – IV

Graphs: Introduction, Directed Graphs, Representation of Graphs, Graph Traversal Algorithms, Graph ADT, Applications of Graphs.

Sorting: Bubble Sort, Insertion Sort, Radix Sort.

Unit – V

Hashing: Introduction, Hash Tables, Hash Functions, Different Hash Functions: Division Method, Multiplication Method, Mid-square Method, Folding Method.

Collision: Collision Resolution by Open Addressing, Collision Resolution by Chaining.

TEXT BOOKS:

1. R. F. Gilberg and B.A. Forouzan, Data Structures: A Pseudocode Approach with C, 2nd Edition, Cengage Learning.
2. S. Tanenbaum, Y. Langsam, and M.J. Augenstein, Data Structures using C, 1st Edition, PHI/Pearson Education.

REFERENCE BOOKS:

1. Reema Thareja, Data Structures using C, 3rd Edition, Oxford University Press.
2. Mark Allen Weiss, Data structures and algorithm analysis in C, 2nd Edition, Pearson.

B. Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
MA305BS	NUMERICAL METHODS AND COMPLEX VARIABLES	3	0	0	3

Pre - Requisite Mathematics courses of first year of study.

Course Description:

The course contains the topics Fourier transforms and Fourier series, Solutions of Algebraic and Transcendental equations, Interpolation with equal and unequal intervals, Numerical Integration, Numerical solutions of first order ordinary differential equations, Complex number and their properties. Complex differentiation and related topics and Complex integration.

Course Outcomes

- C305.1** Expresses a periodic function as a Fourier series and a non-periodic function as Fourier transforms.
- C305.2** Find the root of a given equation using Numerical methods.
- C305.3** Estimate the value for the given data using interpolation.
- C305.4** Find the numerical solutions for a given first order ODEs.
- C305.5** Analyze the complex function with reference to their analyticity.
- C305.6** Evaluate the integrals using Cauchy's integral formula and Cauchy's residue theorem.

Unit – I Fourier series & Fourier Transforms

Fourier series – Dirichlet's Conditions – Half-range Fourier series – Fourier Transforms: Fourier Integral Theorem (Only statements), Fourier Sine and Cosine transforms (Elementary illustrations)

Unit – II Numerical Solutions of Algebraic & Transcendental Equations and Interpolation

Solution of polynomial and transcendental equations: Bisection method – Iteration Method – Newton Raphson method and Regula- Falsi method. Finite differences: forward differences – backward differences – central differences – symbolic relations – Interpolation using Newton's forward and backward difference formulae – Lagrange's method of interpolation.

Unit – III Numerical Integration and Solutions of first order ODE

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

Unit – IV Complex Differentiation

Differentiation of Complex functions – Analyticity – Cauchy-Riemann equations (without proof) – Harmonic Functions – Finding harmonic conjugate – Milne-Thomson method – Elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

Unit – V Complex Integration

Line integral – Cauchy's theorem – Cauchy's Integral formula – Zeros of analytic functions – Singularities – Taylor's series – Laurent's series. Residues – Cauchy Residue theorem (All theorems without Proof).

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. Murray R. Spiegel, Ph.D., Seymour Lipschutz, Ph.D., John J. Schiller, Ph.D.,
2. Dennis Spellman, Ph.D., Complex Variables (Schaum's outline).
3. M. K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering Computations, New Age International publishers.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
5. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Edition, Mc-Graw Hill, 2004.

B. Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
MS306HS	INNOVATION AND ENTREPRENEURSHIP	2	0	0	2

Pre-Requisites: Nil

Course Description: This course introduces the fundamental concepts of innovation and entrepreneurship and their significance in economic development, enabling students to identify problems, explore opportunities and apply idea generation and market segmentation techniques. It also provides practical knowledge in prototype development, Minimum Viable Product (MVP), business and financial planning, Go-to market strategies, start-up formation, venture pitching, funding opportunities and Intellectual property Rights (IPR).

Course Outcomes:

- C306.1** Understand the entrepreneurship and the entrepreneurial process and its significance in economic development.
- C306.2** Assess the problem from an industry perspective and generate solutions using the design thinking principles.
- C306.3** Assess market competition, estimate market size and develop a prototype.
- C306.4** Analyze Business and financial planning models and Go-to-Market strategies.
- C306.5** Able to build a start-up, register IP and identify funding opportunities.
- C305.6** Able to develop and present a comprehensive business plan for an innovative and scalable start-up venture.

Unit-I Fundamentals of Innovation and Entrepreneurship:

Innovation: Introduction, need for innovation, Features, Types of innovations, innovations in manufacturing and service sectors, fostering a culture of innovation, planning for innovation.

Entrepreneurship: Introduction, types of entrepreneurship attributes, mindset of entrepreneurial and intrapreneurial leadership, Role of entrepreneurs in economic development. Woman Entrepreneurship, Importance of on-campus startups. Understanding to build entrepreneurial mindset, attributes and networks individuals while on campus.

Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students-16 industries to choose from), Venture Activity.

Unit-II Problem and Customer Identification:

Identification of gap, problem, analysing the problem from an industry perspective, real-world problems, market and customer segmentation, validation of customer problem fit, Iterating problem-customer fit, Competition and Industry trends mapping and assessing initial opportunity, Porter's Five Force Model. Idea generation, Ideation techniques: Brainstorming, Brain writing, Round robin, and SCAMPER, Design thinking principles, Mapping of solution to problem.

Core Teaching Tool: Several types of activities including: Class, game, Gen AI, 'Get out of the Building' and Venture Activity.

Unit-III Opportunity assessment and Prototype development:

Identify and map global competitors, review industry trends, and understand market sizing: TAM, SAM, and SOM. Assessing scope and potential scale for the opportunity.

Understanding prototyping and Minimum Viable Product (MVP). Developing a prototype: Testing, and validation.

Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

Unit-IV Business & Financial Models

Introduction to Business Model and types, Lean Canvas Approach: 9-block lean canvas model, building lean canvas for your startup. Business planning: components of Business plan- Sales plan, People plan and financial plan, Financial Planning: Types of costs, preparing a financial plan for profitability using a financial template, understanding the basics of Unit economics, Economies of Scale and analyzing financial performance. Go-To-Market (GTM) approach-Selecting the Right Channel, creating digital presence, and building customer acquisition strategy.

Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

Unit-V Startups and IPR

Startup requirements, building founding team members and mentors, pitch preparation, start-up registration process, funding opportunities and schemes, institutional support to entrepreneurs, startup lifecycle, documentation, legal aspects in startup, venture pitching readiness, National Innovation Startup Policy (NISP) and its features.

Patents, Designs, Patentability, Procedure for grants of patents. Indian Scenario of Patenting, International Scenario: International cooperation on Intellectual Property. Patent Rights: Scope of Patent Rights. Copyright, trademark, and GI. Licensing and transfer of technology.

Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

TEXT BOOKS

1. John R Bessant, Joe Tidd, Innovation and Entrepreneurship, 4E, Wiley, Latest Edition.
2. Ajay Batra, The Startup Launch Book- A Practical Guide for Launching Customer Centric
3. Ventures, Wiley, 2020. (For Core Teaching Tool).
4. D.F. Kuratko and T.V. Rao, Entrepreneurship: A South-Asian Perspective, Cengage
5. Learning, 2013.
6. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020).
7. Entrepreneurship, McGrawHill, 11th Edition.

REFERENCE BOOKS:

1. Entrepreneurship Development and Small Business Enterprises, Poornima M Charantimath, 4E, Pearson, 2025.
2. NISP-Brochure inside pages - startup_policy_2019.pdf

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EE307PC	ELECTRICAL MACHINES - I LAB	0	0	2	1

Course Description: Electrical Machines-I Lab course is to provide the practical exposure on performance of various electrical machines like DC Generators, DC Motors and Transformers. This course will also help the students to gain the skill set in order to select the machine for a specific application.

Course Outcomes: After completion of this course, the students will be able to

- C307.1:** Examine performance characteristics of DC generators through magnetization and load tests.
- C307.2:** Compute losses and efficiency of DC machines using indirect and regenerative tests.
- C307.3:** Analyse performance curves of DC motors using load and brake tests.
- C307.4:** Analyse the Performance of Single-Phase Transformer and Poly-Phase Transformer Connections.

The following experiments are required to be conducted compulsorily:

1. Magnetization characteristics 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 (Predetermination of efficiency)
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, at least any two of the experiments from the following list are required to be conducted

1. Brake Test on DC shunt motor (Determination of performance curves).
2. Load Test on DC compound generator (Determination of characteristics).
3. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation).
4. Speed control of DC shunt motor
5. Modelling and testing of DC Machine using simulation tools.
6. Determination of equivalent circuit parameters of 1- ϕ Transformer using simulation tools.

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.

B. Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
CS308ES	Data Structures Lab (Common to ECE and EEE)	0	0	2	1

Course Description: This course focuses on implementation of linear data structures and sorting algorithms. The course also deals with operations related to height balanced trees, graph traversing and Hash functions.

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

C308.1: Implement various kinds of linked list and their operations.

C308.2: Design programs to implement stack and queue ADT.

C308.3: Implement programs for sorting & searching algorithms.

C308.4: Implement trees and graph traversal and Hash functions.

LIST OF PROGRAMS**CYCLE 1:**

1. Write a program that uses functions to perform the following operations on singly linked list:
 - i) Creation ii) Insertion iii) Deletion iv) Traversal
2. Write a program that uses functions to perform the following operations on doubly linked list:
 - i) Creation ii) Insertion iii) Deletion iv) Traversal
3. Write a program that uses functions to perform the following operations on circular linked list:
 - i) Creation ii) Insertion iii) Deletion iv) Traversal
4. Write a program that implement stack (its operations) using
 - i) Arrays ii) Linked List
5. Write a program that implement Queue (its operations) using
 - i) Arrays ii) Linked List
6. Write a program that takes a string (e.g., " $((a+b)*c)-d$ ") and uses a stack to determine whether the parentheses are balanced.
7. Write a program to reverse a Linked list using stack.
8. Write a program that implements Circular Queue (its operations) using arrays

CYCLE 2:

9. Write a program that implements DeQueue (its operations) using arrays.
10. Write a program that implements the following search methods.
 - i) Binary Search ii) Interpolation Search
11. Write a program that implements the following sorting methods to sort a given list of integers in ascending order
 - i) Bubble Sort ii) Insertion Sort iii) Radix Sort
12. Write a program to implement the tree traversal methods (Recursive and Non-Recursive).
13. Write a program to implement
 - i) Binary Search Tree ii) B Trees iii) AVL trees

14. Write a program to implement the graph traversal methods
15. Write a program to implement the following Hash Functions:
 - i) Division Method
 - ii) Multiplication Method
 - iii) Mid-square Method
 - iv) Folding Method

TEXT BOOKS:

1. R. F. Gilberg and B.A. Forouzan, Data Structures: A Pseudocode Approach with C, 2nd Edition, Cengage Learning.
2. A. S. Tanenbaum, Y. Langsam, and M.J. Augenstein, Data Structures using C, 1st Edition, PHI/Pearson Education.

REFERENCE BOOKS:

1. Reema Thareja, Data Structures using C, 3rd Edition, Oxford University Press.
2. Mark Allen Weiss, Data structures and algorithm analysis in C, 2nd Edition, Pearson.

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EE309SD	DESIGN OF ELECTRICAL SYSTEMS USING AUTOCAD	0	0	2	1

Course Description: This skill development course provides comprehensive, hands-on experience in designing electrical systems using AutoCAD. It equips students with the ability to draft accurate electrical wiring diagrams, panel layouts, and distribution systems for residential, commercial, and industrial applications. The course emphasizes the use of IEC/ANSI/IS standard electrical symbols, layers, blocks, and drafting conventions to produce industry-grade CAD drawings. Through practical exercises and structured laboratory work, students develop the competence to interpret design requirements, prepare detailed electrical documentation, and create professional CAD-based electrical designs aligned with real-world engineering practices.

Course Outcomes: After completion of this course, the students will be able to

- C309.1:** Apply AutoCAD tools to create layers, blocks, and standard electrical symbols (IEC/ANSI/IS) for electrical drawings and circuit layouts with accuracy.
- C309.2:** Design and draft residential electrical systems with accurate load calculations and appropriate cable selection.
- C309.3:** Develop commercial and industrial electrical distribution layouts, including control panels and electrical room designs.
- C309.4:** Design and document complete electrical CAD drawings for substations, apartments, and small industrial systems.

Module I:**AutoCAD Fundamentals for Electrical Design**

- Introduction to AutoCAD interface, workspace, and basic tools
- Creation and management of layers, blocks, and annotation styles
- Electrical symbols as per IEC/ANSI/IS standards
- Drawing and editing basic electrical elements and circuit components

Lab Work:

- Preparing simple electrical circuit diagrams in AutoCAD
- Use layers, blocks, and standard symbols to create structured electrical layouts

Module II:**Residential Electrical System Design**

- Preparation of single-line diagrams (SLDs) for residential buildings
- Internal wiring layouts for houses: lighting, power, and switchboard planning
- Load estimation, protective device selection, and cable sizing
- Basics of earthing and safety practices

Lab Work:

- Drafting residential wiring layouts
- Designing lighting and switchboard plans for 1BHK/2BHK units

Module III:**Commercial & Industrial Electrical Layout Development**

- Electrical distribution design for commercial buildings
- Power and lighting circuits, DB design, and component placement

- Control panel layout, busbar arrangement, and electrical room planning

Lab Work:

- Developing distribution layouts for small commercial facilities
- Creating electrical room and control panel diagrams

Module IV:**Substation & Control Circuit Design**

- Single-line diagrams of substations (11 kV/440 V)
- Relay logic, control schematics, and contactor wiring
- Motor starter circuits (DOL / Star-Delta)
- Cable routing, tray layouts, and drafting standards

Lab Work:

- Drafting 11 kV/440 V substation SLD

Panel wiring diagrams for motor starter circuits

Module V:**Mini Project & Professional Documentation**

- Drawing standards, title blocks, and professional documentation practices
- Preparing Bill of Materials (BOM) and project reports
- Printing, plotting, exporting, and finalizing CAD drawings

Lab Activity:

- Mini-project: Design and documentation of an electrical system for a small apartment, laboratory, or industrial setup

Software Requirements

- AutoCAD Electrical (Student/Institution License)

Optional: E-Plan, DraftSight, or equivalent CAD tools

TEXT BOOKS:

1. K.B. Raina and S.K. Bhattacharya “Electrical Design Estimating and Costing” New Age
2. International. Prof. Sham Tickoo “AutoCAD Electrical 2023 for Electrical Control Designers” CADCIM
3. Technologies. Surjit Singh “Basic Electrical Engineering Drawing” Dhanpatrai & Co.

REFERENCE BOOKS:

1. Frederic P. Hartwell and Herbert P. Richter “Practical Electrical Wiring” Park Publishing.
2. James A. Leach and Shawna Lockhart “AutoCAD 2023 Instructor” SDC Publications.
3. Ray C. Mullin and Phil Simmons “Electrical Wiring Residential” Cengage Learning.
4. IS 732: Code of Practice for Electrical Wiring Installations.
5. National Electrical Code (NEC) – India.

ONLINE RESOURCES:

1. Autodesk Knowledge Network: <https://knowledge.autodesk.com>.

B. Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
MA310BS	COMPUTATIONAL MATHEMATICS LAB (using Python)	0	0	2	1

Pre - Requisite Mathematics courses in the first year of study.

Course Description: The course contains the topics Eigen values and Eigen vectors, System of linear equations, First order differential equations, Higher order differential equations, Solutions of Algebraic and Transcendental equations. Their methods of solutions and programs of implementation.

Course Outcomes

- C310.1** Compute eigenvalues and eigenvectors of matrices using programming tools.
- C310.2** Develop programs to compute roots of algebraic and transcendental equations using Bisection and Newton–Raphson methods.
- C310.3** Develop programs for solving systems of linear equations using Jacobi and Gauss–Seidel iteration methods.
- C310.4** Implement algorithms to solve first order & first degree and higher-order linear differential equations with constant coefficients.

Unit – I Eigen values and Eigenvectors:

- Finding real and complex Eigen values.
- Finding Eigen vectors.

Unit – II Solution of Algebraic and Transcendental Equations**Programs:**

- Root of a given equation using Bisection method.
- Root of a given equation Newton Raphson Method.

Unit–III Linear system of equations:

Jacobi’s iteration method and Gauss-Seidel iteration method Programs:

- Solution of given system of linear equations using Jacobi’s method
- Solution of given system of linear equations using Gauss-Seidel method

Unit–IV First-Order ODEs

- Exact and non-exact equations, Applications: exponential growth/decay, Newton's law of cooling.

Programs:

- Solving exact and non-exact equations
- Solving exponential growth/decay and Newton's law of cooling problems

Unit–V Higher order linear differential equations with constant coefficients

- Solving homogeneous ODEs
- Solving non-homogeneous ODE

TEXT BOOKS:

1. MATLAB and its Applications in Engineering, Rajkumar Basal, Ashok Kumar Geo, Manoj Kumar Sharma, Pearson publication.
2. Kenneth A. Lambert, The fundamentals of Python: First Programs, 2011, Cengage Learnings.

3. Think Python First Edition, by Allen B. Downey, Orielly publishing.
4. Introduction to Python Programming, William Mitchell, Povel Solin, Martin Novak et al., N C Lab Public Computing, 2012.
5. Introduction to Python Programming, ©Jacob Fredslund, 2007.

REFERENCE BOOKS:

1. An Introduction to Python, John C. Luth, The University of Alabama, 2011.
2. Introduction to Python, Dave Kuhlman, 2008.

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
VA300ES	ENVIRONMENTAL SCIENCE (Common to CSE, EEE, ECE)	3	0	0	1

Pre-Requisite Intermediate Chemistry/ 10+2 Chemistry knowledge

Course Description: This course enables the students engage with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world. The course requires that students identify and analyze natural and human-made environmental problems, evaluate the relative risks associated with these problems. It provides the scope to examine alternative solutions for resolving or preventing them. It is essentially a multidisciplinary approach that brings out an appreciation of our natural world and human impact on its existence and integrity. Its components include Biology, Geology, Chemistry, Physics, Engineering, Sociology, Health, Anthropology, Economics, Statistics, Computers and Philosophy.

Course Outcomes: After completion of this course, the students will be able to

- C300.1** Analyze the important components of environment.
- C300.2** Illustrate the major environmental effects of exploiting natural resources.
- C300.3** Utilize Environmental laws for the protection of forest and wildlife.
- C300.4** Categorize different types of pollutions and their control measures and discover effective methods of waste management.
- C300.5** Identify global environmental problems and come out with best possible solutions.
- C300.6** Illustrate green environmental issues.

Unit-I ECOSYSTEMS

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, Biomagnifications, ecosystem value, services and carrying capacity, Field visits

Unit-II Natural Resources: Classification of Resources

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, Water Foot print.

Mineral resources: use and exploitation, environmental effects of extracting 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

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-wild life conflicts; Conservation of biodiversity: In-Situ and Ex-situ conservation.

Unit–IV Environmental Pollution and Control Technologies:

Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality 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/Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

Green Environmental Issues: Clean development mechanism, carbon foot printing, carbon credits, carbon sequestration and Polluter pay principle.

Unit– V Environmental Policy, Legislation & EIA

Environmental Policy, Legislation& EIA: Environmental Protection act, Legal aspects Air Act-1981, Water Act, Forest Act, Wildlife 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. Concepts of Environmental Management Plan (EMP).

Towards Sustainable Future: Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

Text Books:

1. Erach Bharucha “Text book of Environmental Studies for Undergraduate Courses”, 1st edition, Universities press,2005.
2. Anubha Kaushik, C.P. Kaushik, Perspectives in environmental Studies, 4thedition, New age international publishers, 2014.
3. S. Deswal and A. Deswal, “A basic course in environmental studies” 2ndedition, Dhanapathirai & Co, 2004.
4. Bennyjoseph.Environmentalstudies.3rdedition, Mc Graw Hill Education (India)Private Limited, 2005.

Reference Books:

1. Daniel B. Botkin and Edwards A. Keller. “Environmental science” 8thedition, Wiley India(P) Ltd.
2. Richard T. Wright “Environmental Science: towards a sustainable future” 4th edition, PHI, Learning Private Ltd.
3. P. D. Sharma “Ecology and Environment” 5th edition, Rastogi Publications.

B. Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
EE401PC	ELECTRICAL MEASUREMENTS AND SENSORS	2	0	0	2

Prerequisites Electrical Circuits-I &II, Analog Electronics and Electromagnetic Fields

Course Description: This course introduces the principles and operation of electrical measuring instruments, bridges, potentiometers, and instrument transformers used for accurate measurement of electrical quantities. It also covers various sensors, transducers, smart instruments, and modern smart metering technologies used in electrical and industrial applications.

Course Outcomes: After completion of this course, the students will be able to

- C401.1:** Understand the principles, characteristics, and errors of electrical measuring instruments
- C401.2:** Use appropriate analog and digital instruments for measurement of electrical quantities.
- C401.3:** Apply potentiometers and instrument transformers for accurate electrical measurements.
- C401.4:** Analyze single-phase and three-phase power and energy measurement methods.
- C401.5:** Apply DC and AC bridge techniques for measurement of resistance, inductance, and capacitance.
- C401.6:** Explain the working and applications of sensors, smart instruments, MEMS, and smart metering systems.

UNIT - I: Introduction to Measuring Instruments

Classification of instruments, static characteristics, errors, comparison of analog and digital instruments (introductory), deflecting, control and damping torque – 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.

UNIT - II: Potentiometers & Instrument Transformers

Principle and operation of DC Crompton's potentiometer and AC potentiometer (Qualitative), standardization and Measurement of unknown resistance CT and PT – Ratio and phase angle errors CT and PT selection criteria for metering and protection, nameplate data interpretation, and practical considerations in substations.

UNIT – III: Measurement of Power & Energy

Construction and working of single phase dynamometer wattmeter, expression for deflecting and control torques.

Single phase induction type energy meter – driving and braking torques – errors and compensations – testing by phantom loading.

UNIT - IV: DC & AC Bridges

Method of measuring low, medium and high resistance – sensitivity of Wheat-stone’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, Measurement of capacitance and loss angle - Schering Bridge, Wien’s bridge. (Qualitative approach)

UNIT - V: Sensors and Smart Instruments.

Sensors: Temperature sensors- Proximity sensor- Pressure sensor- IR sensors- Motion detection sensors- Ultrasonic sensors - Thermocouples, construction and working of LVDT. Study of sensor datasheets including interpretation of specifications such as measurement range, accuracy, sensitivity, response time, and selection criteria for voltage, current, and temperature sensors. (Elementary treatment only)

Smart instruments: Intelligent transducer, self-diagnosis and remote calibration features, HART communication; smart energy meter components, working principle; Advanced Metering Infrastructure (AMI)

TEXTBOOKS:

1. A. K. Sawhney, “Electrical & Electronic Measurement & Instruments”, Dhanpat Rai & Co. Publications, 2005.
2. Dr. Rajendra Prasad, “Electrical Measurements & Measuring Instruments”, Khanna Publishers, 1989.
3. P. Purkait, B.Biswas, S. Das, C. Koley, “Electrical and Electronics Measurements and Instrumentation”, Mcgraw Hill Publishers, 2013.

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.

B. Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
EE402PC	ELECTRICAL MACHINES-II	3	0	0	3
Prerequisites	Electrical Circuit Analysis-I, Electrical Circuit Analysis-II & Electrical Machines-I				

Course Description: Electrical Machines are the heart of every system and the electrical power sector is the need of society and nation. The rotating electrical machines play a vital role for the society and overall development of the country by providing hassle free operations with low maintenance. This particular subject deals with the theory, practical and performance analysis of various electrical machines with different loading conditions.

Course Outcomes: After completion of this course, the students will be able to

- C402.1:** Illustrate the construction and working principle of Induction machines.
- C402.2:** Analyze the performance, starting, speed control, and applications of induction machines
- C402.3:** Illustrate the construction and working principle of alternators, and evaluate the performance characteristics of synchronous generators.
- C402.4:** Analyze voltage regulation of synchronous generators and load sharing of alternators under parallel operation.
- C402.5:** Analyze the operation, performance, and starting methods of synchronous motors.
- C402.6:** Understand the operation, performance, and applications of single-phase induction motors.

UNIT - I:

Three 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. Torque equation-expressions for maximum torque and starting torque – torque-slip characteristics.

UNIT - II:

Characteristics of Induction Machines: Equivalent circuit - phasor diagram - crawling and cogging, No-load Test and Blocked rotor test –Predetermination of performance of Induction motor - Methods of starting; starting current and Torque calculations, Applications.

Speed Control Methods: Change of voltage, change of frequency, change of voltage/frequency, injection of an EMF into rotor circuit (qualitative treatment only)-induction generator-principle of operation.

UNIT - III:

Synchronous Generator (Alternator): Constructional Features of round rotor and salient pole synchronous machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – EMF Equation. Harmonics in generated EMF – suppression of harmonics– armature reaction - leakage reactance – synchronous reactance and impedance – phasor diagram – load characteristics.

UNIT - IV:

Regulation of Synchronous Generator: Voltage regulation - Synchronous impedance (EMF) method, MMF method and ZPF method— two reaction theory— Determination of X_d and X_q (Slip test) Phasor diagrams – Regulation of salient pole alternators.

Parallel Operation of Alternators: Synchronizing Alternators with infinite bus bars – synchronizing power/ torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input, Power flow equations.

UNIT - V:

Synchronous Motors: Theory of operation –Methods of starting, phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed. Hunting and its suppression.

Single Phase Machines: Single phase induction motor – Constructional Features-Double revolving field theory – split-phase motors – resistance split phase, capacitor start, capacitor start and run - shaded pole motor 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.
5. Theraja, B. L., Theraja, A. K., Patel, U., Uppal, S., Panchal, J., Oza, B., & Patel, R., “A textbook of electrical technology vol ii”, S. Chand publishers, 2005.
6. S.K. Sahdev, “Electrical Machines”, Cambridge University Press, 2017.

B.Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
EE403PC	CONTROL SYSTEMS	3	0	0	3

Prerequisites: Ordinary Differential Equations and Vector Calculus, Electrical Circuits-I & II and Electrical Machines-I

Course Description: This course introduces the principles of control systems essential for analyzing and regulating dynamic engineering systems. It emphasizes system modeling, stability analysis, and controller design with applications in power systems, robotics, industrial automation, aerospace, and process control. The subject is crucial for designing efficient, stable, and reliable engineering systems in real-world applications.

Course Outcomes: After completion of this course, the students will be able to

- C403.1:** Compute transfer function of a system by different techniques.
- C403.2:** Evaluate the time response of systems for standard input signals.
- C403.3:** Probe the stability of a system using time domain approach.
- C403.4:** Probe the stability of a system using frequency domain approach.
- C403.5:** Examine the performance of systems with compensators and controllers.
- C403.6:** Construct state models for continuous time systems and comment on controllability and observability of the system.

Unit – I Mathematical modelling of physical systems

Open – loop and Closed loop Systems, Concept of Feedback Control, Effects of feedback, Linear, Non-Linear, Time Variant and Time Invariant systems, Mechanical and Electrical Systems. Transfer function, Block-Diagram Techniques, Signal flow graph, Transfer function of DC Servo motors and AC Servomotors, Synchro as an Error Detector.

Unit – II Time-Domain Analysis with Input-Output Models

Type and order of Systems, Time response of first and second order systems for standard test inputs. Analysis of standard Second order systems with step input, Error Analysis for Linear time Invariant Systems.

Concept of Stability: Routh-Hurwitz Criteria. Relative Stability analysis, Root-Locus technique: Construction of Root-loci.

Unit -III Frequency Domain Analysis

Introduction to frequency response, Relationship between time and frequency response, Concept of Bode plots and construction, gain and phase margin, Polar plots, Nyquist stability criterion.

Unit – IV Classical Controllers and Compensators

Analysis of Proportional, Integral and Derivative, PI, PD and PID controllers; Compensators - Lead, Lag and Lead-Lag (elementary treatment only).

Unit – V State Variable Analysis

Concept of State, State variables and State model. State Representation, Transformation of State variables to Transfer function & Vice versa, Solution of state equations and Complete

response of the Systems. Concept of controllability and observability.

TEXT BOOKS

1. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.
2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.
3. Norman S Nise, "Control Systems Engineering", Wiley, 2019 8th Edition.

REFERENCE BOOKS

1. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
2. K. R. Varmah, "Control Systems", McGraw Hill Education, 2010.
3. A. Anand Kumar, 'Control Systems', PHI Learning Private Limited, 2007
4. A. Nagoorkani, 'Control Systems Engineering', RBA Publications, 2017

B.Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
EE404PC	DIGITAL ELECTRONICS	3	0	0	3

Course Description: This course provides a thorough understanding of basic concepts required for digital system design.

Course Outcomes: After completion of this course, the students will be able to

C404.1 Apply the concepts of number systems in digital system design.

C404.2 Minimize Boolean expressions using various techniques.

C404.3 Design combinational logic circuits to meet given functional specifications.

C404.4 Design Shift Registers and Counters using different types of flip-flops.

C404.5 Model finite state machines for applications such as serial adders, parity generators, and sequence detectors.

C404.6 Implement Boolean functions using different PLDs.

Unit – I Fundamentals of Digital Systems

Number systems-binary, Signed binary, Octal, hexadecimal number, Binary arithmetic, One's and Two's complements arithmetic, Digital logic gates - AND, OR, NOT, NAND, NOR and Exclusive-OR, Boolean algebra.

Unit – II Boolean Expressions and Minimization Techniques

Standard representation for logic functions, Minimization of Boolean expressions, K-map representation and simplification of logic functions using K- map up to 4 variables, don't care conditions, Q-M method for function minimization.

Unit – III Combinational Circuits

Adders, Subtractors, Carry look ahead adder, Multiplexer, De-Multiplexer, Digital comparator, Encoders and Decoders, Code converters.

Unit – IV Sequential Circuits

Introduction to flip-flops, SR, JK, T and D type flip-flops, Conversion of flip-flops, Shift registers, Ring counter, Twisted Ring counter, Ripple (Asynchronous) counters and Synchronous counters.

Unit – V Semiconductor Memories and Programmable Logic Devices

Finite State Machine – Mealy and Moore models, Serial Binary Adder, Parity Generator and Sequence Detector.

Programmable Logic Devices -Read Only Memory (ROM), Programmable logic array (PLA), Programmable array logic (PAL), Introduction to Field Programmable Gate Array (FPGA).

TEXT BOOKS

1. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
2. Zvi Kohavi and Niraj K Jha, "Switching and Finite Automata Theory", Third Edition, Cambridge University, 2009.

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.
3. A. Anand Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

B.Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
EE405PC	POWER SYSTEMS – II	3	0	0	3

Prerequisites: Electrical Circuits - I & II and Power Systems – I

Course Description: This course provides knowledge of overhead transmission line insulators, and underground cables. It emphasizes the application of voltage control, power factor improvement, and compensation techniques for efficient and stable power system operation. The course also introduces the per-unit system and travelling wave concepts for effective power system modelling and analysis. Finally, it develops the ability to analyze symmetrical components and fault currents for power system fault analysis and protection.

Course Outcomes: After completion of this course, the students will be able to

- C405.1:** Understand overhead transmission line, insulators, and underground cables.
- C405.2:** Analyze performance of short, medium, and long transmission lines.
- C405.3:** Apply voltage control techniques to ensure stable operation of power systems.
- C405.4:** Analyze and implement power factor improvement and compensation techniques to enhance efficiency in power systems
- C405.5:** Use per unit system and travelling wave concepts for power system analysis.
- C405.6:** Analyze symmetrical components and fault currents in power systems.

Unit-I: Overhead Line Insulators & Underground Cables

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.

Underground cables: Construction, Classification of cables, Calculation of insulation resistance and capacitance of single core and three core cables, applications and losses.

Unit-II: Performance of Lines

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, and D constants, Ferranti Effect.

Unit-III: Voltage Control, Power Factor Improvement and Compensation in Power Systems

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.

Unit-IV: Per Unit Representation of Power Systems and Travelling Waves on Transmission Lines

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 coefficients.

Unit–V Symmetrical Components and Fault Calculations

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, “Generation, Distribution and Utilization of Electrical Energy”, 3rd Edition, New Age International, 2009.
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. W. D. Stevenson, “Elements of Power System Analysis”, 4th Edition, McGraw Hill, 1984.
3. John J. Grainger & W.D. Stevenson, “Power System Analysis”, Mc Graw Hill International, 1994.
4. Hadi Sadat, “Power System Analysis”, Tata Mc Graw Hill Pub. Co. 2002.

B. Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
EE406PC	ELECTRICAL MEASUREMENTS AND SENSORS LAB	0	0	2	1

Prerequisites Electrical Circuits-I, Electrical Circuits-II, Electrical Machines-I

Course Description:

Course Outcomes: After completion of this course, the students will be able to

- C406.1:** Select, connect, and operate electrical measuring instruments and sensors for basic electrical measurements.
- C406.2:** Perform calibration of energy meters, power factor meters, and PMMC instruments using standard procedures.
- C406.3:** Determine electrical parameters (R, L, C) and material properties using DC and AC bridge techniques.
- C406.4:** Analyze accuracy and performance of instrument transformers (CTs and PTs) through ratio and phase angle error tests.

PART-A

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 DC Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter.
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Dielectric testing of oil using HT Testing Kit.
6. Schering Bridge & Anderson Bridge.
7. Measurement of displacement with the help of LVDT.
8. Measurement and datasheet analysis of voltage, current, and temperature sensors.

PART-B

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

9. Calibration LPF wattmeter – by Phantom testing.
10. Measurement of 3-phase power with single watt meter and two CTs.
11. C.T. testing using mutual Inductor – Measurement of % ratio error and phase angle of given CT by Null method.
12. PT testing by comparison – V. G. as Null detector – Measurement of % ratio error and phase angle of the given PT
13. Resistance strain gauge – strain measurements and Calibration.
14. 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.

B. Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
EE407PC	ELECTRICAL MACHINES-II LAB	0	0	2	1

Prerequisites Electrical Machines-I

Course Description: This lab course is to provide the practical exposure on performance of various electrical machines like Induction Machines and Synchronous Machines. This course will also help the students to gain the skillset in order to select the machine for a specific application.

Course Outcomes: After completion of this course, the students will be able to

- C407.1:** Evaluate the performance of single-phase transformers using standard tests and connections.
- C407.2:** Analyze the performance and characteristics of induction motors under different operating conditions.
- C407.3:** Examine the performance of synchronous machines using regulation, characteristic, and parameter determination methods.
- C407.4:** Analyze synchronization and operational behavior of alternators.

PART-A

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

1. Sumpner's test on pair of single-phase transformers
2. Scott Connection of transformer
3. No-load and Blocked rotor test on Three Phase Induction Motor.
4. Regulation of Alternator by EMF, MMF and ZPF Methods
5. 'V' and 'Inverted V' Curves of three phase Synchronous Motor
6. Equivalent circuit of Single-Phase Induction Motor
7. Determination of X_d and X_q of a salient pole synchronous machine
8. Load Test on Three Phase slip ring Induction Motor

PART-B

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

9. Separation of core losses of a single-phase transformer
10. Efficiency and regulation of 3-phase alternator by direct load test
11. Synchronization of Alternator with Infinite Bus Bars
12. Measurement of sequence impedance of a three-phase alternator
13. Parallel operation of Single-phase Transformers

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.

B.Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
EE408PC	CONTROL SYSTEMS LAB	0	0	2	1

Prerequisites Electrical Circuit Analysis-I & Electrical Circuit Analysis-II

Course Description: 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, and Design controllers and compensators to improve system performance based on the assessments from time and frequency domain analyses.

Course Outcomes: After completion of this course, the students will be able to

C408.1: Design the state space model of a linear system using simulation.

C408.2: Analyze the response of systems in frequency & time domain.

C408.3: Calculate the transfer function and observe the effect of feedback on the systems

C408.4: Examine the effect of controllers & Compensators on the system.

Part-A

The following experiments are required to be conducted compulsory experiments:

1. Time response of Second order system
2. Characteristics of Synchro's
3. Programmable logic controller – Study and verification of truth tables of logic gates and simple Boolean expressions
4. Transfer function of DC generator
5. Characteristics of AC servo motor
6. Effect of P, PD, PI, PID Controller on a second order systems
7. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using suitable software
8. State space model for classical transfer function using suitable software -Verification.

Part-B

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

1. Effect of feedback on DC servo motor
2. Transfer function of DC motor
3. Temperature controller using PID
4. Lag and lead compensation – Magnitude and phase plot
5. Simulation of P, PI, PID Controller.
6. Linear system analysis (Time domain analysis, Error analysis) using suitable software
7. 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.

B. Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
EE409PC	DIGITAL ELECTRONICS LAB	0	0	2	1

Course Description: This course describes about the design and implementation of various Combinational and sequential circuits using 74XX ICs.

Course Outcomes: After completion of this course, the students will be able to

- C409.1** Realize Boolean functions and arithmetic circuits using gates
- C409.2** Design and verify various combinational circuits using gates.
- C409.3** Realize Boolean functions using Multiplexers and Decoders.
- C409.4** Design and verify shift registers and counters using flip-flops.

The following experiments are required to be conducted compulsory experiments:

1. Realization of Boolean Expressions using Gates
2. Design and realize all logic gates using Universal gates
3. Design and realize a Half adder, Full adder, half subtractor and Full subtractor using gates
4. Design and realize a 2-bit comparator using logic gates
5. Realize a 2 to 4 decoder using gates and design a 3 to 8 decoder using 2 to 4 decoders
6. Design and verify 4X1 mux using 2X1 mux
7. Realize and implement a given Boolean function using Decoder
8. Realize and implement a given Boolean function using Mux
9. Verify the truth tables of flip flops and convert given flip flop type to another
10. Design a n-bit Universal shift register using flip flops and multiplexers
11. Design a 4 bit asynchronous counter using flip flops
12. Design and verify Mod 8 synchronous counter.

Hardware Requirements:

1. Linear and Digital IC Trainer kits
2. Digital ICs 74xx series

B. Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
EE410SD	PCB DESIGN	0	0	2	1

Prerequisites

Course Description: This course introduces the fundamentals of PCB types, materials, fabrication processes, and international design standards. Students gain hands-on experience with industry-relevant PCB design and layout tools, while developing skills in schematic capture, component selection, placement, routing, and manufacturability checks. The course culminates in generating fabrication-ready outputs and fabricating/testing basic PCBs to bridge theory with practical application.

Course Outcomes: After completion of this course, the students will be able to

C410.1: Explain PCB design workflow from concept to fabrication

C410.2: Design circuit schematics and convert them into PCB layouts using EDA tools

C410.3: Apply design rules, ERC/DRC, and manufacturability constraints.

C410.4: **Generate** fabrication-ready outputs (Gerber, drill, BOM files) and **fabricate, assemble, and test** basic single-layer PCBs.

Module I: Fundamentals of PCB Design

- Evolution and role of PCBs in electronic systems
- Types of PCBs: single-layer, double-layer, multilayer, rigid, flexible
- PCB materials, stack-up basics and Manufacturing process overview
- PCB design rules and standards (IPC-2221, IPC-7351)
- Introduction to EDA tools (e.g., KiCad, Eagle, Altium, EasyEDA)

Lab Activity

- ✓ Exploring the user interface of PCB design software
- ✓ Setting up design rules

Module II: Schematic Design

- Creating circuit schematics using PCB CAD tools
- Component symbols and library management
- Net labeling and hierarchical schematics
- Electrical Rule Check (ERC)
- Netlist generation

Lab Activity

- ✓ Designing a basic power supply or LED flasher circuit
- ✓ Performing ERC and generating netlist

Module III: PCB Layout and Routing

- Netlist import and footprint assignment
- Component placement strategies
- Manual vs auto-routing
- Grounding and track width basics

Lab Activity

- ✓ Placing components and routing for the schematic designed earlier
- ✓ Performing DRC and correcting errors

Module IV: PCB Output Files and Fabrication

- Generating Gerber files, drill files, and BOM
- Understanding layers (Top, Bottom, Soldermask, Silkscreen)
- PCB printing, photoresist method, and etching
- Introduction to SMD and through-hole assembly

Lab Activity

- ✓ Generate Gerber files and preview using Gerber viewer
- ✓ Fabricate a basic single-layer PCB (simulation or actual lab process)

Module V: Mini Project and Testing

- Assembling components on fabricated PCB
- Soldering and desoldering techniques
- Continuity testing and troubleshooting
- Mini-project: Design a simple power supply, logic gate trainer, or timer circuit

Lab Activity

- ✓ Complete mini project: From schematic to testing of PCB

TEXT BOOKS

1. Walter C. Bosshart “Printed Circuit Board Design and Technology” Tata McGraw Hill
2. Clyde F. Coombs “Printed Circuit Boards: Design and Technology”: McGraw-Hill
3. Peter Dalmaris “PCB Design Using KiCad 6”

REFERENCE BOOKS

1. Kraig Mitzner “Complete PCB Design Using OrCAD Capture and PCB Editor”
2. James Angus “Electronic Product Design”

IPC Standards

1. IPC-2221: Generic Standard on Printed Board Design
2. IPC-7351: Generic Requirements for Surface Mount Design

Software Tools (Free/Open Source Recommended)

1. KiCad (Open-source)
2. EasyEDA (Online tool)
3. Eagle CAD (Free for education)
4. LTSpice / Tinkercad for circuit simulation (optional)