ACADEMIC REGULATIONS (BH23)
COURSE STRUCTURE AND
DETAILED SYLLABUS

ELECTRICAL AND ELECTRONICS ENGINEERING

B.Tech. Four Year Degree Course

(Applicable for the batches admitted from AY 2023-24 onwards)

VISHNU
UNIVERSAL LEARNING

BVRIT H

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

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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 (BH23) for B.Tech. Regular Students with effect from Academic Year 2023-24

The B.Tech. degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates, admitted to the programme and fulfill 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 4 Year (8 Semesters) **Bachelor of Technology** (B.Tech.) Degree Programme, under **Choice Based Credit System** (CBCS) with effect from the Academic Year 2023-24 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	12	Information Technology (IT)
5	66	Computer Science and Engineering (AI & ML)

2.0 Eligibility for admission

2.1 Admission to the undergraduate (UG) Programme shall be made either on the basis of the merit rank obtained by the qualified student in entrance test conducted by the Telangana State Government (TSEAMCET) 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 instructions for the entire undergraduate programme in Engineering & Technology will be English only.

3.0 B.Tech. Programme structure

3.1 A student after securing admission shall complete the B.Tech. Programme in a minimum period of **four** academic years (8 semesters), and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech. course. Each student shall secure 160 credits (with CGPA $\geq$ 5) required for the completion of the undergraduate programme and award of the B.Tech. degree.

3.2 UGC / AICTE specified definitions / descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations / norms, which are listed below.

3.2.1 Semester scheme

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

3.2.2 Credit courses

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

- One credit for one hour / week / semester for theory / lecture (L) courses or tutorials.
- One credit for two hours / week / semester for laboratory/ practical (P) courses.

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

3.2.3 Subject / Course Classification

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

S. No.	Broad Course Classification	Course Group /Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes Mathematics, Physics and Chemistry 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 discipline / department / branch of Engineering.
5	Elective Courses(EℓC)	PE – Professional Electives	Includes elective courses related to the parent discipline / department / branch of Engineering.
6		OE – Open Electives	Elective offered by all the disciplines / departments / branches of Engineering.

7	Core Courses	Project Work	B.Tech. project or UG project or UG major Project or Project Stage I & II
8		Industry Training / Internship / Industry Oriented Mini-project / Mini- Project / Skill Development Courses	Industry Training / Internship / Industry Oriented Mini-Project / Mini-Project / Skill Development Courses
9		Real-time Research Project/ Field Based Project	Real-time Research Project / Field Based Project
10		Seminar	Seminar / Colloquium based on core contents related to parent discipline/ department/ branch of Engineering.
11	Minor courses	-	1 or 2 Credit Courses (subset of HS)
12	Mandatory Courses(MC)	-	Mandatory Courses (non-credit)

4.0 Course registration

4.1 The academic section of the college invites **'registration forms'** from students before the beginning of the semester through **'online registration'**, ensuring **'date and time stamping'.** The online registration requests for any **'current semester'** shall be completed before the commencement of SEEs (Semester End Examinations) of the **'preceding semester'**.

4.2 A student can apply for on-line registration by consulting Faculty Advisor / Counselor / Head of the Department (HoD).

4.3 A student may be permitted to register for all the subjects / courses in a semester as specified in the course structure with maximum additional subject (s) / course (s) limited to 6 Credits (any 2 elective subjects), based on progress and SGPA / CGPA, and completion of the '**prerequisites'** as indicated for various subjects / courses, in the department course structure and syllabus contents.

4.4 Choice for '**additional subjects / courses'**, not more than any 2 elective subjects in any semester, must be clearly indicated.

4.5 If the student submits ambiguous choices or multiple options or erroneous entries during online registration for the subject (s) / course (s) under a given / specified course group / category as listed in the course structure, only the first mentioned subject / course in that category will be taken into consideration.

4.6 Subject / course options exercised through online registration are final and cannot be changed or inter-changed; further, alternate choices also will not be considered. However, if the subject / course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any inevitable or unexpected reasons, then the student shall be allowed to have alternate choice either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within a week after the commencement of class-work for that semester.

4.7 Dropping of subjects / courses may be permitted, only after obtaining prior approval from the faculty counselor and HoD **'within a period of 15 days'** from the beginning of the current semester.

4.8 **Open Electives:** The students have to choose three Open Electives (OE-I, II & III) from the list of Open Electives given by other departments. However, the student can opt for an Open Elective subject offered by her own (parent) department, if the student has not registered and not studied that subject under any category (Professional Core, Professional Electives, Mandatory Courses, etc.) offered by parent department in any semester. Open Elective subjects already studied should not repeat / should not match with any category (Professional Core, Professional Electives, Mandatory Courses, etc.) of subjects even in the forthcoming semesters.

4.9 **Professional Electives:** The students have to choose six Professional Electives (PE-I to VI) from the list of professional electives given.

5.0 Subjects / courses to be offered

5.1 An Elective Course may be offered to the students, only if a minimum of 30 students opt for it. The maximum strength of a section is limited to 75.

5.2 In case of options coming from students of other departments / branches / disciplines (not considering **open electives**), first priority shall be given to the student of the '**parent department'**.

6.0 Attendance requirements

6.1 A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects / courses (excluding attendance in mandatory courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab) for that semester. Two periods of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject. **This attendance should also be included in the fortnightly upload of attendance to the Academic Section.**

6.2 Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned by the Academic Council on genuine and valid

grounds, based on the student's representation with supporting evidence.

6.3 A stipulated fee shall be payable for condoning of shortage of attendance.

6.4 Shortage of attendance below 65% in aggregate shall in no case be condoned.

6.5 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled, including all academic credentials (internal marks, etc.) of that semester. They will not be promoted to the next semester. They may seek re-registration for all those subjects registered in that semester, in which the student is detained, by seeking re-admission into that semester as and when offered; if there are any professional electives and / or open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the same set of elective subjects offered under that category.

6.6 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

7.0 Academic requirements

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no.**6.**

7.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject / course, if the student secures not less than 35% (14 marks out of 40 marks) in the Continuous Internal Evaluation (CIE), not less than 35% (21 marks out of 60 marks) in the semester end examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing **'C'** grade or above in that subject / course.

7.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Real-Time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship (or) Seminar, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if she (i) does not submit a report on Industry Oriented Mini Project / Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in Real-Time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship evaluations.

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

7.3 Promotion Rules

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

7.4 A student (i) shall register for all courses / subjects covering 160 credits as specified and listed in the course structure, (ii) fulfills all the attendance and academic requirements for 160 credits, (iii) earn all 160 credits by securing SGPA ≥ 5.0 (in each semester), and CGPA ≥ 5.0 (at the end of 8 semesters), (iv) **passes all the**

mandatory courses, to successfully complete the undergraduate programme. The performance of the student in these 160 credits shall be considered for the calculation of the final CGPA **(at the end of undergraduate programme)**, and shall be indicated in the grade card / marks memo of IV-year II semester.

7.5 If a student registers for '**extra subjects'** (in the parent department or other departments / branches of Engineering.) other than those listed subjects totalling to 160 credits as specified in the course structure of her department, the performance in those '**extra subjects**' (although evaluated and graded using the same procedure as that of the required 160 credits) will not be taken into account while calculating the SGPA and CGPA. For such '**extra subjects'** registered, percentage of marks and letter grade alone will be indicated in the grade card as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations 6 and 7.1-7.4 above.

7.6 A student eligible to appear in the semester end examination for any subject / course, but absent from it or failed (thereby failing to secure 'C' grade or above) may reappear for that subject / course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject / course will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that subject.

7.7 A student **detained in a semester due to shortage of attendance may be re-admitted in the same semester in the next academic year for fulfillment of academic requirements.** The academic regulations under which a student has been readmitted shall be applicable. However, no grade allotments or SGPA / CGPA calculations will be done for the entire semester in which the student has been detained.

7.8 A student detained **due to lack of credits, shall be promoted to the next academic year only after acquiring the required academic credits.** The academic regulations under which the student has been readmitted shall be applicable to her.

8.0 Evaluation-Distribution and Weightage of marks

8.1 The performance of a student in every subject / course (including practicals and Project Stage - I & II) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination).

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

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

The objective / quiz paper is set with multiple choices, fill - in the blanks and match the following type of questions for a total of 10 marks. The descriptive paper shall contain 6 full questions out of which, the student has to answer 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).

The remaining 10 marks of Continuous Internal Evaluation are distributed as

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

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

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

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

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

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

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

There is NO Computer Based Test (CBT) for BH23 regulations.

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

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

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from each unit and may contain sub-questions. For

each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

The duration of Semester End Examination is 3 hours.

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

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

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

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

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

1. 10 marks for write-up
2. 15 for experiment / program
3. 15 for evaluation of results
4. 10 marks for presentation on another experiment / program in the same laboratory course and
5. 10 marks for viva-voce on concerned laboratory course.

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

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

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

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

1. I Year I Semester course (*ex.,* ***Elements of EEE / ECE / CSE*** *etc*): The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations are the final for 50 marks. Student shall have to earn 40%, i.e. 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if she (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.

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

   Part A: Objective / quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 20 marks. **Part B:** Descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks.

   The remaining 10 marks of Continuous Internal Evaluation are for Assignment (5 marks) and Subject Viva-Voce / PPT / Poster Presentation / Case Study (5 marks) and the evaluation pattern will remain same as for other theory subjects.

   For all other branches, the Continuous Internal Evaluation (CIE) will be for 50 marks. Out of the 50 marks for internal evaluation:

   a) A write-up on day-to-day experiment in the laboratory (in terms of aim, components/ procedure, expected outcome) which shall be evaluated for 10 marks

   b) **10 marks for viva-voce (**or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.

   c) Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for15 marks.

   d) The remaining 15 marks are for Laboratory Report/Project and Presentation, which consists of the Design (or) Software/Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

2. II Year II Semester *Real-Time (or) Field-based Research Project* course: The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations are the final for 50 marks. Student shall have to earn 40%, i.e. 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. 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 internal committee as per schedule, or (iii) secures less than 40% marks in this course.

8.5 There shall be Industry training (or) Internship (or) Industry oriented Mini-project (or) Skill Development Courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project in collaboration with an industry of their specialization. Students shall register for this immediately after II-Year II Semester Examinations and pursue it during summer vacation / semester break & during III Year without effecting regular course work. Internship at reputed organization (or) Skill development courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project shall be submitted in a report form and presented before the committee in III-year II semester before end semester examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project (or) Internship etc, Internal Supervisor and a Senior Faculty Member of the Department. There shall be **NO internal marks** for Industry Training (or) Internship (or) Mini-Project (or) Skill Development Courses (or) Paper Presentation in reputed journal (or) Industry Oriented Mini Project.

8.6 The UG project shall be initiated in the IV Year I Semester and the duration of the project work is one year. The student must present Project Stage - I during IV Year I Semester before II Mid examinations, in consultation with her Supervisor, the title, objective and plan of action of her Project work to the departmental committee for approval before commencement of IV Year II Semester. Only after obtaining the approval of the departmental committee, the student can start her project work.

8.7 UG project work shall be carried out in two stages: Project Stage - I for approval of project before Mid-II examinations in IV Year I Semester and Project Stage - II during IV Year II Semester. Student has to submit project work report at the end of IV Year II Semester. The project shall be evaluated for 100 marks before commencement of SEE Theory examinations.

8.8 For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall approve the project work to begin before II Mid-Term examination of IV Year I Semester. The student is deemed to be not eligible to register for the Project work, if he does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule.

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

8.9 For Project Stage –II, the external examiner shall evaluate the project work for 60 marks and the internal project committee shall evaluate it for 40 marks. Out of 40 internal marks, the departmental committee consisting of Head of the Department, Project Supervisor and a Senior Faculty Member shall evaluate the project work for 20 marks and Project Supervisor shall evaluate for 20 marks. The topics for Industry Oriented Mini Project / Internship / SDC etc. and the main Project shall be different from the topic already taken. The student is deemed to have failed, if 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.

For conducting viva-voce of project, Controller of Examinations / Chief Superintendent select an external examiner from the list of experts in the relevant branch submitted by the BoS Chairman of the concerned department.

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

8.10 A student shall be given only one time chance to re-register for a maximum of two subjects in a semester:

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

A student must re-register for the failed subject (s) for 40 marks within four weeks of commencement of the class work in next academic year.
In the event of the student taking this chance, her Continuous Internal Evaluation marks for 40 and Semester End Examination marks for 60 obtained in the previous attempt stand cancelled.

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

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

9.0 Grading procedure

9.1 Grades will be awarded to indicate the performance of students in each Theory Subject, Laboratory / Practical's, Seminar, Industry Oriented Mini Project, and Project Stage-I & II. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade shall be given.

9.2 As a measure of the performance of a student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

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

9.3 A student who has obtained an '**F'** grade in any subject shall be deemed to have '**failed'** and is required to reappear as a **'supplementary student'** in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier.

9.4 To a student who has not appeared for an examination in any subject, '**Ab'** grade will be allocated in that subject, and she is deemed to have '**failed'**. A student will be required to reappear as a **'supplementary student'** in the semester end examination, as and when offered next. In this case also, the internal marks in those subjects will remain the same as those obtained earlier.

9.5 A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

9.6 A student earns grade point (GP) in each subject / course, on the basis of the letter grade secured in that subject/ course. The corresponding **'credit points'** (CP) are computed by multiplying the grade point with credits for that particular subject/ course.

Credit Points (CP) = Grade Point (GP) x Credits for a course

9.7 A student passes the subject / course only when **GP ≥ 5 ('C' grade or above)**

9.8 The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points (∑CP) secured from all subjects / courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA is thus computed as

$$\textbf{SGPA} = \{ \sum_{i=1}^{N} C_i G_i \} / \{ \sum_{i=1}^{N} C_i \} \text{ .... for each semester}$$

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

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

$$\textbf{CGPA} = \{ \sum_{j=1}^{M} C_j G_j \} / \{ \sum_{j=1}^{M} C_j \} \quad \text{... for all S semesters registered}$$

(i.e., up to and inclusive of S semesters, S≥2),

where '**M'** is the **total** no. of subjects (as specifically required and listed under the course structure of the parent department) the student has '**registered'** i.e., from the1st semester onwards up to and inclusive of the 8th semester, 'j' is the subject indicator index (takes into account all subjects from 1 to 8 semesters), C_j is the no. of credits allotted to the j^{th} subject, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} subject. After registration and completion of I year I semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA:

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

SGPA = 152 / 21 = 7.24

Illustration of calculation of CGPA up to 3rd Semester:

Semester	Course/ Subject Title	Credits Allotted	Letter Grade Secured	Corresponding Grade Point (GP)	Credit Points (CP)
I	Course1	3	A	8	24
I	Course2	3	O	10	30
I	Course3	3	B	6	18
I	Course4	4	A	8	32
I	Course5	3	A+	9	27
I	Course6	4	C	5	20
II	Course7	4	B	6	24
II	Course8	4	A	8	32
II	Course9	3	C	5	15
II	Course10	3	O	10	30
II	Course11	3	B+	7	21
II	Course12	4	B	6	24
II	Course13	4	A	8	32
II	Course14	3	O	10	30
III	Course 15	2	A	8	16
III	Course 16	1	C	5	5
III	Course 17	4	O	10	40
III	Course 18	3	B+	7	21
III	Course 19	4	B	6	24
III	Course 20	4	A	8	32
III	Course 21	3	B+	7	21
	Total Credits	**69**		**Total Credit Points**	**518**

CGPA = 518 / 69 = 7.51

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

9.10 For merit ranking or comparison purposes or any other listing, **only** the '**rounded off'** values of the CGPAs will be used.

9.11 SGPA and CGPA of a semester will be mentioned in the semester Memorandum of Grades if all subjects of that semester are passed in first attempt. Otherwise the SGPA and CGPA shall be mentioned only on the Memorandum of Grades in which sitting she passed her last exam in that semester. However, mandatory courses will not be taken into consideration.

10.0 Passing standards

10.1 A student shall be declared successful or 'passed' in a semester, if she secures a GP ≥ 5.0 (**'C'** grade or above) in every subject / course in that semester (i.e. when the student gets an SGPA ≥ 5.0 at the end of that particular semester); and she shall be declared successful or 'passed' in the entire undergraduate programme, only when gets a CGPA ≥ 5.0 (**'C'** grade or above) for the award of the degree as required.

10.2 After the completion of each semester, a grade card or grade sheet shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, grade earned, etc.), credits earned. **There is No exemption of credits in any case**.

11.0 Declaration of results

11.1 Computation of SGPA and CGPA are done using the procedure listed in 9.6 to 9.9.

11.2 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used.

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

12.0 Award of degree

12.1 A student who registers for all the specified subjects / courses as listed in the course structure and secures the required number of 160 credits (with CGPA ≥ 5.0), within 8 academic years from the date of commencement of the first academic year, shall be declared to have '**qualified'** for the award of B.Tech. degree in the chosen branch of Engineering selected at the time of admission.

12.2 A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.

12.3 A student with final CGPA (at the end of the undergraduate programme) ≥ 8.00, and fulfilling the following conditions-shall be placed in '**first class with distinction'**.

However, she

(i) Should have passed all the subjects / courses in '**first appearance'** within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.

(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 ≥ 8.00 shall be placed in **'First Class'.**

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

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

12.6 All other students who qualify for the award of the degree (as per item 12.1), with final CGPA (at the end of the undergraduate programme) ≥ 5.00 but < 6.00, shall be placed in '**Pass Class**'.

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

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

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

1. A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and earned all the 80 credits (within 4 years from the date of admission) up to B.Tech. II Year II Semester, if the student wants to exit the 4-Year B.Tech. Programme and *requests for the 2 –Year* B.Tech. (*UG) Diploma Certificate.*

2. The student **once opted and awarded 2-Year UG Diploma Certificate, the student will be permitted to join** in B.Tech. III Year I Semester and continue for completion of remaining years of study for 4-Year B.Tech. Degree ONLY in the next academic year along with next batch students. *However, if any student wishes to continue the study after opting for exit, she should register for the subjects / courses in III Year I Semester before commencement of class work for that semester.*

3. *The students, who exit the 4-Year B.Tech. Programme after II Year of study and wish to re-join the B.Tech. Programme, must submit the 2 - Year* B.Tech. (*UG) Diploma Certificate awarded to her, subject to the eligibility for completion of Course / Degree.*

4. A student may be permitted to take one year break after completion of II Year II Semester or B.Tech. III Year II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in **next Academic Year in the same college** and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year Programme).

13.0 Withholding of results

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

14.0 Transitory Regulations

A. For students detained due to shortage of attendance:

1. A student, who has been detained in I Year of R18/R22 Regulations due to lack of attendance, shall be permitted to join I Year I Semester of BH23 Regulations and she is required to complete the study of B.Tech. Programme within the stipulated period of eight academic years from the date of first admission in I Year.
2. A student, who has been detained in any semester of II, III and IV years of R18/R22 regulations for want of attendance, shall be permitted to join the corresponding semester of BH23 Regulations and is required to complete the study of B.Tech. Within the stipulated period of eight academic years from the date of first admission in I Year. The BH23 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

3. A student of R18/R22 Regulations, who has been detained due to lack of credits, shall be promoted to the next semester of BH23 Regulations only after acquiring the required number of credits as per the corresponding regulations of her first admission. The total credits required are 160 including both R18/R22 & BH23 regulations. The student is required to complete the study of B.Tech. within the stipulated period of eight academic years from the year of first admission. The BH23 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in BH23 Regulations:

4. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.
5. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of her study including BH23 Regulations. **There is NO exemption of credits in any case**.
6. If a student is readmitted to BH23 Regulations and has any subject with 80% of syllabus common with her previous regulations, that particular subject in BH23 Regulations will be substituted by another subject to be recommended by the Academic Council (AC), and approved by Governing Body (GB).

Note: If a student readmitted to BH23 Regulations and has not studied any subjects / topics in her earlier regulations of study which is prerequisite for further subjects in BH23 Regulations, the concerned department HoD shall conduct remedial classes to cover those subjects / topics for the benefit of the students.

15.0 Student Transfers

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

15.2 The students seeking transfer to BVRITHCEW(A) from various other Universities / Institutions have to pass the failed subjects which are equivalent to the subjects of BVRITHCEW(A), and also pass the subjects of BVRITHCEW(A) which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of BVRITHCEW(A), the students have to study those subjects in BVRITHCEW(A) in spite of the fact that those subjects are repeated.

15.3 The BVRITHCEW(A) will provide one chance to write the internal examinations in the equivalent subject (s) to the students transferred from other universities / institutions, as per the clearance (equivalence) letter issued by the University.

16.0 Scope

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

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

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

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Academic Regulations (BH23) for B.Tech. (Lateral Entry Scheme) from the AY 2024-25

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

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

2. The student shall register for 120 credits and secure 120 credits with CGPA ≥ 5.0 from II year to IV year B.Tech. Programme (LES) for the award of B.Tech. degree.

3. The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.

4. The attendance requirements of B.Tech. (Regular) shall be applicable to B.Tech. (LES).

5. **Promotion rules**

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

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

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

Malpractices Rules

Disciplinary Action for Malpractices / Improper Conduct in Examinations

	Nature of Malpractices / Improper conduct	**Punishment**
	If the student:	
1.(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, she will be handed over to the police and a case is registered against her.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and allot her subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the student is to be cancelled.
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester / year. The student is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, she will be handed over to the police and a case is registered against her.

4.	Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting her to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the chief superintendent/assistant -superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walkout, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to her person or to any of her relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of her relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part there of inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.

8.	Possesses any lethal weapon or fire arm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.
9.	If student of the college, who is not a student for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester / year. The student is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared for including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester / year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the student has appeared for including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Chief Superintendent for further action to award a suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the students as per the above guidelines.

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Academic Regulations for B.Tech. with Minor program

1. Introduction

The philosophy behind Engineering as an academic discipline has been to orient the knowledge seekers in a manner that shatters the theoretical boundaries and pushes them into the realms of a practical world view.

The emphasis of BVRITHCEW has always been to orient the students towards the technologies that shall drive the world in the years to come; with this philosophy the Institution has decided to launch the **Bachelor of Technology in a particular branch with minor in a specified program** (Ex. B.Tech. in ECE / EEE with Minor in AI&ML) from the AY 2025-26 onwards.

The **Bachelor of Technology (B.Tech.) with Minor** program focuses on the fundamental principles of multiple Engineering disciplines, critical & analytical thinking and the ability to develop a distinctive approach to the interdisciplinary problems.

2. Objectives

The key objectives of offering B.Tech. with Minor program are:

- To expand the domain knowledge of the students in one of the other branches of engineering.
- To increase the employability of undergraduate students keeping in view of better opportunity in inter-disciplinary areas of engineering & technology.
- To provide an opportunity to students to pursue their higher studies in the inter-disciplinary areas in addition to their own branch of study.
- To offer the knowledge in the areas which are identified as emerging technologies / thrust areas of Engineering.

3. Minor courses and the offering departments

S. No.	Minor Program	Eligible branch of students	@Offering Department	Award of Degree
1.	Data Science	All branches, except B.Tech. in CSE (Data Science) / B.Tech. (Data Science)	CSE	"B.Tech.in branch name with Minor in Data Science"
2.	IOT	All branches, except B.Tech. in CSE (IOT) / B.Tech. (IOT)	ECE	"B.Tech. in branch name with Minor in IOT"
3.	Innovation and Entrepreneurship	All branches	Management Science / MBA	"B.Tech. in branch name with Minor in Innovation and Entrepreneurship"

Note: @As per AICTE guidelines.

4. Academic Regulations for B.Tech. Degree with Minor programs

1. The weekly instruction hours, internal & external evaluation and award of grades

are on par with regular 4-Years B.Tech. program.

2. For B.Tech. with Minor, a student needs to earn additional 18 credits (over and above the required 160 credits for B.Tech degree). All these 18 credits need to be completed in III year and IV year only.
3. After registering for the Minor program, if a student is unable to earn all the required 18 credits in a specified duration (twice the duration of the course), she shall not be awarded Minor degree. However, if the student earns all the required 160 credits of B.Tech., she will be awarded only B. Tech degree in the concerned branch.
4. There is no transfer of credits from Minor program courses to regular B.Tech. degree course & vice versa.
5. These 18 credits are to be earned from the additional courses offered by the host department in the college as well as from the MOOCs platform.
6. For the course selected under MOOCs platform following guidelines may be followed:
    a) Prior to registration of MOOCs courses, formal approval of the courses, by the Academic Council is essential. Academic Council considers the parameters viz., the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation, etc. before the issue of approval.
    b) Minimum credits for MOOCs course must be equal to or more than the credits specified in the Minor course structure provided by the University.
    c) Only Pass-grade / marks or above shall be considered for inclusion of grades in minor grade memo.
    d) Any expenses incurred for the MOOCs courses are to be met by the students only.
7. The choice to opt/ take a Minor program is purely on the choice of the students.
8. The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Minor program at any time; and in that case the student will be awarded only B.Tech. degree in the concerned branch on earning the required credits of 160.
9. The student can choose only one Minor program along with her basic engineering degree. **A student, who chooses an Honors program, is not eligible to choose a Minor program and vice-versa.**
10. The B.Tech. with a Minor program shall be offered from the AY 2025-26 onwards. The students, pursuing their III year I semester from the AY 2025-26 onwards can register for the Minor program if they fulfill the eligibility criteria.

11. A student can graduate with a Minor if she fulfils the requirements for her regular B.Tech. program as well as fulfils the requirements for Minor program.
12. The institute shall maintain a record of students registered and pursuing their Minor programs, minor program-wise and parent branch-wise.
13. The concerned department shall prepare the time-tables for each Minor course offered at without any overlap / clash with other courses of study in the respective semesters.

5. Eligibility conditions for the student to register for Minor course

a) A student can opt for B.Tech. degree with Minor program if she has no active backlogs till II Year I Semester (III semester) at the time of entering into III year I semester.

b) Prior approval of mentor and Head of the Department for the enrolment into Minor program, before commencement of III year I Semester (V Semester), is mandatory

c) If more than 50% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 50%.

6. Registration for the courses in Minor Program

d) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in semester.

e) The students should choose a course from the list against each semester (from Minors course structure) other than the courses they have studied / registered for regular B.Tech. programme. No course should be identical to that of the regular B.Tech. course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

f) The maximum no. of courses for the Minor is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

g) The registration fee to be collected from the students by the College is **Rs. 1000/-** per one credit.

h) A fee for late registration may be imposed as per the norms.

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Academic Regulations (BH23) for B.Tech. with Honors program

1. Objectives

The key objectives of offering B.Tech. with Honors program are:

- To expand the domain knowledge of the students laterally and vertically.
- To increase the employability of undergraduate students with expanded knowledge in one of the core Engineering disciplines.
- To provide an opportunity for the students to pursue their higher studies in wider range of specializations.

2. Academic Regulations for B.Tech. Honors degree

1) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B.Tech. program.
2) For B.Tech with Honors program, a student needs to earn additional 20 credits (over and above the required 160 credits for B.Tech. degree). All these 20 credits need to be completed in III year and IV year only.
3) After registering for the Honors program, if a student is unable to pass all courses in first attempt and earn the required 20 credits, she shall not be awarded Honors degree. However, if the student earns all the required 160 credits of B.Tech., she will be awarded only B.Tech. degree in the concerned branch.
4) There is no transfer of credits from courses of Honors program to regular B.Tech. degree course & vice versa.
5) These 20 credits are to be earned from the additional courses offered by the host department in the college or from a closely related department in the college as well as from the MOOCs platform.
6) For the courses selected under MOOCs platform following guidelines may be followed:
    a) Prior to registration of MOOCS courses, formal approval of the courses, by the Academic Council is essential. The Academic Council considers the parameters viz., the institute / agency, offering the course, syllabus, credits, duration of the programme and mode of evaluation, etc., before the issue of approval
    b) Minimum credits for a MOOCS course must be equal to or more than the credits specified in the Honors course structure provided by the Institution.
    c) Only Pass-grade / marks or above shall be considered for inclusion of grades in the Honors grade memo.
    d) Any expenses incurred for the MOOCS courses are to be met by the students only.
7) The choice to opt / take the Honors program is purely on the choice of the students.

8) The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Honors program at anytime; and in that case the student will be awarded only B.Tech. degree in the concerned branch on earning the required credits of 160.

9) The students of every branch can choose Honors program in their respective branches if they are eligible for the Honors program. A student who chooses an Honors program is not eligible to choose a Minor program and vice-versa.

10) The B.Tech. with Honors program shall be offered from the AY 2025-26 onwards. The students, pursuing their III year I semester from the AY 2025-26 onwards can register for the Honors program if they fulfill the eligibility criteria.

11) A student can graduate with Honors if she fulfils the requirements for her regular B.Tech. program as well as fulfils the requirements for Honors program.

12) The Institution shall maintain a record of students registered and pursuing their Honors programs branch-wise.

13) The department shall prepare the time-tables for each Honors program offered at their respective departments without any overlap / clash with other courses of study in the respective semesters.

3. Eligibility conditions of the students for the Honors degree

a) A student can opt for B.Tech. degree with Honors, if she passed all subjects in first attempt in all the semesters till the results announced and maintaining 7.5 or more CGPA.

b) If a student fails in any registered course of either B.Tech. or Honors in any semester of four years program, she will not be eligible for obtaining Honors degree. She will be eligible for only B.Tech. degree

c) Prior approval of mentor and Head of the Department for the enrolment into Honors program, before commencement of III year I Semester (V Semester), is mandatory.

d) If more than 30% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 30%. The criteria to be followed for choosing 30% candidates in a branch may be the CGPA secured by the students till II year I semester.

e) The department concerned should be preferably NBA accredited and shall offer at least one M.Tech. Program.

f) Successful completion of 20 credits earmarked for Honors program with at least 7.5 CGPA along with successful completion of 160 credits earmarked for regular B.Tech. Program with at least 7.5 CGPA and passing all subjects in first attempt gives the eligibility for the award of B. Tech. (Honors) degree.

g) For CGPA calculation of B.Tech. course, the 20 credits of Honors program will not be considered.

4. Registration for the course in Honors program

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.

b) The students should choose a course from the list against each semester (from Honors course structure) other than the courses they have studied / registered for regular B.Tech. programme. No course should be identical to that of the regular B.Tech. course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

c) The maximum no. of courses for the Honors is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is **Rs. 1000/-** per one credit.

e) A fee for late registration may be imposed as per the norms.

5. The broad guidelines for the courses of Honors program, their respective credits weightage and semester-wise break-up of the course are:

S. No.	Year /Semester	Course to be chosen from/studied	Mode of Learning	No. of Credits
1	III-I	PE-I or PE-II	Blended/Conventional	3
2	III-II	Research Methodologies	Conventional	3
3	III-II	PE-III	Conventional	3
4	IV-I	PE-IV	Conventional	3
5	IV-I	PE-V	Conventional	3
6	IV-II	Technical Paper writing	Under the mentorship of a supervisor	2
7	IV-II	PE-VI or an Inter-disciplinary subject as suggested by the Academic Council	MOOCs	3
	Total Credits			20

Note:

i. Professional Elective (PE) course should be selected (which is not studied) from each Professional Electives' list provided in regular B.Tech. course.

ii. Courses can be chosen as in above table.

1. **Technical paper writing:**
   a) The student shall take up a problem / topic of engineering branches (inter-disciplinary nature) and apply the knowledge which they acquired while pursuing their engineering branch. It is expected to analyze, design and develop an application for the identified problem and write a technical paper / document.

      Alternatively, the student i) shall identify a research topic, analyze the problem, carryout the experiments, write a technical paper and publish in / communicate for a Scopus indexed journal / any journal with decent reputation or ii) Demonstrate a talent / an idea / development of an innovative product.

   b) The evaluation shall be done by the same committee which is constituted for project evaluation, along with the final semester project work.

   c) The students should start exploration for the Technical Paper Writing immediately after the semester exams of III-II semester. Only the evaluation part shall be carried in IV-II semester.

2. The institute shall offer a course on Research Methodologies by combining the students of all branches (if the number of students is more, multiple parallel sessions may be conducted). The time slots in the time-tables of respective branches should be aligned. Both the CIE and SEE for the Research Methodologies course shall be done as regular B.Tech. courses.

3. If the blended course option is chosen, for the subject in III-I semester, the learning should be partially in online mode and partially in offline mode. The external evaluation shall be done as regular B.Tech. courses; however, for the CIE component, online assessment should also be taken into account while finalizing the internal marks by the course teacher.

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Academic Regulations for B.Tech. - MOOCs

1. Introduction

As per NEP, to inculcate the habit of self-learning and in compliance with the UGC guidelines, MOOC (Massive Open Online Courses) have been introduced.

The proposed MOOCs would be additional choices, proposed by concern department BoS (having credits >= the required credits) and approved by the Academic Council, in all the elective group courses subjected to the availability in the MOOC platforms during the respective semesters.

After the approval, at the beginning of the semester, the concerned departments shall declare the list of permitted courses to the student.

The progress of the MOOCs shall be monitored by the course coordinator of the department, nominated by the concerned HoD.

2. 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 a 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.

3. Course Registration

Students interested in pursuing MOOCs shall register the course title at their department office before the start of the semester.

A student can register at most two MOOCs throughout the course of study after approval from Faculty Advisor / Counselor / HoD.

Detailed guidelines regarding credit transfer of the courses pursued through MOOC (NPTEL-SWAYAM) shall be issued time to time by the Institution.

Academic Regulations for B.Tech. - Acceleration of Course Work

1. 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 the final semester.

2. 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 a 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.

3. 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.

COURSE STRUCTURE (BH23 Regulations)
Applicable from A.Y. 2023-24 Batch

I Year I – Semester

S.No	Course Code	Course Title	L	T	P	Credits
1	**MA101BS**	Matrices and Calculus	3	1	0	4
2	**CH102BS**	Engineering Chemistry	3	1	0	4
3	**EE103ES**	C Programming and Data structures	3	0	0	3
4	**EE104ES**	Electrical Circuit Analysis -1	3	0	0	3
5	**EN105HS**	English for Skill Enhancement	2	0	0	2
6	**EE106ES**	Elements of Electrical and Electronics Engineering	0	0	2	1
7	**CH107BS**	Engineering Chemistry Laboratory	0	0	2	1
8	**EE108ES**	C Programming and Data structures Laboratory	0	0	2	1
9	**EN109HS**	English Language and Communication Skills Laboratory	0	0	2	1
		Induction Program				
		Total	**14**	**2**	**8**	**20**

I Year II - Semester

S.No	Course Code	Course Title	L	T	P	Credits
1	**MA201BS**	Ordinary Differential Equations and Vector Calculus	3	1	0	4
2	**PH202BS**	Applied Physics	3	1	0	4
3	**ME203ES**	Computer Aided Engineering Graphics	1	0	4	3
4	**ME204ES**	Engineering Workshop	0	1	3	2.5
5	**EE205ES**	Electrical Circuit Analysis-II	2	0	0	2
6	**EE206ES**	Applied Python Programming Laboratory	0	1	2	2
7	**PH207BS**	Applied Physics Laboratory	0	0	3	1.5
8	**EE208ES**	Electrical Circuit Analysis Laboratory	0	0	2	1
		Total	**9**	**4**	**14**	**20**

II Year I - Semester

S. No	Course Code	Course Title	L	T	P	Credits
1	**MA301BS**	Numerical Methods and Complex Variables	3	1	0	4
2	**EE302PC**	Electrical Machines-I	3	1	0	4
3	**EE303PC**	Analog Electronic Circuits	3	0	0	3
4	**EE304PC**	Power System-I	3	0	0	3
5	**EE305PC**	Electro Magnetic Fields	3	0	0	3
6	**EE306PC**	Electrical Machines Laboratory-I	0	0	2	1
7	**EE307PC**	Analog Electronic Circuits Laboratory	0	0	2	1
8	**EE308PC**	Electrical Simulation tools Laboratory	0	0	2	1
9	**MC311**	Environmental Science	3	0	0	0
		Total	**15**	**2**	**8**	**20**

II Year II – Semester

S. No	Course Code	Course Title	L	T	P	Credits
1	**ME401ES**	Solid Mechanics and Hydraulic Machines	3	1	0	4
2	**EE402PC**	Measurements and Instrumentation	3	0	0	3
3	**EE403PC**	Electrical Machines–II	3	0	0	3
4	**EE404PC**	Digital Electronics	2	0	0	2
5	**EE405PC**	Power System-II	3	0	0	3
6	**EE406PC**	Digital Electronics Laboratory	0	0	2	1
7	**EE407PC**	Measurements and Instrumentation Laboratory	0	0	2	1
8	**EE408PC**	Electrical Machines Laboratory-II	0	0	2	1
9	**EE409PC**	Real-time Research Project / Field Based Project	0	0	4	2
10	**MC410**	Gender Sensitization Lab	0	0	2	0
		Total	**14**	**1**	**12**	**20**

III Year I – Semester

S.No	Course Code	Course Title	L	T	P	Credits
1	**EE501PC**	Power Electronics	3	1	0	4
2	**EE502PC**	Control Systems	3	1	0	4
3	**EE503PC**	Microprocessors and Microcontrollers	3	0	0	3
4		**Professional Elective – I**	3	0	0	3
5	**EE504PC**	Power System Protection	3	0	0	3
6	**EE505PC**	Power Electronics Laboratory	0	0	2	1
7	**EE506PC**	Control Systems Laboratory	0	0	2	1
8	**EE507PC**	Microprocessors and Microcontrollers Laboratory	0	0	2	1
9	**MC508**	Intellectual Property Rights	3	0	0	0
		Total	**18**	**2**	**6**	**20**

III Year II – Semester

S.No	Course Code	Course Title	L	T	P	Credits
1		**Open Elective-I**	3	0	0	3
2		**Professional Elective-II**	3	0	0	3
3	**SM601MS**	Business Economics and Financial Analysis	3	0	0	3
4	**EE602PC**	Signals and Systems	3	0	0	3
5	**EE603PC**	Power System Operation and Control	3	0	0	3
6	**EE604PC**	Power System Laboratory	0	0	2	1
7	**EN605HS**	Advanced English Communication Skills Laboratory	0	0	2	1
8	**EE606PC**	Digital Signal Processing Lab	0	0	2	1
9	**EE607PC**	Industry Oriented Mini Project/ Internship	0	0	4	2
10	**MC608**	Constitution of India	3	0	0	0
		Total	**18**	**0**	**10**	**20**

IV Year I – Semester

S. No	Course Code	Course Title	L	T	P	Credits
1	**SM701MS**	Fundamentals of Management for Engineers	2	0	0	2
2	**EE702PC**	Power Electronic Applications to Renewable Energy Systems	3	1	0	4
3		**Open Elective-II**	3	0	0	3
4		**Professional Elective-III**	3	0	0	3
5		**Professional Elective-IV**	3	0	0	3
6	**EE703PC**	Simulation of Renewable Energy Systems Laboratory	0	0	4	2
7	**EE704PC**	Project Stage - I	0	0	6	3
		Total	**14**	**1**	**10**	**20**

IV Year II – Semester

S. No	Course Code	Course Title	L	T	P	Credits
1		**Open Elective-III**	3	0	0	3
2		**Professional Elective-V**	3	0	0	3
3		**Professional Elective-VI**	3	0	0	3
4	**EE801PC**	Project Stage – II including Seminar	0	0	22	11
		Total	**9**	**0**	**22**	**20**

Professional Electives

PE-I	**EE511PE**	Programmable Logic Controller
	EE512PE	High Voltage Engineering
	EE513PE	Computer Aided Electrical Machine Design
	EE514PE	Automotive Engineering
PE-II	**EE611PE**	Wind and Solar Energy systems
	EE612PE	Neural networks & fuzzy logic control
	EE613PE	Energy storage systems & management
	EE614PE	Optimization techniques
PE-III	**EE711PE**	Digital Signal Processing
	EE712PE	Electric and Hybrid Vehicles
	EE713PE	Battery Energy Management Systems
	EE714PE	Sensing techniques and sensor systems
PE-IV	**EE721PE**	HVDC Transmission
	EE722PE	Embedded applications
	EE723PE	Power Converters for RES
	EE724PE	Power System Stability
PE-V	**EE811PE**	Power Quality & FACTS
	EE812PE	Solar Power Batteries
	EE813PE	AI Techniques in Electrical Engineering
	EE814PE	Electric Vehicle Architecture
PE-VI	**EE821PE**	Smart Grid Technologies
	EE822PE	Electrical Distribution Systems
	EE823PE	Machine Learning Applications to Electrical Engineering
	EE824PE	Cyber-Physical Systems

Open Electives

Open Electives	Department Offering	Course Code	Course Name
OE-I	EEE	EE600OE	Renewable Energy Sources
		EE601OE	Green Energy Technologies
		EE602OE	Fundamentals of Electric Vehicles
	ECE	EC600OE	Microcontrollers
		EC601OE	Fundamentals of IoT
		EC602OE	VLSI Design
	CSE/ CSE(AIML) /IT	CS600OE	Problem Solving using Data Structure
		CS601OE	Java Programming
		CS602OE	Fundamentals of AI
OE-II	EEE	EE700OE	Utilization of Electrical Energy
		EE701OE	Electric Drives and Control
		EE702OE	Principles of Power Systems
	ECE	EC700OE	Electronic Sensors
		EC701OE	Digital Image Processing
		EC702OE	Principles of Communications
	CSE/ CSE(AIML) /IT	CS700OE	Scripting Languages
		CS701OE	Database Management Systems
		CS702OE	Machine Learning
OE-III	EEE	EE800OE	Basics of Power Plant Engineering
		EE801OE	Energy Sources and Applications
		EE802OE	Battery Management Systems
	ECE	EC800OE	Electronic Measurements and Instrumentation
		EC801OE	Embedded System Design
		EC802OE	FPGA based System Design
	CSE/ CSE(AIML) /IT	CS800OE	Operating Systems
		CS801OE	Software Engineering
		CS802OE	Computer Networks

B.Tech I Year I Semester

Course Code	Course Title	L	T	P	Credits
MA101BS	**MATRICES AND CALCULUS**	3	1	0	4

Prerequisites Mathematical Knowledge at pre-university level

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 vectors, Reduction of Quadratic form to canonical forms, Mean value theorems, Improper Integration and their applications of beta, gamma functions, Maxima and minima of functions of two variables and three variables, Partial Differentiation, 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: Find the Eigen values and Eigen vectors and reduce the Quadratic form to canonical Form.

C101.3: Apply Mean value theorems for given functions

C101.4: Evaluate the improper integrals using Beta and Gamma functions

C101.5: Find the extreme values of functions of two variables with/ without constraints.

C101.6: Evaluate the multiple integrals and apply the concept to find areas, volumes

Unit – I Matrices

Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss- Jordan method, System of linear equations: 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

Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series, Maclaurin Series.

Definition of Improper Integrals: Beta, Gamma functions and their properties, Relation between Beta & Gamma functions and their applications.

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 (Cartesian to polar) for double integrals. Evaluation of triple integrals (Cartesian 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.

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, 2002, Pearson.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 2008, Laxmi Publications, Reprint.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
CH102BS	ENGINEERING CHEMISTRY	3	1	0	4

Prerequisites Fundamental knowledge and solid understanding of 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, analyze chemical reactions, and apply chemical concepts in engineering practice.

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

C102.1: Analyze the basic properties of water and its usage in domestic and industrial purposes.

C102.2: Inspect the working principles and reaction mechanisms of various energy storage devices

C102.3: Acquire the basic knowledge of electrochemical procedures related to corrosion and its control.

C102.4: Impart the fundamental knowledge and sustainability implemented through smart engineering materials.

C102.5: Distinguish various energy sources to prioritise eco-friendly fuels for environmentally sustainable development.

C102.6: Discriminate the limitations of conventional basic engineering materials for developing multiphase materials.

Unit – I Water and its Treatment

Hardness of water – Types of hardness, Units, Estimation of hardness of water by complexometric method; numerical problems. Potable water and its specifications - Steps involved in the treatment of potable water - Disinfection of potable water by ozonisation and chlorination - breakpoint chlorination. Defluoridation - Determination of F^- ion by ion-selective electrode method. Boiler troubles: Sludges, Scales and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning, External treatment methods - Softening of water by ion- exchange processes. Desalination of Brackish water – Reverse osmosis.

Unit – II Battery Chemistry and Corrosion

Introduction to Electrochemistry- Galvanic Cells, Electrode Potentials, Nernst Equation, EMF of the cell, Cell representation. Classification of batteries- primary, secondary, flow and reserve batteries with examples. Basic requirements for commercial batteries. Construction, working and applications of Zn-air, Pb/$HClO_4$ and Lithium-ion battery, Applications of Li-ion battery to electrical vehicles. Fuel Cells- Differences between battery and a fuel cell, Construction and applications of Methanol Oxygen fuel cell and Solid oxide fuel cell.

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

Unit– III Polymeric Materials

Definition – Classification of polymers with examples – Types of polymerization – addition (free radical addition) and condensation polymerization with examples – Nylon 6:6, Terylene Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, Preparation, Properties and engineering applications of PVC and Bakelite, Teflon, Fiber reinforced plastics (FRP).

Rubbers: Natural rubber and its vulcanization.

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

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

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

Unit – IV Energy Sources

Calorific value of fuel – HCV, LCV- Dulongs formula. Classification- solid fuels: coal – analysis of coal – Proximate and Ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking types – moving bed catalytic cracking. Knocking – octane and cetane rating, Gaseous fuels – composition and uses of natural gas, LPG and CNG, Biodiesel – Transesterification, advantages. Hydrogen as fuel-Production, Storage & applications.

Unit – V Engineering Materials

Composites: Introduction- Constituents of composites – advantages, classification and constituents of composites. Applications of composites.

Smart Materials and Engineering Applications: Smart Materials- Classification- (Piezo-electric materials, Shape Memory Alloys, Thermoresponse Materials, Magnetorhetroic Materials, Smart Polymers) SMAs-Nitinol. Thermoresponse materials- Poly vinyl amides.

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

TEXT BOOKS

1. P.C. Jain and M. Jain, Engineering Chemistry, 16th Edition, 2010, Dhanpatrai Publishing.
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, 2022, Cengage Publications.

REFERENCE BOOKS

1. H.D. Gesser, Applied Chemistry: A Textbook for Engineers and Technologists, 1st Edition, 2002, Springer New York.
2. Jaya Shree Anireddy, Textbook of Engineering Chemistry, 1st Edition, 2018, Wiley.
3. M. Thirumala Chary, E. Laxminarayana, Engineering Chemistry, 3rd Edition, 2016, Scitech Publishers.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
EE103ES	**C PROGRAMMING AND DATA STRUCTURES**	3	0	0	3

Course Description: The course covers the fundamentals of C programming, control structures, functions, derived data types and files concepts. It also focuses on various data structures, such as linked lists, stacks, queues and their implementation in C.

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

C103.1: Explore the basic constructs of C Programming Language.

C103.2: Implement control structures & apply the concepts of modular programming.

C103.3: Develop C programs to demonstrate the applications of derived data types such as arrays and pointers

C103.4: Apply the knowledge of various string handling functions.

C103.5: Explore user defined data types and file handling functions using C.

C103.6: Describe Linear data structures used for problem solving.

Unit-I Introduction to Programming

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Representation of an algorithm, flowchart and Pseudocode.

Introduction to C Language – Background, Simple C programs, Identifiers, Basic data types, Variables, Constants, Input / Output.

Structure of a C Program – Operators, Expressions, Precedence and Associatively, Expression Evaluation, Type conversions.

Unit -II Control Statements, Functions and Arrays

Statements – if and switch statements, Repetition statements – while, for, do-while statements, Loop examples, other statements related to looping – break, continue, go to.

Designing Structured Programs-Functions, basics, user defined functions, inter function communication, standard functions, Recursion.

Arrays – Concepts, using arrays in C, inter function communication, array applications, two – dimensional arrays, multidimensional arrays, searching and sorting.

Unit-III Pointers and Strings

Pointers – Introduction, Pointers for inter function communication, pointers to pointers, compatibility, Pointer Applications – Passing an array to a function, Memory allocation functions, array of pointers.

Strings – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion.

Unit-IV Structures and File Handling

Derived types –The Typedef, enumerated types, Structures – Declaration, definition and initialization of structures, accessing structures, operations on structures, complex structures.

Unions – Referencing unions, initializers, unions and structures.
Input and Output – Text vs Binary streams, standard library functions for files, converting file types, File programs – copy, merge files.

Unit-V Data Structures

Data Structures – Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations.

TEXT BOOKS

1. B.A.Forouzan and R.F. Gilberg, C Programming & Data Structures, 3rd Edition, Cengage Learning.
2. J.R. Hanly and E.B. Koffman, Problem Solving and Program Design in C, 5th Edition, Pearson Education.
3. B.W. Kernighan and Dennis M.Ritchie, The C Programming Language, PHI/Pearson Education.

REFERENCE BOOKS

1. P. Padmanabham, C & Data structures, 3rd Edition, B.S. Publications.
2. J.A. Jones & K. Harrow, C Programming with problem solving, Dreamtech Press
3. Stephen G. Kochan, Programming in C, 3rd Edition, Pearson Education.
4. H. Cheng, C for Engineers and Scientists, McGraw-Hill International Edition
5. A. M. Tanenbaum, Y. Langsam, and M.J. Augenstein, Data Structures using C, Pearson Education / PHI
6. E. Balagurusamy, C Programming & Data Structures, TMH.
7. P. Dey, M Ghosh R Thereja, C Programming & Data Structures, Oxford University Press.
8. E V Prasad and N B Venkateswarlu, C & Data structures, S. Chand & Co.

B.Tech. I Year I Semester

Course code	Course Title	L	T	P	Credits
EE104ES	**ELECTRICAL CIRCUIT ANALYSIS - I**	**3**	**0**	**0**	**3**

Course Description: This is the first undergraduate course in electric circuits and it is a foundation course for all subjects of the Electrical Engineering discipline. This course begins with the basic introduction of all the elements in electrical Engineering and later with its connections and analysis. AC circuit analysis is studied for both single phase and Poly phase circuits too. Various electrical circuit theorems are analyzed in this subject.

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

C104.1: Analyze DC electrical networks using different approaches.

C104.2: Analyze AC electrical networks using different approaches.

C104.3: Solve the DC electrical circuits using various theorems.

C104.4: Solve the AC electrical circuits using various theorems.

C104.5: Analyze the Poly phase circuits for both balanced and unbalanced loads.

C104.6: Analyze magnetic circuits and form Dual 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 transformations, Star-delta transformations, Node voltage method, Mesh current method including super node and super mesh analysis.

Unit-II Single Phase Circuits and Resonance

RMS and Average values of periodic sinusoidal and non- sinusoidal waveforms, Phasor representation, Steady-state response of series, parallel and series-parallel circuits. Impedance, Admittance, Current locus diagrams of RL and RC series with variation of parameters.

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

Unit-III Network Theorems

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

Unit-IV Poly Phase Circuits

Analysis of balanced and unbalanced 3-phase circuits, Star and delta connections, Measurement of Three Phase power for balanced and unbalanced loads.

Unit-V Coupled Circuits and Duality

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

Concepts of Duality and Dual Networks.

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

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
EN105HS	**ENGLISH FOR SKILL ENHANCEMENT**	2	0	0	2

Course Description: With the growing importance of English as a tool for global technical communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop the linguistic, communicative, creative and critical thinking competencies of Engineering students. In English classes, the focus should be on the skills development in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed text for detailed study. The students should be encouraged to read the texts leading to reading comprehension and different passages may be given for practice in the class. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material etc. The focus in this syllabus is on skill development.

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

C105.1 Apply English language effectively in spoken and written forms

C105.2 Analyze the given texts and essence of poem ,respond appropriately

C105.3 Apply various grammatical structures in personal and academic fronts.

C105.4 Develop appropriate vocabulary for professional communication

C105.5 Make use of competency in various forms of academic and professional writing.

C105.6 Improve language skills for the enhancement of employability opportunities.

Unit – I Toasted English by R.K.Narayan

Vocabulary: The concept of Word Formation, Prefixes and Suffixes

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

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

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

Unit – II Appro JRD by SudhaMurty

Vocabulary: Words Often Confused, Homophones, Homonyms and Homographs & collocations

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

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

Writing Skills: Nature and Style of Writing

Unit – III The Character of a Happy Life by Sir Henry Wotton(Poem)

Vocabulary: Words Often Misspelt, - Words from Foreign Languages and their Use in

English.
Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.
Reading Skills: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice.
Writing Skills: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/Resume.

Unit – IV Art and Literature by Abdul Kalam

Vocabulary: Standard Abbreviations in English.

Grammar: Redundancies and Clichés in Oral and Written Communication

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

Writing Skills: Writing Practices- Essay Writing-Writing Introduction, Body and Conclusion

Unit – V Go, Kiss the World by Subroto Bagchi

Vocabulary: Technical Vocabulary and their Usage

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

Reading Skills: Reading Comprehension-Exercises for Practice

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

TEXT BOOKS

1. Board of Editors English: Language, Context and Culture, Orient Black Swan Pvt. Ltd, Hyderabad. 2022. Print.

REFERENCE BOOKS

1. Liss and Davis, Effective Academic Writing, 2nd Edition, 2017, Oxford University Press.
2. Wood F.T, Remedial English Grammar, 2017, 2nd Edition, Macmillan.
3. Wiley, Technical Communication, 2019, India Pvt. Ltd.
4. Swan, Michael, Practical English Usage, 4th Edition, 2016, Oxford University Press.

B. Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
EE106ES	ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING	0	0	2	1

Course Description: This lab deals with the understanding basic concepts in Electrical and Electronics Engineering. It begins with the basic electric circuits, covering theorems and then machines. Basic electronics circuits and PCB design of circuits are worked in this lab. Concepts of PV Cell, Control systems and Power system are also covered.

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

C106.1: Verify the basic Electrical circuits with theorems.

C106.2: Perform experiments on three phase systems.

C106.3: Perform experiments on basic electronic circuits.

C106.4: Evaluate the performance calculations of Electrical Machines and Transformers through various testing methods.

List of Experiments/Demonstrations:

PART-A (Compulsory)

1. Verification of KVL and KCL.
2. Verification of Thevenin's and Norton's theorem.
3. Performance Characteristics of a DC Shunt Motor.
4. Measurement of Active Power for Star and Delta connected balanced loads.
5. Determination of Co-efficient of Coupling and Separation of Self and Mutual inductance in a Coupled Circuits.
6. Characteristics of Full wave rectifier.
7. Build PCB for simple circuit.
8. I-V Characteristics of Solar Panel.

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

1. Verification of Superposition Theorem.
2. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single Phase Transformer.
3. Single Phase Bridge inverter with R and RL loads.
4. Study on Single Phase energy Meter.
5. Demonstration of Temperature controller using PID.
6. Demonstration of transmission line model.
7. Demonstrate working function of SPST and DPST switches.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
CH107BS	**ENGINEERING CHEMISTRY LABORATORY**	0	0	2	1

Prerequisites

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

C107.1: Analysis of materials using small quantities of materials involved for quick and accurate results

C107.2: Interpret a new application by the analysis of physical principle involved in various instruments.

C107.3: Develop experimental skills in building technological advances by qualitative and quantitative analysis of materials.

C107.4: Learn and apply basic techniques used in chemistry laboratory for preparation, purification and identification.

List of Experiments

1. Determination of total hardness of water by complex-metric method using EDTA.
2. Estimation of concentration of an acid by Conductometric titrations.
3. Estimation of concentration of an acid by pH metry..
4. Estimation of Concentration of Ferrous Iron (II) by Potentiometry using $KMnO_4$.
5. Estimation of Concentration of Fluoride ion by UV-Visible spectrometer.
6. Determination of viscosity of lubricant oil by using Ostwald's viscometer.
7. Preparation of Bakelite.
8. Determination of rate of corrosion of mild steel in presence and absence of inhibitor.
9. Determination of Acid value of given coconut oil.
10. Proximate analysis of solid fuel- Coal.

Virtual Lab Experiments

1. Batteries for Electric Vehicles.
2. Conducting Polymers-Study and Working.
3. Smart Materials-Engineering Applications.
4. Construction of Fuel Cell & It's Working.

TEXT BOOKS

1. J. Mendhem, RC. Denney, JD Barnes, M. Thomas, B. Sivasankar, Vogel's Text book of Quantitative Chemical Analysis, 6th Edition, 2009, Pearson Publishing.
2. S. S. Dhara, A Textbook on Experiments and Calculations in Engineering Chemistry, 9th Edition, 2015, S. Chand.
3. B. Ramadevi, P. Aparna, Laboratory Manual in Engineering Chemistry, Special Edition, 2022, S. Chand Publishing.
4. K. Mukkanti, Practical Engineering Chemistry, 1st Edition, 2009, BS Publications.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
EE108ES	**C PROGRAMMING AND DATA STRUCTURES LABORATORY**	0	0	2	1

Course Description: Introduce the importance of programming, C language constructs, and program development. The lab also focuses on implementing various data structures, such as linked lists, stacks, queues.

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

C108.1: Build programs using control structures to solve simple mathematical problems

C108.2: Develop modular and readable C Programs.

C108.3: Solve problems using derived, user defined data types and files

C108.4: Implement linear data structures concepts.

List of Programs:

Cycle 1:

1. Write a C program to find the sum of individual digits of a positive integer.
2. 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.
2. Write a C program to generate the first n terms of the sequence.
3. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
4. Write a C program to find the roots of a quadratic equation.
5. Write a C program to find the factorial of a given integer.
6. Write a C program to find the GCD (greatest common divisor) of two given integers.
7. Write a C program to solve Towers of Hanoi problem.
8. 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)
9. Write a C program to find both the largest and smallest number in a list of integers.
10. Write a C program that uses functions to perform the following:
    i. Addition of Two Matrices
    ii. Multiplication of Two Matrices
11. Write a C program that implements the following sorting methods to sort a given list of integers in ascending order.
    i. Bubble sort
    ii. Selection sort
    iii. Insertion sort
12. Write C programs that use both recursive and non recursive functions to perform the following searching operations for a Key value in a given list of integers:
    i. Linear search
    ii. Binary search

Cycle 2:

1. Write a C program that uses functions to perform the following operations:
   i. To insert a sub-string in to a given main string from a given position.
   ii. To delete n Characters from a given position in a given string.
2. Write a C program to determine if the given string is a palindrome or not
3. Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.
4. Write a C program to count the lines, words and characters in a given text.
5. Write a C program to generate Pascal's triangle.
6. Write a C program to construct a pyramid of numbers.
7. Write a C program that uses functions to perform the following operations:
   i. Reading a complex number
   ii. Writing a complex number
   iii. Addition of two complex numbers
   iv. Multiplication of two complex numbers
   (Note: represent complex number using a structure.)
8. i) Write a C program which copies one file to another.
   ii) Write a C program to reverse the first n characters in a file.
   (Note: The file name and n are specified on the command line.)
9. i) Write a C program to display the contents of a file.
   ii) 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)
10. Write a C program that uses functions to perform the following operations on singly linked list.
    i. Creation
    ii. Insertion
    iii. Deletion
    iv. Traversal
11. Write C programs that implement stack (its operations) using
    i. Arrays
    ii. Pointers
12. Write C programs that implement Queue (its operations) using
    i. Arrays
    ii. Pointers

TEXT BOOKS

1. B.A. Forouzan and R. F. Gilberg, C Programming & Data Structures, 3rd Edition, Cengage Learning.
2. Yeswanth Kanitkar, Let us C.
3. E. Balaguruswamy, C Programming.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
EN109HS	ENGLISH LANGUAGE AND COMMUNICATION SKILLS LABORATORY	0	0	2	1

Course Description: The course aims an in-depth look into English articulation and its sound system, thus developing your sensitivity to all aspects of English pronunciation. Students develop their listening skills to appreciate its role in the LSRW skills approach to language and improve their pronunciation. Students able to express themselves fluently and appropriately in social and professional contexts.

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

C109.1: Understand the nuances of English language through audio - visual experience

C109.2: Apply soft skills effectively while working in group activities

C109.3: Create Neutralize accent for intelligibility

C109.4: Understand and Discuss with clarity and confidence which in turn enhances their employability skills

Listening Skills

Objectives

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

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

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills

Objectives

1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional contexts

- Oral practice: Just A Minute (JAM) Sessions
- Describing objects/situations/people
- Role play – Individual/Group activities
- Group Discussions
- Debate

Exercise-1

CALL Lab:

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

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

ICS Lab:

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

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

Exercise II

CALL Lab:

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

Practice: Basic Rules of Word Accent– Contractions –Stress Shift-Weak Forms and Strong Forms – Intonation in context -*Testing Exercises*

ICS Lab:

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

*Practice:*SituationalDialogues–RolePlay-ExpressionsinVariousSituations–Making Requests and Seeking Permission-Telephone Etiquette

Exercise III

CALL Lab:

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

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

ICS Lab:

*Understand:*Descriptions-Narrations-GivingDirectionsandGuidelines–BlogWriting-Netiquette

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

Exercise-IV

CALL Lab:

Understand: Listening for Specific Details.

Practice: Listening Comprehension Tests-*Testing Exercises*

ICS Lab:

Understand: Public Speaking–Structured Talks - signposting in speech-Non-verbal Communication-Presentation Skills.

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

Exercise-V

CALL Lab:

Understand: Listening for Inference *(focus on implicit meaning)*

Practice: Listening Comprehension Tests-*Testing Exercises*

ICS Lab:

Understand: Introduction to Group Discussion & Interview Skills

Practice: Group Discussion & Mock Interviews

Minimum Requirement of Infrastructural Facilities for ELCS Lab:

1. **Computer Assisted Language Learning (CALL) Lab:**

The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

System Requirement (Hardware component):

Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

i) Computers with Suitable Configuration

ii) High Fidelity Headphones

2. **Interactive Communication Skills (ICS) Lab:**

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo –audio & video system and camcorder, etc.

Source of Material (Master Copy):

- *Exercises in Spoken English. Part1, 2, 3*. CIEFL and Oxford University Press

Note: Teachers are requested to make use of the master copy and get it tailor-made to suit the contents of the syllabus.

SUGGESTED SOFTWARE

- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley.
- Punctuation Made Easy by Darling Kindersley.
- Oxford Advanced Learner's Compass, 10th Edition.
- English in Mind (Series1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- TOEFL & GRE (KAPLAN, AARCO &BARRONS, USA, Cracking GRE by CLIFFS).
- Digital All
- Orell Digital Language Lab (Licensed Version)

REFERENCE BOOKS

1. Y. Prabhavathi, People Interface: English Language Communication Skills Manual / Workbook, 1st Edition, 2023, CL India.
2. Board of Editors, ELCS Lab Manual A Workbook for CALL and ICS Lab Activities Orient BlackSwan Pvt.Ltd.
3. Shobha K.N & Rayen J.Lourdes, Communicative English A workbook, 2019, 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	1	0	4

Prerequisites Mathematical Knowledge at pre-university level

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, Equations reducible to linear ODE with constant coefficients, Applications to Electric Circuits, 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: Solve first order Ordinary differential equations by analytical methods.

C201.2: Solve higher Ordinary differential equations by analytical methods.

C201.3: Find Laplace and inverse Laplace transform of given functions and solve ODEs byapplying Laplace Transform

C201.4: Calculate divergence, curl of a vector point function and gradient of scalar point function.

C201.5: Apply and verify Gauss, Green's & Stoke's theorems and find volume, surface of the solid and work done by force.

C201.6: Evaluate the line, surface & volume integrals and converting them from one to another

Unit – I First Order Ordinary Differential Equations

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

Unit – II Ordinary Differential Equations Of Higher Order

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax}, sinax, cosax, polynomials in x, (x), and $x(x)$, Method of variation of parameters.

Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy-Eulerequation. Applications: Electric Circuits

Unit– III Laplace Transforms

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

Unit – IV Vector Differentiation

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

Unit – V Vector Integration

Line, Surface and Volume Integrals, Vector Integral theorems: 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, 2002, Pearson.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 2008, Laxmi Publications, reprint.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
PH202BS	**APPLIED PHYSICS**	3	1	0	4

Prerequisite Nil

Course Description: This course consists of principles of Quantum mechanics with advanced topics in their respective engineering branches. It introduces the principles of semiconductors and some widely used semiconductor devices for various applications. It introduces fundamental concepts related to the dielectric, magnetic and energy harvesting materials. It introduces the importance of Lasers, optical fibers with propagation characteristics. It also introduces the fundamentals of nanotechnology and various material growth and characterization techniques.

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

C202.1: Understand the physical world from a fundamental point of view by the concepts of quantum mechanics.

C202.2: Identify the role of semiconductor devices in science and technology applications.

C202.3: Explore the fundamental properties of dielectric, magnetic and energy materials for device applications.

C202.4: Understand various aspects of Lasers and their applications in diverse fields.

C202.5: Explain the principle of optical fibers and their significance in communication

C202.6: Appreciate the features and applications of nanomaterials.

Unit – I Principles Of Quantum Mechanics

Quantum Mechanics: Introduction, blackbody radiation – Stefan-Boltzmann's law, Wein's and Rayleigh-Jean's law (qualitative) - Planck's radiation law - photoelectric effect – De-Broglie hypothesis - matter waves - Davisson and Germer experiment –Heisenberg uncertainty principle – time independent Schrodinger wave equation - Born interpretation of the wave function - particle in a 1-D potential well.

Unit – II Semiconductors And Devices

Intrinsic and extrinsic semiconductors – Hall effect – construction, working principle and characteristics of P-N Junction diode, Zener diode and Bipolar Junction Transistor (BJT) – direct and indirect band gap semiconductors – LED – photodiodes: PIN photodiode, avalanche photodiode (APD) and solar cells: structure, materials, working principle and characteristics.

Unit – III Dielectric And Magnetic Materials

Dielectric Materials: Basic definitions - types of polarizations (qualitative) - ferroelectric, piezoelectric and pyroelectric materials – applications - liquid crystal displays (LCD) and crystal oscillators.

Magnetic Materials: Origin of the magnetic moment - classification of magnetic materials - domain theory of ferromagnetism - hysteresis - soft and hard magnetic materials – magneto-

striction, magnetoresistance – applications – magnetic field sensors and multiferroics.

Unit – IV Lasers And Fiber Optics

Lasers: Laser beam characteristics - three quantum processes - Einstein coefficients and their relations - laser components - lasing action - pumping methods - Types of Lasers: Ruby laser, Nd:YAG laser, He-Ne laser, CO_2 laser - semiconductor laser – applications.

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

Unit – V Nanotechnology

Introduction - Nanoscale, surface-to-volume ratio, quantum confinement - bottom-up approach: sol-gel and precipitation methods – top-down approach: ball milling, physical vapor deposition (PVD) and chemical vapor deposition (CVD) - characterization techniques - XRD, SEM &TEM - applications of nanomaterials.

TEXT BOOKS

1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy, A Text book of Engineering Physics, 11th Edition, 2019, S.Chand Publications.
2. B.K. Pandey and S. Chaturvedi, Engineering Physics, 2nd Edition, 2022, Cengage Learning.
3. Donald A, Neamen, Semiconductor Physics and Devices - Basic Principle, 4th Edition, 2021Mc Graw Hill.
4. Narasimha Reddy Katta, Essentials of Nanoscience & Nanotechnology,1st Edition, 2021, Typical Creatives NANO DIGEST.

REFERENCE BOOKS

1. H.C. Verma, Quantum Physics, 2nd Edition, 2012, TB.
2. Halliday, Resnick and Walker, Fundamentals of Physics, 11th Edition, 2018, John Wiley &Sons.
3. A. K. Bandyopadhyay, Nano Materials, 1st Edition, 2007, New Age International.

B. Tech. I Year Semester II

Course Code	Course Title	L	T	P	Credits
ME203ES	COMPUTER AIDED ENGINEERING GRAPHICS	1	0	4	3

Prerequisite 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

C203.1: Construct different types of non-circular curves and scales used in various engineering applications.

C203.2: Analyze the projections of points and lines.

C203.3: Analyze the projections of planes and solids.

C203.4: Apply different types of sectional planes to get the interior features of the objects bymeans of sectional views.

C203.5: Develop the surfaces to fabricate the objects

C203.6: Identify orthographic, Isometric projections and various CAD commands.

Unit – I

Introduction to Engineering Graphics: Principles of Engineering Graphics and their Significance, Geometrical Constructions

Scales: Plain & diagonal

Conic Sections: Conic Sections including the rectangular hyperbola- General methods only

Cycloidal curves: Cycloid, Epicycloid and Hypocycloid -General methods only.

Unit – II

Orthographic Projections: Principles of orthographic projections- conventions- Projectionsof points in all positions.

Projection of straight lines: Line inclined to one reference plane and with two referenceplanes

Unit – III

Projections of Planes: Projections of Plane geometric figures.

Projections of Regular Solids: Projections of solids (prisms, pyramids, cylinders and cones) in simpleposition and axis inclined to one reference plane and with two reference plane.

Introduction to computer aided drafting: (For internal evaluation weightage only)

Introduction to AutoCAD Software: The Menu System, Toolbars (Standard, Object Properties, Draw)

Unit – IV

Section of Regular solids: Section or Sectional views of Right Regular Solids- Prism, Cylinder,Pyramid and Cone.

Development of Surfaces of Right Regular Solids

Unit – V

Isometric Projections: Principles of Isometric Projection – Isometric Scale Isometric Views – Isometric views of Lines, Planes and Simple Solids only. Orthographic Views: Conversionof Isometric Views to Orthographic Views and Vice-Versa.

Auto CAD Software: (For internal evaluation weightage only)

Toolbars (Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line, The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.

TEXT BOOKS

1. N. D. Bhatt, 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. Parthasarathy N. S, and Vela Murali, Engineering drawing, 1st Edition, 2015, Oxford University Press.
2. Balaveera Reddy. K, Computer Aided Engineering Drawing, 2nd Edition, 2015, CBS Pvt. Limited.

Note: Syllabus for external examination will be from 1-5 units in conventional mode and introduction to computeraided drafting is exempted from the external examination.

B. Tech. I Year Semester II

Course Code	Course Title	L	T	P	Credits
ME204ES	**ENGINEERING WORKSHOP**	0	1	3	2.5

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

C204.1: Distinguish carpentry, fitting, black smithy and welding manufacturing processes.

C204.2: Develop house hold and engineering goods from metallic sheets in tin smithy.

C204.3: Apply basic electrical engineering knowledge for house wiring practice.

C204.4: Construct a sand mould for a given pattern using foundry tools.

I-TRADES FOR EXERCISES: At least two exercises from each trade:

Cycle 1:

1. Tin Smithy – (Square Tin, Rectangular Tray & Conical Funnel)
2. Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
3. Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
4. Black Smithy – (Round to Square, Fan Hook and S-Hook

Cycle 2:

5. Fitting – (Square fit, V-Fit & Dovetail Fit)
6. House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
7. Welding Practice – (Arc Welding & Gas Welding)

II-TRADES FOR DEMONSTRATION & EXPOSURE:

Plumbing, Machine Shop, Metal Cutting, Power tools in construction and Wood Working.

TEXT BOOKS

1. Kannaiah. P, Narayana. K. L, Work shop Manual, 2nd Edition, 2013, Scitech.
2. Venkat Reddy, Workshop Manual, 6th Edition, 2008, BSP.

REFERENCE BOOKS

1. Juneja. B. L, Workshop Practice, 2nd Edition, 2016, Cengage Learning India Pvt. Limited.
2. Venugopal. K, Prabhu Raja. V, Sreekanjana. G, Workshop Manual, 1st Edition, 2012, Anuradha.

B.Tech. I Year II Semester

Course code	Course Title	L	T	P	Credits
EE205ES	ELECTRICAL CIRCUIT ANALYSIS-II	2	0	0	2

Prerequisites Electrical circuit analysis – I, Matrices and Calculus

Course Description: This is the second undergraduate course in electric circuits and it is a foundation course for all subjects of the Electrical Engineering discipline. The emphasis of this course is laid on the transient analysis of DC and AC circuits using classical and Laplace transform approach. This course also deals the significance of two port network parameters, design and analysis of filter circuits.

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

C205.1: Analyze transient response of electrical networks using classical approach.
C205.2: Analyze the networks for standard input functions using Laplace transforms
C205.3: Evaluate two-port network parameters and effect of their inter connections
C205.4: Analyze the effect of inter connections two port networks
C205.5: Analyze the design aspects of various types of filters
C205.6: Formulate various types of network matrices using graph theory.

Unit-I Transient analysis

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

Unit-II Electrical Circuit Analysis using Laplace Transforms

Application of Laplace Transforms to RL, RC and RLC (series and parallel) Networks for impulse, step, and ramp, exponential and sudden sinusoidal excitations.

Unit-III Two Port Network Parameters

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

Unit-IV Filters

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

Unit-V Topological Description of Networks

Topological Description of Networks: Definitions, Graph, tree, chord, cut-set, tie-set incidence matrix, Basic cut-set and Basic Tie-set matrices for planar networks.

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, McGrawHill.

REFERENCE BOOKS

1. James W. Nilsson, Susan A.Riedel, Electric Circuits, 11th Edition, 2020, Pearson.
2. A Sudhakar, Shyammohan S Palli, Circuits and Networks: Analysis and Synthesis, 5th Edition,2017, McGraw Hill.
3. Jagan N.C, Lakshrninarayana C, Network Analysis,3rd Edition, 2014, B.S. Publications.
4. William Hayt H, Kimmerly Jack E. and Steven Durbin M, Engineering Circuit Analysis, 6th Edition, 2002, McGraw Hill.
5. Chakravarthy A., Circuit Theory, First Edition, 1999, Dhanpat Rai &Co.
6. Charles K.Alexander & Matthew N. O. Sadiku, Fundamentals of Electric circuits, 5th edition, 2012, McGraw-Hill.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
EE206ES	APPLIED PYTHON PROGRAMMING LABORATORY	0	1	2	2

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 students will be able to

C206.1: Build basic programs using fundamental programming constructs.
C206.2: Develop reusable code using standard library functions
C206.3: Use different packages for processing data from files and plotting graphs.
C206.4: 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 x 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 a 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 PiImager
   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 and Anupama C. Raman, The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press.
2. Vijay Madisetti, Arshdeep Bahga, Internet of Things: A Hands-On Approach
3. Kenneth A. Lambert, Introduction to Python, Cengage.
4. Vamsi Kurama, Python Programming: A Modern Approach, Pearson.
5. Mark Lutz, O'Really, Learning Python.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
PH207BS	**APPLIED PHYSICS LABORATORY**	**0**	**0**	**3**	**1.5**

Prerequisite Nil

Course Description: This course is designed for the students to provide an opportunity for learning through observation, interpretation and application. It includes the instruments related to the Hall Effect, Photoelectric Effect, dielectric constant and B-H curve experiments and their measurements. It introduces the characteristics of various devices such as P-N junction diode, Zener diode, BJT, LED, solar cell, LASERs and optical fibers, measurement of energy gap and resistivity of semiconductor materials.

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

C207.1: estimate the work function of metal using Photoelectric effect and identify the type of semiconductor material whether it is n-type or p-type by Hall effect.

C207.2: determine energy gap and resistivity of semiconductors and draw the characteristics of semiconductor and optoelectronic devices.

C207.3 understand the electrical and magnetic properties of materials

C207.4: demonstrate the working principle of lasers and optical fibers

LIST OF EXPERIMENTS

1. Determination of work function of a metal and Planck's constant using photoelectric effect
2. Determination of Hall co-efficient, carrier concentration and carrier mobility of a given semiconductor
3. Characteristics of series and parallel LCR circuits
4. V-I characteristics of a p-n junction diode and Zener diode
5. Input and output characteristics of BJT (CE / CB configurations)
6. V-I and L-I characteristics of light emitting diode (LED)
7. V-I Characteristics of solar cell
8. Determination of energy gap of a semiconductor using p-n junction diode
9. Determination of the resistivity of semiconductor by two probe method
10. Study B-H curve characteristics of a magnetic material
11. Determination of dielectric constant of a given material
12. a) Determination of the beam divergence of a given LASER beam
    b) Determination of acceptance angle and numerical aperture of an optical fiber

Note: Any 8 experiments are to be performed.

REFERENCE BOOK

1. S. Balasubramanian, M. N. Srinivasan, A Textbook of Practical Physics, 2017, S. Chand.

B.Tech. I Year II Semester

Course code	Course Title	L	T	P	Credits
EE208ES	**ELECTRICAL CIRCUIT ANALYSIS LABORATORY**	**0**	**0**	**2**	**1**

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

Course Description: This is the lab course in which course the transient analysis of with DC and AC excitations learned in theory are verified. This course also deals the significance of magnetically coupled circuits and effect of resonance circuits, graph theory, two port network parameters, design and analysis of filter circuits.

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

C208.1: Analyze the time response of R-L-C circuits with DC and AC sources

C208.2: Study the resonance phenomena and filter circuits characteristics

C208.3: Determine the active and reactive power of a three phase electrical networks.

C208.4: Calculate two port network parameters for a given electrical network.

The following experiments are required to be conducted as compulsory

1. To draw the locus Diagrams of RL (R-Varying) and RC (R-Varying) Series Circuits.
2. Transient Response of Series RL and RC circuits for DC excitation
3. Verification of Series and Parallel Resonance.
4. Determination of Two port network parameters – Z & Y parameters.
5. Determination of Two port network parameters – A, B, C, D parameters.
6. Measurement of active power for star and delta connected unbalanced loads.
7. Frequency domain analysis of low-pass filter.
8. Frequency domain analysis of band-pass filter.

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

9. Measurement of reactive power for Star and Delta connected unbalanced loads.
10. Frequency domain analysis of high-pass filter.
11. Verification Two port network parameters - Hybrid parameters.
12. Locus Diagrams of RL (L-Varying) and RC (C-Varying) Series Circuits.
13. Determination of Time response of first order RL and RC circuit for periodic non – sinusoidal inputs – Time Constant and Steady state error

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
MA301BS	NUMERICAL METHODS AND COMPLEX VARIABLES	3	1	0	4

Prerequisites 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 & related topics and Complex integration.

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

C301.1: Express any periodic function in terms of sine and cosine transforms.

C301.2: Find the root of a given polynomial and transcendental equations.

C301.3: Estimate the value for the given data using interpolation.

C301.4: Find the numerical solutions for a given first order ODE.

C301.5: Analyse the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems.

C301.6: Taylor's and Laurent's series expansions in complex function.

Unit – I Fourier series & Fourier Transforms

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

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

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

Unit – III Numerical Integration

Numerical integration: Trapezoidal rule, Simpson's 1/3rd and 3/8th rules.

Ordinary differential equations: Taylor's series, Picard's method, Euler and modified Euler's methods, Runge - Kutta method of fourth order for first order ODE

Unit – IV Complex Differentiation

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

Unit – V Complex Integration

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

TEXT BOOKS

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

REFERENCE BOOKS

1. M. K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering Computations, New Age International publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, 2006, John Wiley & Sons.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Edition,2004, Mc Graw Hill Publications.

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EE302PC	ELECTRICAL MACHINES-I	3	1	0	4

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

Course Description: Electrical machines course is one of the important courses of the Electrical discipline. In this course the different types of DC generators and motors which are widely used in industry are covered and their performance aspects will be studied. This course will also facilitate to study of the performance of Transformers.

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

C302.1: Assess the characteristics for different types of DC machines.
C302.2: Compute losses and efficiency of DC machines.
C302.3: Evaluate the types of starters and speed control techniques of DC motors.
C302.4: Illustrate the equivalent circuit parameters for single phase transformer.
C302.5: Evaluate the performance of Transformers under different loading conditions.
C302.6: Distinguish poly phase transformers based on connections.

Unit – I D.C. Generators

Introduction to basics of magnetic circuits - Principle of operation – Action of commutator – constructional features – armature windings – lap and wave windings – simplex and multiplex windings – use of laminated armature – E. M.F Equation.

Armature reaction – Cross magnetizing and de-magnetizing AT/pole – compensating winding –commutation – reactance voltage – methods of improving commutation.

Methods of Excitation – separately excited and self-excited generators – build-up of E.M.F - critical field resistance and critical speed - causes for failure to self-excited and remedial measures. Load characteristics and applications of shunt, series and compound generators.

Unit – II D.C. Motors

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

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

Motor starters - 3 point and 4 point starters.

Unit -III Testing of D.C. Machines

Losses - Constant and Variable losses –Calculation of efficiency – condition for maximum efficiency - Methods of Testing – direct, indirect, and regenerative testing – Brake test – Swinburne's test – Hopkinson's test –Field's test - separation of stray losses in a D.C. motor.

Unit – IV Single Phase Transformers

Types - constructional details-minimization of hysteresis and eddy current losses- EMF equation - operation on no load and on load - phasor diagrams and Applications.

Equivalent circuit - losses and efficiency – regulation - All day efficiency - effect of

variations of frequency & supply voltage on iron losses.

Unit – V Testing of Transformers and Poly-Phase Transformers

Poly-phase transformers – Poly-phase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ, Scott connection and Applications.

Open Circuit and Short Circuit tests - Sumpner's test - predetermination of efficiency and regulation-separation of losses test parallel operation with equal and unequal voltage ratios - auto transformers-equivalent circuit - comparison with two winding transformers.

TEXT BOOKS

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

REFERENCE BOOKS

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, Electrical Machines, 2017, Oxford.
2. M. G. Say, Performance and Design of AC Machines, 2002, CBS Publishers.
3. A. E. Fitzgerald and C. Kingsley, Electric Machinery, 2013, McGraw Hill Education, New York.
4. A. E. Clayton and N. N. Hancock, Performance and design of DC machines, 2004, CBS Publishers.
5. J. B. Gupta, Theory and Performance Electrical Machines, 2015, Katsons Book Publisher.
6. S.K. Sahdev, Electrical Machines, 2017, Cambridge University Press.

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EE303PC	ANALOG ELECTRONIC CIRCUITS	3	0	0	3

Prerequisites **Applied Physics, Electrical Circuit Analysis**

Course Description: This Course provides a comprehensive knowledge on characteristics of Diode, Transistor, FET, Operational Amplifier and implementation of various analog circuits like Multi-stage, Power, Feedback amplifiers and Oscillators

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

C303.1: Illustrate the characteristics of PN junction diode and its applications

C303.2: Analyse the construction, characteristics and small signal model of BJT and FET

C303.3: Build different types of multistage amplifiers, differential amplifiers and power amplifiers.

C303.4: Examine the characteristics of different Feedback Amplifiers.

C303.5: Design various sinusoidal oscillator circuits for given frequencies.

C303.6: Design simple analog circuits using Op-Amp.

Unit – I Diode and Bipolar Transistor Circuits

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

Unit – II FET Circuits

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

Unit – III Multi-Stage and Power Amplifiers

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

Unit – IV Feedback Amplifiers and Oscillators

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

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

Unit – V Operational Amplifiers

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

TEXT BOOKS

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

REFERENCE BOOKS

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

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EE304PC	POWER SYSTEM - I	3	0	0	3

Prerequisites Electrical Circuit Analysis-I & II, Electrical Machines-I.

Course Description: This course is an introductory subject in the field of electric power systems, to understand the power generation through conventional and non-conventional sources. The emphasis of this course is laid on the Economics of power generation and load tariffs, this course also deals the Overhead line transmission performance analysis by calculating transmission line parameters, AC and DC Distribution system and Indoor, outdoor substations.

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

C304.1: Categorize the sources of power generation.

C304.2: Outline the economic aspects for electrical power generation and loads.

C304.3: Compute transmission line parameters for different configurations.

C304.4: Analyze the Performance of overhead transmission lines using equivalent circuit models.

C304.5: Compute voltage drop in distribution systems based on various requirements & design features.

C304.6: Differentiate the features of various substations

Unit-I Generation of Electric Power

Conventional Sources: Hydro station, Steam Power Plant, Nuclear Power Plant and Gas Turbine Plant, Combined cycle generation (Steam and Gas)

Non-Conventional Sources (Elementary Treatment) Solar Energy, Wind Energy, Fuel Cells, Ocean Energy, Tidal Energy, Wave Energy, and Cogeneration, energy conservation and storage.

Unit-II Economics of Power Generation

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

Cost of electrical energy-fixed cost, running cost, Revised tariff on charge to customer (Case study for grid integrated RES).

Unit-III Overhead Transmission Line Parameters

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

Unit-IV Substations

Air Insulated Substations (AIS): Indoor & Outdoor substations: Substations layout showing

the location of all the substation equipment. Bus bar arrangements in the Sub-Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.

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

Unit – V DC And AC Distribution

D.C. 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 and Under-Ground vs. Over- Head Distribution Systems. 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 with respect to load voltages.

TEXT BOOKS

1. C.L. Wadhwa, Electrical Power Systems, 5th Edition, New Age International, 2009.
2. V.K Mehta and Rohit Mehta, Principles of Power Systems, S. Chand & Company Ltd, New Delhi, 2004.
3. R. K. Rajput, Power System Engineering, 1st Edition, LAXMI Publications, 2006.

REFERENCE BOOKS

1. A. Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, A Text book on Power System Engineering, 2008, Dhanpat Rai Publishing Company (P) Ltd.
2. C.L. Wadhwa, Generation, Distribution and Utilization of Electrical Energy, 2nd Edition, 2009, New Age International.
2. M.V. Deshpande, Elements of Electrical Power Station Design, 3rd Edition, 1998, Wheeler Pub.
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, 1984, McGraw Hill.

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EE305PC	**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

C305.1: Illustrate the concepts of electromagnetic field theory using fundamental laws

C305.2 Examine the influence of electric fields on conductors, insulators and dielectrics.

C305.3: Compute the Magnetostatic parameters using Biot Savart's and Ampere's circuital laws for different conductor configuration.

C305.4: Calculate Force, Torque and inductance in magnetic fields for electrical engineering applications.

C305.5: Interpret the concepts of Maxwell's equations from electromagnetic fields.

C305.6: 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, Ohms 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.

Unit – III Static Magnetic Fields and Magnetic Forces

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.

Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions, Magnetic circuits, Self-inductances and mutual inductances.

Unit – IV 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
EE306PC	**ELECTRICAL MACHINES LABORATORY-I**	0	0	2	1

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

Course Description: Electrical Machines Laboratory-I 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

C306.1: Examine the performance characteristics of DC generators

C306.2: Compute the losses and efficiency of DC machines.

C306.3: Outline the performance curves of DC motors.

C306.4: Analyse the Performance of Single-Phase Transformer and Poly-Phase Transformer Connections.

Part-A: The following experiments are required to be conducted compulsory experiments:

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 and speed control of DC shunt motor (Predetermination of efficiencies)
6. Brake test on DC compound motor (Determination of performance curves)
7. OC and SC Test on Single Phase Transformer
8. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star)

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

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EE307PC	ANALOG ELECTRONIC CIRCUITS LABORATORY	0	0	2	1

Prerequisites Applied Physics, Electrical Circuit Analysis

Courses Description: This course provides practical knowledge on characteristics and applications of Diode, 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

C307.1: Analyse the characteristics of PN junction diode and rectifier circuits.

C307.2: Verify the characteristics of different configurations of BJT and JFET.

C307.3: Design Various analog application circuits using Op-Amp

C307.4: Analyse positive & negative Feedback amplifiers and power amplifiers.

List of Experiments / Programs

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

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EE308PC	ELECTRICAL SIMULATION TOOLS LABORATORY	0	0	2	1

Prerequisites Electrical Circuit Analysis –I and II, Electrical Machines-I

Course Description: This lab deals with the implementation of different electrical/electronic circuits using basic block sets of different simulation platforms as well as coding. It gives the basic knowledge about the various software tools available and helps the students in carrying out their project works.

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

C308.1: Gain knowledge of software packages to simulate electrical and electronics systems using block sets of various simulation platforms.

C308.2: Gain knowledge of software packages to simulate electrical and electronics systems using programming/coding.

C308.3: Model different electrical and electronic systems and analyze the results.

C308.4: Articulate importance of software packages used for simulation in laboratory experimentation by analyzing the simulation results.

List of Experiments / Programs

Part-A: *The following experiments are required to be conducted as compulsory experiments:*

1. Introduction to basic block sets of simulation platforms. Basic matrix operations, generation of standard test signals.
2. Obtain the total time response of series RL and RC circuits by solving differential equations with DC source.
3. Analyze the step response of second order series RLC circuit for various damping factors.
4. Verification of different network theorems with dependent and independent sources using suitable simulation tools.
5. Verification of performance characteristics of diode and BJT using suitable simulation tools.
6. Analysis of series and parallel resonance circuits using suitable simulation tools.
7. Obtaining the response of electrical network for different standard test signals using suitable simulation tools.
8. Modeling and analysis of low pass and high pass filters using suitable simulation tools.

Part-B*: In addition to the above experiments, at least any two of the following experiments are required to be conducted.*

9. Performance analysis of DC motor using suitable simulation tools.
10. Modeling and analysis of equivalent circuit of transformer using suitable simulation tools.
11. Analysis of single-phase bridge rectifier with and without filter using suitable simulation tools.

12. Modeling and verification of voltage regulator using suitable simulation tools.
13. Modeling of transmission line using simulation tools.
14. Performance analysis of solar PV model using suitable simulation tools.

Note: Minimum of 10 Experiments are to be performed

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
*MC311	ENVIRONMENTAL SCIENCE	3	0	0	0

Prerequisites Nil

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

C311.1: Analyze the important components of environment.

C311.2: Illustrate the major environmental effects of exploiting natural resources.

C311.3: Utilize environmental laws for the protection of forest and wildlife.

C311.4: Categorize different types of pollutions and their control measures and discover effective methods of waste management.

C311.5: Identify global environmental problems and come out with best possible solutions.

C311.6: 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: benefitsand problems.

Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources

Land resources: Forest resources

Energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies

Unit-III Biodiversity and Biotic Resources

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit.

Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situconservation.

Unit-IV Environmental Pollution and Control Technologies:

Environmental Pollution: Classification of pollution,

Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambientair 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.

International conventions / 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, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Concepts of Environmental Management Plan (EMP).

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

TEXT BOOKS

1. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses, 1st Edition, 2005, Universities press.
2. Anubha Kaushik, C.P. Kaushik, Perspectives in Environmental Studies.,4th Edition, 2014, New age international publishers.
3. S. Deswal and A. Deswal, A basic course in environmental studies, 2nd Edition, 2004, Dhanapathirai & Co.
4. Benny joseph, Environmental studies, 3rd Edition, 2017, McGraw Hill Education (India) Private Limited.

REFERENCE BOOKS

1. Daniel B. Botkin and Edwards A. Keller, Environmental science, 8th Edition, 2010, Wiley India (P) Ltd.
2. Richard T. Wright, Environmental Science: towards a sustainable future, 4th Edition, 2008, PHL Learning Private Ltd.
3. P. D. Sharma, Ecology and Environment, 5th Edition, 2009, Rastogi Publications.

SUSTAINABLE DEVELOPMENT GOALS

01 NO POVERTY

02 ZERO HUNGER

03 GOOD HEALTH AND WELL-BEING

04 QUALITY EDUCATION

05 GENDER EQUALITY

06 CLEAN WATER AND SANITATION

07 AFFORDABLE AND CLEAN ENERGY

08 DECENT WORK AND ECONOMIC GROWTH

09 INDUSTRY, INNOVATION AND INFRASTRUCTURE

10 REDUCED INEQUALITIES

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

14 LIFE BELOW WATER

15 LIFE ON LAND

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

17 PARTNERSHIPS FOR THE GOALS