ACADEMIC REGULATIONS (BH23)
COURSE STRUCTURE AND
DETAILED SYLLABUS

ELECTRONICS AND COMMUNICATION 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 Electronics and Communication Engineering

VISION

To emerge as a centre of academic and research excellence in Electronics and Communication Engineering and create globally competent women technocrats with a high degree of social consciousness in a holistic learning environment.

MISSION

M1: To provide quality education to the students with emphasis on training related to latest technologies as per industrial needs

M2: To impart research culture, professional ethics and moral values to the students by committed and competent faculty striving for excellence.

M3: To inculcate a perceptive alacrity in students to identify real life problems, formulate strategies and evolve into contextually effective solutions.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

After 3 to 6 years of graduation, the graduates will be able to

PEO-1: Excel in contemporary problem solving in Electronics and Communication Engineering and the allied fields through the knowledge base provided by the program.

PEO-2: Demonstrate their technical, communication and leadership skills in professional environment or as entrepreneurs with social responsibility.

PEO-3: Analyze the latest issues and technology growth in the field of Electronics and Communication Engineering and update their knowledge and skills accordingly through continuous learning.

PEO-4: Demonstrate ethical and human values in multicultural and multidisciplinary environments.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO-1: Provide optimized solutions for digital, signal processing and communication systems.

PSO-2: Develop compact, energy efficient and low cost products to assist the differently abled people.

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 opts 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 fulfilment 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 / Practicals, 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.

% of Marks = (final CGPA – 0.5) x 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) 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	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already

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

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 semester.

b) 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.

c) 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.

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.

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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 fulfil 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 $\geq$ 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 $\geq$ 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 $\geq$ 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 AY 2023-24 Batch

I Year I Semester

S. No.	Code	Title	L	T	P	Credits
1	MA101BS	Matrices and Calculus	3	1	0	4
2	PH102BS	Applied Physics	3	1	0	4
3	EC103ES	C Programming for Engineers	3	0	0	3
4	ME104ES	Engineering Workshop	0	1	3	2.5
5	EE105ES	Basic Electrical Engineering	2	0	0	2
6	EC106ES	Elements of Electronics and Communication Engineering	0	0	2	1
7	PH107BS	Applied Physics Laboratory	0	0	3	1.5
8	EC108ES	C Programming for Engineers Laboratory	0	0	2	1
9	EE109ES	Basic Electrical Engineering Laboratory	0	0	2	1
		Induction Programme				
		Total	11	3	12	20

I Year II Semester

S. No.	Code	Title	L	T	P	Credits
1	MA201BS	Ordinary Differential Equations and Vector Calculus	3	1	0	4
2	CH202BS	Engineering Chemistry	3	1	0	4
3	ME203ES	Computer Aided Engineering Graphics	1	0	4	3
4	EC204ES	Electronic Devices and Circuits	2	0	0	2
5	EN205HS	English for Skill Enhancement	2	0	0	2
6	EC206ES	Applied Python Programming Laboratory	0	1	2	2
7	CH207BS	Engineering Chemistry Laboratory	0	0	2	1
8	EN208HS	English Language and Communication Skills Laboratory	0	0	2	1
9	EC209ES	Electronic Devices and Circuits Laboratory	0	0	2	1
		Total	11	3	12	20

II Year I Semester

S. No.	Code	Title	L	T	P	Credits
1	MA301BS	Numerical Methods and Complex Variables	3	1	0	4
2	EC302PC	Analog Circuits	3	0	0	3
3	EC303PC	Network analysis and Synthesis	3	0	0	3
4	EC304PC	Digital Logic Design	3	0	0	3
5	EC305PC	Signals and Systems	3	1	0	4
6	EC306PC	Analog Circuits Laboratory	0	0	2	1
7	EC307PC	Digital Logic Design Laboratory	0	0	2	1
8	EC308PC	Basic Simulation Laboratory	0	0	2	1
9	MC311	Environmental Science	3	0	0	0
		Total	18	2	6	20

II Year II Semester

S. No.	Code	Title	L	T	P	Credits
1	EC401PC	Probability Theory and Stochastic Processes	3	0	0	3
2	EC402PC	Electromagnetic Fields and Transmission Lines	3	0	0	3
3	EC403PC	Analog and Digital Communications	3	0	0	3
4	EC404PC	Linear and Digital IC Applications	3	0	0	3
5	EC405PC	Electronic Circuit Analysis	3	0	0	3
6	EC406PC	Analog and Digital Communications Laboratory	0	0	2	1
7	EC407PC	Linear and Digital IC Applications Laboratory	0	0	2	1
8	EC408PC	Electronic Circuit Analysis Laboratory	0	0	2	1
9	EC409PC	Real Time Project/ Field Based Project	0	0	4	2
10	MC410	Gender Sensitization Lab	0	0	2	0
		Total	15	0	12	20

III Year I Semester

S. No.	Code	Title	L	T	P	Credits
1	EC501PC	Microcontrollers	3	1	0	4
2	EC502PC	Antennas and Wave Propagation	3	0	0	3
3	EC503PC	Control Systems	3	1	0	4
4	SM504MS	Business Economics & Financial Analysis	3	0	0	3
5		Professional Elective – I	3	0	0	3
6	EN505HS	Advanced English Communication Skills Laboratory	0	0	2	1
7	EC506PC	Advanced Communication Laboratory	0	0	2	1
8	EC507PC	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.	Code	Title	L	T	P	Credits
1	EC601PC	IoT Architectures and Protocols	3	0	0	3
2	EC602PC	Digital Signal Processing	3	0	0	3
3	EC603PC	CMOS VLSI Design	3	0	0	3
4		Professional Elective - II	3	0	0	3
5		Open Elective – I	3	0	0	3
6	EC604PC	Digital Signal Processing Laboratory	0	0	2	1
7	EC605PC	CMOS VLSI Design Laboratory	0	0	2	1
8	EC606PC	IoT Architectures and Protocols Laboratory	0	0	2	1
9	EC607PC	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.	Code	Title	L	T	P	Credits
1	**EC701PC**	Microwave and Optical Communications	**3**	**1**	**0**	**4**
2		Professional Elective – III	**3**	**0**	**0**	**3**
3		Professional Elective – IV	**3**	**0**	**0**	**3**
4		Open Elective – II	**3**	**0**	**0**	**3**
5	**SM702MS**	Professional Practice, Law & Ethics	**2**	**0**	**0**	**2**
6	**EC703PC**	Microwave and Optical Communications Laboratory	**0**	**0**	**4**	**2**
7	**EC704PC**	Project Stage – I	**0**	**0**	**6**	**3**
		Total	**14**	**1**	**10**	**20**

IV Year II Semester

S. No.	Code	Title	L	T	P	Credits
1		Professional Elective – V	**3**	**0**	**0**	**3**
2		Professional Elective – VI	**3**	**0**	**0**	**3**
3		Open Elective – III	**3**	**0**	**0**	**3**
4	**EC801PC**	Project Stage – II including Seminar	**0**	**0**	**22**	**11**
		Total	**9**	**0**	**22**	**20**

Professional Electives

PE-I	**EC511PE**	Computer Organization and Operating Systems
	EC512PE	Data Communications and Computer Networks
	EC513PE	Electronic Measurements and Instrumentation
	EC514PE	Electronic Sensors
PE-II	**EC611PE**	Digital Design through Verilog HDL
	EC612PE	Cellular and Mobile Communications
	EC613PE	Coding Theory and Techniques
	EC614PE	Artificial Intelligence
PE-III	**EC711PE**	Embedded System Design
	EC712PE	CMOS Analog IC Design
	EC713PE	System Verilog for Verification
	EC714PE	Speech Signal Processing
PE-IV	**EC721PE**	Image and Video Processing
	EC722PE	Machine Learning
	EC723PE	VLSI Physical Design
	EC724PE	Satellite Communications
PE-V	**EC811PE**	System on Chip Architecture
	EC812PE	FPGA Architectures
	EC813PE	Wireless Sensor Networks
	EC814PE	Radar Systems
PE-VI	**EC821PE**	Testing & Testability
	EC822PE	Navigational Systems
	EC823PE	5G and Beyond Communications
	EC824PE	Low Power VLSI Design

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

Prerequisite: **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: Eigen values, Eigen vectors 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.
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
PH102BS	Applied Physics	3	1	0	4

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 and magnetic 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

C102.1: Understand the physical world from a fundamental point of view by the concepts of quantum mechanics.
C102.2: Identify the role of semiconductor devices in science and technology applications.
C102.3: Explore the fundamental properties of dielectric and magnetic materials for device applications.
C102.4: Understand various aspects of Lasers and their applications in diverse fields.
C102.5: Explain the principle of optical fibers and their significance in communication
C102.6: 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 - magnetostriction, 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, 2021, Mc 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, TBS Publication.
2. Halliday, Resnick and Walker, Fundamentals of Physics, 11th Edition, 2018, John Wiley & Sons.
3. A. K. Bhandhopadhya, Nano Materials, 1st Edition, 2007, New Age International.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
EC103ES	C Programming for Engineers	3	0	0	3

Course Description: The course contains topics related to fundamentals of problem solving using structured programming approach. It introduces standard programming techniques like alternation, iteration and recursion using C. It aims on using arrays, pointers and structures to formulate algorithms and programs. The course also covers files, searching and sorting problems.

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

C103.1: Identify various components of Computer and understand the basics of algorithms and flowcharts.

C103.2: Implement control structures using C programming language

C103.3: Develop reusable code using the concept of modular programming.

C103.4: Use arrays and various string handling functions to solve problems.

C103.5: Explore pointers and file handling functions using C

C103.6: Apply the knowledge of user defined data types and demonstrate various searching and sorting techniques along with their time complexities

Unit – I Introduction to Computer Algorithms and Programming

Components of a computer system: Memory, processor, I/O devices, storage, operating system, the concept of assembler, compiler, interpreter, loader, and linker.
From algorithm to program: Representation of an algorithm, flowchart, Pseudo code with examples, converting algorithms to programs.
Programming Basics: Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object, and executable code. Components of C language, standard I/O in C, data types, variables and constants, memory storage, and storage classes.

Unit – II Expressions and Statements

Expressions and their evaluation: Operands and Operators, formation of expressions using arithmetic, relational, logical, and bitwise operators, precedence and associativity rules, mixed operands, type conversion, and evaluation of expressions.
Statements: Simple and compound statements, Conditional Branching: if and switch statements, nested if-else, dangling else problem, use of break and default with switch. Iteration and loops: use of while, do-while and for loops, nested loops, use of break and continue statements

Unit – III Functions and Arrays

Designing Structured Programs: Introduction to functions, advantages of modularizing a program into functions, types of functions, passing parameters to functions: call by value, call by reference, passing arrays to functions, recursion with example programs.
Arrays: Array notation and representation, manipulating array elements, using multi-dimensional arrays, character arrays, C strings, string input/output functions, Array of strings, string manipulation functions with example programs

Unit – IV Pointers and File handling

Pointers: Introduction, declaration, applications, dynamic memory allocation (malloc, calloc, realloc, free), use of pointers in self-referential structures.
File handling: File I/O functions, standard C pre-processors, defining and calling macros, command- line arguments.

Unit – V Derived types and Basic Algorithms

Structures, Union, Enums and Bit-fields: Defining, declaring, and usage of structures, unions, and their arrays, passing structures, and unions to functions, introduction to enums and bit-fields.
Basic Algorithms: Searching and Sorting Algorithms (Bubble, Insertion, and Selection), finding roots of equations, notion of order of complexity through example programs.

TEXT BOOKS

1. B. A. Forouzan and R. F. Gilberg, Programming & Data Structures, 3rd Edition, Cengage Learning.
2. Byron Gottfried, Schaum's Outline of Programming with C, 2nd Edition, McGraw-Hill.

REFERENCE BOOKS

1. Ajay Mittal, Programming in C: A practical approach, 2010, Pearson Education.
2. Kernighan Brian W. and Ritchie Dennis M., The C programming, Pearson Education.
3. J. R. Hanlyand, E. B. Koffman, Problem Solving and Program Design, 5th Edition, Pearson Education.
4. H. Cheng, C for Engineers and Scientists, McGraw-Hill International Edition.
5. V. Rajaraman, Computer Basics and C Programming, 2015, PHI Learning.
6. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivert, Clifford Stein, Introduction to Algorithms, 4th Edition, MIT Press.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
ME104ES	**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

C104.1: Distinguish carpentry, fitting, black smithy and welding manufacturing processes.
C104.2: Develop house hold and engineering goods from metallic sheets in tin smithy.
C104.3: Apply basic electrical engineering knowledge for house wiring practice.
C104.4: Construct a sand mould for a given pattern using foundry tools.

1. 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)

2. 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 I Semester

Course code	Course Title	L	T	P	Credits
EE105ES	**Basic Electrical Engineering**	2	0	0	2

Course Description: Basic Electrical Engineering is a professional engineering subject that deals with the study and application of electrical engineering. A good grasp of the fundamentals of Electrical Engineering is an absolute necessity to become a good engineer in any discipline. Our day-to-day life is completely dependent on electricity. A reasonable understanding on the basics of electricity is therefore important for every engineer. This course deals with the basics of DC and AC circuit analysis under steady state and transient conditions. The basic knowledge on the constructional details and working principles of the commonly used DC and AC machines are included in the course. This course also gives an overview of the components in electrical installations.

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

C105.1: Analyze DC electric circuits with basic electrical components.

C105.2: Analyze single phase and three phase AC circuits.

C105.3: Illustrate the performance of transformers.

C105.4: Explain the construction of DC and AC machines

C105.5: Explain the working Principle of DC and AC machine

C105.6: Differentiate various components in electrical installations

Unit – I D.C. Circuits

Electrical circuit elements (R, L and C), voltage and current sources, KVL & KCL, analysis of simple circuits with dc excitation - Network reduction techniques, Mesh Analysis, Super-Mesh Analysis, Nodal Analysis and Super-Node Analysis. Superposition, Thevenin and Norton Theorems. (Problems with independent sources).

Time-domain analysis of first-order RL and RC circuits.

Unit – II A.C. Circuits

Representation of sinusoidal waveforms, peak, rms, and average values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance in series R-L-C circuit.

Three-phase balanced circuits, voltage and current relations in star and delta connections.

Unit – III Transformers

Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Working principle of Auto-transformer and three-phase transformer connections.

Unit – IV Electrical Machines

Construction and working principle of dc motor, performance characteristics of dc shunt motor. Generation of rotating magnetic field, Construction and working principle of a three-

phase induction motor, Significance of torque-slip characteristics, Single-phase induction motor - Capacitor-start Capacitor run motor (elementary treatment only). Construction and working principle of synchronous generator.

Unit – V Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Types of Cables, Earthing. Elementary calculations for energy consumption, power factor improvement, Applications of Batteries as Energy storage devices.

TEXT BOOKS

1. D.P. Kothari and I. J. Nagrath, Basic Electrical Engineering, 4th Edition, 2019, Tata McGraw Hill.
2. P. Ramana, M. Suryakalavathi, G.T. Chandrasheker, Basic Electrical Engineering, 2nd Edition, 2019, S. Chand.

REFERENCE BOOKS

1. M. S. Naidu and S Kamakshaiah, Basic Electrical Engineering, 2nd Edition, 2008, Tata McGraw Hill.
2. D. C. Kulshreshtha, Basic Electrical Engineering, 2009, McGraw Hill.
3. M. S. Sukhija, T. K. Nagsarkar, Basic Electrical and Electronics Engineering, 1st Edition, 2012, Oxford.
4. Abhijit Chakrabarthi, Sudipta Debnath, Chandan Kumar Chanda, Basic Electrical Engineering, 2nd Edition, 2021, McGraw Hill.
5. L. S. Bobrow, Fundamentals of Electrical Engineering, 1996, Oxford University Press.
6. E. Hughes, Electrical and Electronics Technology, 2010, Pearson.
7. V. D. Toro, Electrical Engineering Fundamentals, 2nd Edition, 2015, Pearson Education India.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
EC106ES	**Elements of Electronics and Communication Engineering**	0	0	2	1

Course Description: This course introduces the various electronic components, measuring devices and software tools used in Electronics and Communication Engineering.

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

C106.1: Identify the different components and ICs used for electronic applications.
C106.2: Measure different parameters using various measuring devices.
C106.3: Distinguish various signal used for analog and digital communications
C106.4: Describe the significance of Electronics and communication subjects and various Software tools

List of Experiments

1. Understand the significance of Electronics and communications subjects.
2. Identify the different passive and active components.
3. Colour code of resistors, finding the types and values of capacitors.
4. Measure the voltage and current using voltmeter and ammeter.
5. Measure the voltage, current with Multimeter and study the other measurements using Multimeter.
6. Study the CRO/DSO and measure the frequency and phase of given signal.
7. Draw the various Lissajous figures using CRO/DSO.
8. Soldering and De-soldering Practice.
9. Study the function generator for various signal generations.
10. Study of Spectrum analyser and measure the spectrum.
11. Operate Regulated power supply for different supply voltages.
12. Study the various gates module and write down the truth table of them.
13. Identify various Digital and Analog ICs.
14. Observe the various types of modulated signals.
15. Know the available Software for Electronics and communication applications.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
PH107BS	**Applied Physics Laboratory**	0	0	3	1.5

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

C107.1: 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.
C107.2: Determine energy gap and resistivity of semiconductors and draw the characteristics of semiconductor and optoelectronic devices.
C107.3: Understand the electrical and magnetic properties of materials
C107.4: 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 Text book of Practical Physics, 2017, S Chand Publishers.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
EC108ES	C Programming for Engineers Laboratory	0	0	2	1

Course Description: This lab introduces the importance of programming, C language constructs, and program development. It introduces standard programming techniques like alternation, iteration and modular programming.

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: Use functions to develop modular reusable code.

C108.3: Apply derived data types and file handling functions to solve problems.

C108.4: Implement searching and sorting algorithms

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.
3. Write a C program to generate the first n terms of the sequence.
4. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
5. Write a C program to find the roots of a quadratic equation.
6. Write a C program to find the factorial of a given integer.
7. Write a C program to find the GCD (greatest common divisor) of two given integers.
8. Write a C program to solve Towers of Hanoi problem.
9. 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)
10. Write a C program to find both the largest and smallest number in a list of integers.
11. Write a C program that uses functions to perform the following:
    i) Addition of Two Matrices ii) Multiplication of Two Matrices
12. 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.
13. Write a C program to determine if the given string is a palindrome or not.

Cycle 2:

14. 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.
15. Write a C program to count the lines, words and characters in a given text.
16. Write a C program to generate Pascal's triangle.
17. Write a C program to construct a pyramid of numbers
18. Write a C program to convert a Roman numeral to its decimal equivalent.
19. 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.)
20.
    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.)
21.
    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)

22. 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

23. 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

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
EE109ES	**Basic Electrical Engineering Laboratory**	0	0	2	1

Course Description: BEE lab is part of the curriculum for the first year students. The lab is intended for introducing the basic methods and instruments used for measuring the electrical quantities to the newly joined students. The experiments are modeled in such a way that it can be used as a learning aid for the students, as it goes in hand with the theory.

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

C109.1: Measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach
C109.2: Analyze the transient responses of first order circuits.
C109.3: Evaluate the performance of Transformers through various testing methods.
C109.4: Evaluate the performance of DC and AC Motors by direct testing methods.

The following experiments are required to be conducted as compulsory.

PART-A

1. Verification of KVL and KCL.
2. Verification of Thevenin's and Norton's theorems.
3. Transient Response of Series RL and RC circuits for DC excitation.
4. Resonance in series RLC circuit.
5. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits.
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer.
7. Performance Characteristics of a DC Shunt Motor.
8. Torque-Speed Characteristics of a Three-phase Induction Motor.

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

PART-B

1. Verification of Superposition theorem.
2. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star).
3. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation).
4. Measurement of Active and Reactive Power in a balanced Three-phase circuit.
5. No-Load Characteristics of a Three-phase Alternator.

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

Prerequisite: 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 toanother

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}, $\sin ax$, $\cos ax$, polynomials in x, $e^{ax}(x)$, and $xV(x)$, 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, Reprint, 2008, Laxmi Publications.
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
CH202BS	**Engineering Chemistry**	3	1	0	4

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

C202.1: Analyze the basic properties of water and its usage in domestic and industrial purposes.

C202.2: Inspect the working principles and reaction mechanisms of various energy storage devices

C202.3: Acquire the basic knowledge of electrochemical procedures related to corrosion and its control.

C202.4: Impart the fundamental knowledge and sustainability implemented through smart engineering materials.

C202.5: Distinguish various energy sources to prioritise eco-friendly fuels for environmentally sustainable development.

C202.6: 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, 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.
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 II Semester

Course Code	Course Title	L	T	P	Credits
ME203ES	Computer Aided Engineering Graphics	1	0	4	3

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 engineeringapplications.
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 reference planes.

Unit – III

Projections of Planes: Projections of Plane geometric figures
Projections of Regular Solids: Projections of solids (prisms, pyramids, cylinders and cones) in simple position 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. Bhatt N. D., V. M. Panchal, and Pramod R. Ingle, Engineering Drawing, 53rd Edition, 2016, Charotar Publishing House Pvt. Limited.
2. Agrawal, Basant and C. M. Agrawal, Engineering Drawing, 3rd Edition, 2020, Tata McGraw Hill Education (India).
4. Venugopal K., Sreekanjana G., Engineering Drawing, 2nd Edition, 2011, New Age International.
5. 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.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
EC204ES	**Electronic Devices and Circuits**	2	0	0	2

Course Description: This course provides an in-depth understanding of the principles, operation, and design of electronic devices and circuits, equipping students with the knowledge and skills necessary to analyze, design, and troubleshoot electronic systems.

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

C204.1: Analyze the characteristics of PN junction diode.
C204.2: Construct diode circuits for various applications.
C204.3: Illustrate the transistor working in different configurations.
C204.4: Differentiate between FET and BJT devices.
C204.5: Illustrate the operation and characteristics of special purpose diodes.
C204.6: Use diode and transistor as switches in electronic circuits.

Unit – I Diodes
Diode - Static and Dynamic resistances, Equivalent circuit, Diffusion and Transition Capacitances, V-I Characteristics, Diode as a switch- switching times

Unit – II Diode Applications
Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers with Capacitive and Inductive Filters, Clippers-Clipping at two independent levels, Clamper-Clamping Circuit Theorem, Clamping Operation, Types of Clampers.

Unit – III Bipolar Junction Transistor (BJT)
Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch, switching times.

Unit – IV Junction Field Effect Transistor (FET)
Construction, Principle of Operation, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET, FET as Voltage Variable Resistor, MOSFET, MOSTET as a capacitor.

Unit – V Special Purpose Devices
Zener Diode - Characteristics, Zener diode as Voltage Regulator, Principle of Operation - SCR, Tunnel diode, UJT, Varactor Diode, Schottky diode.

TEXT BOOKS

1. Jacob Millman, Electronic Devices and Circuits, McGraw Hill Education.
2. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuits theory, 11th Edition, 2009, Pearson.

REFERENCE BOOKS

1. David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford.
2. Chinmoy Saha, Arindam Halder, Debaati Ganguly, Basic Electronics-Principles and Applications, 2018, Cambridge.
3. Thomas L. Floyd, Electronic Devices, 9th Edition, 2012, Pearson.
4. A. Anand Kumar, Pulse and Digital Circuits, PHI Learning.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
EN205HS	**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

C205.1: Apply English language effectively in spoken and written forms
C205.2: Analyze the given texts and essence of poem ,respond appropriately
C205.3: Apply various grammatical structures in personal and academic fronts.
C205.4: Develop appropriate vocabulary for professional communication
C205.5: Make use of competency in various forms of academic and professional writing.
C205.6: 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 Sudha Murty
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. English: Language, Context and Culture by 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, 2nd Edition, 2017, Macmillan.
3. Technical Communication, 2019, Wiley India Pvt. Ltd.
4. Swan, Michael, Practical English Usage, 4th Edition, 2016, Oxford University Press.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
EC206ES	**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 $m \times n$ containing *random numbers* in the range 1 to 99999
   b) Write a program that adds, subtracts and multiplies two matrices. Provide an interface such that, based on the prompt, the function (addition, subtraction, multiplication) should be performed
   c) Write a program to solve a system of n linear equations in n variables using matrix inverse

5. The package scipy and pyplot
   a) Finding if two sets of data have the same *mean* value
   b) Plotting data read from a file
   c) Fitting a function through a set 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, Learning Python, O'Reilly.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
CH207BS	**Engineering Chemistry Laboratory**	0	0	2	1

Prerequisite: Fundamental knowledge of quantitative and qualitative analysis

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

C207.1: Analysis of materials using small quantities of materials involved for quick and accurate results

C207.2: Interpret a new application by the analysis of physical principle involved in various instruments.

C207.3: Develop experimental skills in building technological advances by qualitative and quantitative analysis of materials.

C207.4: 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 complexometric 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 Textbook 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 II Semester

Course Code	Course Title	L	T	P	Credits
EN208HS	**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

C208.1: Understand the nuances of English language through audio - visual experience

C208.2: Apply soft skills effectively while working in group activities

C208.3: Create Neutralize accent for intelligibility

C208.4: 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: Situational Dialogues–Role Play – Expressions in Various Situations – 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 – Giving Directions and Guidelines – Blog Writing- 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 Black Swan Pvt. Ltd.
3. Shobha K N & Rayen J. Lourdes, Communicative English–A work book, 2019, Cambridge University Press.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
EC209ES	**Electronic Devices and Circuits Laboratory**	0	0	2	1

Course Description: This course provides hands-on experience in applying theoretical concepts to design and build electronic circuits using different electronic components.

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

C209.1: Analyze the characteristics of PN junction diode and its applications.
C209.2: Verify the characteristics of various configurations of BJT and FET devices.
C209.3: Analyze the switching characteristics of a transistor.
C209.4: Verify the characteristics of various special purpose diodes and transistors.

List of Experiments (Twelve experiments to be done):
Verify any twelve experiments in H/W Laboratory

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Full Wave Rectifier with & without filters
3. Types of Clippers at different reference voltages
4. Types of Clampers at different reference voltages
5. The steady state output waveform of clampers for a square wave input
6. Input and output characteristics of BJT in CB Configuration
7. Input and output characteristics of BJT in CE Configuration
8. Input and output characteristics of BJT in CC Configuration
9. Input and Output characteristics of the JFET in CS configuration.
10. Input and output characteristics of MOSFET in CS Configuration
11. Input and output characteristics of MOSFET in CD Configuration
12. Switching characteristics of a transistor
13. Zener diode characteristics and Zener as voltage Regulator
14. SCR Characteristics.
15. UJT Characteristics and identify negative region

Major Equipment required:

1. Regulated Power Suppliers, 0-30V
2. 20 MHz, Dual Channel Cathode Ray Oscilloscopes
3. Functions Generators-Sine and Square wave signals
4. Multimeters, voltmeters and Ammeters
5. Electronic Components and devices

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
MA301BS	Numerical Methods and Complex Variables	3	1	0	4

Prerequisite: 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 $1/3^{rd}$ and $3/8^{th}$ 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.

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EC302PC	**Analog Circuits**	3	0	0	3

Prerequisite: Electronic Devices and Circuits

Course Description: This course is advanced level of Electronics Devices & Circuits and it contains biasing techniques of BJT, FET Amplifiers, different Multistage & Feedback Amplifiers and Oscillators.

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

C302.1: Apply the biasing and stabilization techniques for the bipolar junction transistor and FET.
C302.2: Explore different types of single and multistage BJT amplifiers.
C302.3: Analyze the small signal model of various FET Amplifiers.
C302.4: Derive high frequency transistor parameters using hybrid pi model.
C302.5: Examine the characteristics of different Feedback Amplifiers.
C302.6: Design various sinusoidal oscillator circuits for given frequencies.

Unit – I BJT Biasing & Analysis and Design of Small Signal Low Frequency BJT Amplifiers

BJT Biasing: Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing -Fixed Bias, Self-Bias, Bias Stability, Bias Compensation using Diode.

Analysis and Design of Small Signal Low Frequency BJT Amplifiers: Transistor Hybrid model, Determination of h-parameters from transistor characteristics, Typical values of h- parameters in CE,CB and CC configurations, Transistor amplifying action, Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors on CE Amplifier.

Unit – II FET Amplifiers

FET- Biasing Techniques

FET Amplifiers: Analysis of CS, CD, CG JFET Amplifiers, comparison of performance with BJT, Amplifiers, Basic Concepts of MOSFET Amplifiers, MOS Small signal model, Common source amplifier with resistive, Diode connected and Current source loads, Source follower, Common Gate Stage, Cascode and Folded Cascode Amplifier – frequency response.

Unit – III Multistage Amplifiers & Transistor at High Frequency

Multistage Amplifiers: Classification of Amplifiers, Distortion in amplifiers, Different coupling schemes used in amplifiers, Frequency response and Analysis of multistage amplifiers, Cascade RC Coupled amplifiers, Cascade amplifier, Darlington pair.

Transistor at High Frequency: Hybrid –π model of Common Emitter transistor model, f_α, f_β and unity gain bandwidth, Gain-bandwidth product.

Unit – IV Feedback Amplifiers

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.

Unit – V Oscillators

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, Frequency and amplitude stability of Oscillators, Crystal Oscillator.

TEXT BOOKS

1. Jacob Millman, Christos C Halkias, Integrated Electronics, McGraw Hill Education.
2. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuits theory, 11th Edition, 2009, Pearson.

REFERENCE BOOKS

1. David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford.
2. Adel S. Sedra, Kenneth C. Smith, Microelectronic Circuits - Theory and Applications, Oxford.
3. Chinmoy Saha, Arindam Halder, Debaati Ganguly, Basic Electronics-Principles and Applications, 2018, Cambridge.
4. Behzad Razavi, Fundamentals of Microelectronics, 3rd Edition, Wiley.

B.Tech. II Year I Semester

Course code	Course Title	L	T	P	Credits
EC303PC	**Network Analysis and Synthesis**	3	0	0	3

Prerequisite: Basic Electrical Engineering

Course Description: Network analysis and synthesis is a professional engineering course that deals with the study and application of network concepts in communication engineering. This course gives significance of magnetically coupled circuits and graph theory in communication engineering. It also deals with transient and steady state analysis of RLC circuits, two port network parameters, design and analysis of filter circuits and network synthesis.

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

C303.1: Analyze the electrical circuits using the concepts of network topology and coupled circuits.

C303.2: Analyze the Steady state and transient analysis of RLC Circuits.

C303.3: Characterization of two port network parameters

C303.4: Analyze the design aspects of various types of filters and attenuators

C303.5: Evaluate various transmission line parameters

C303.6: Synthesize various types of networks using network functions

Unit – I Network Topology

Basic cutset and tie set matrices for planar networks, Magnetic Circuits, Self and Mutual inductances, dot convention, impedance, reactance concept, Impedance transformation and coupled circuits, co-efficient of coupling, equivalent T for Magnetically coupled circuits, Ideal Transformer.

Unit – II Transient and Steady state analysis

RC, RL and RLC Circuits, Sinusoidal, Step and Square responses. RC Circuits as integrator and differentiators. 2nd order series and parallel RLC Circuits, damping factor, over damped, under damped, critically damped cases, quality factor and bandwidth for series and parallel resonance, resonance curves.

Unit – III Two port network parameters

Z, Y, ABCD, h and g parameters, Characteristic impedance, Image transfer constant, image and iterative impedance, network function, driving point and transfer functions – using transformed (S) variables, Poles and Zeros. Standard T, π, L Sections, Characteristic impedance, image transfer constants, Design of Attenuators, impedance matching network.

Unit – IV Filters

Classification of Filters, Filter Networks, Constant-K Filters-Low pass, high pass, Band pass, band-stop filters, M-derived Filters- T and π filters- Low pass, high pass Attenuators: Types – T, π , L, Bridge T and lattice ,Asymmetrical Attenuators T, π , L Equalizers-Types- Series,

Shunt, Constant resistance, bridge T attenuation, bridge T phase, Lattice attenuation, lattice Phase equalizers

Unit – V Network Synthesis

Driving point impedance and admittance, transfer impedance and admittance, network functions of Ladder and non ladder networks, Poles, Zeros analysis of network functions, Hurwitz polynomials, Positive Real Functions, synthesis of LC, RC and RL Functions by foster and causer methods.

TEXT BOOKS

1. Van Valkenburg, Network Analysis, 3rd Edition, 2016, Pearson.
2. JD Ryder, Networks, Lines and Fields, 2nd Edition, 1999, PHI.

REFERENCE BOOKS

1. J. Edminister and M. Nahvi, Electric Circuits, Schaum's Outline Series, 4th Edition, 1999, Mc Graw Hill Education.
2. A. Sudhakar and Shyammohan S Palli, Circuits and Networks: Analysis and Synthesis, 5th Edition, 2017, Tata McGraw- Hill Publications.
3. William Hayt and Jack E. Kimmerley, Engineering Circuit Analysis, 6th Edition, 2005, McGraw Hill Company.
4. S. P. Eugene Xavier, Statistical Theory of Communication, 2003, New Age Publications.

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EC304PC	**Digital Logic Design**	3	0	0	3

Prerequisite: Electronic Devices and Circuits

Course Description: This course provides thorough understanding of basic concepts required for digital system design and various logic families.

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

C304.1: Apply the concepts of number systems and codes in digital system design.
C304.2: Minimize Boolean expressions using various techniques
C304.3: Compare various characteristics of logic families.
C304.4: Realize combinational logic circuits for given specifications
C304.5: Design sequential circuits and state machines
C304.6: Realize logic circuits using programmable logic devices

Unit – I Number Systems & Boolean Algebra

Number Systems: Number systems, Complements of Numbers, Codes- Weighted and Non-weighted codes and its Properties, Parity check code and Hamming code.

Boolean algebra: Basic Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.

Unit – II Minimization Techniques & Logic Families

Minimization of Boolean functions: Karnaugh Map Method - Up to five Variables, Don't Care Map Entries, Tabular Method

Realization of Logic Gates Using Diodes & Transistors: AND, OR and NOT Gates using Diodes and Transistors, DCTL, RTL, DTL, TTL, CML and CMOS Logic Families and its Comparison, standard TTL NAND Gate-Analysis & characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tri-state outputs, IC interfacing- TTL driving CMOS & CMOS driving TTL.

Unit – III Combinational Circuits and fundamentals of Sequential Circuits

Combinational Logic Circuits: Adders, Subtractors, Comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations.

Sequential Circuits Fundamentals: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another.

Unit – IV Registers, Counters & Sequential Machines

Registers and Counters: Shift Registers – Left, Right and Bidirectional Shift Registers, Applications of Shift Registers - Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.

Sequential Machines: Finite State Machines, Synthesis of Synchronous Sequential Circuits-Serial Binary Adder, Sequence Detector, Parity-bit Generator, Synchronous Modulo N – Counters.

Unit – V Finite State Machines and Programmable Logic Devices

Finite state machine: capabilities and limitations, Mealy and Moore models, State equivalence and machine minimization, simplification of incompletely specified machines, Merger graphs. Asynchronous design-modes of operation, Hazards, synthesis of SIC fundamental mode circuits, synthesis of burst mode circuits.

Programmable Logic Devices: Read Only Memory, Programmable Array Logic, Programmable Logic Array, Introduction to Field Programmable Gate Array.

TEXT BOOKS

1. Zvi Kohavi & Niraj K. Jha, Switching and Finite Automata Theory, 3rd Edition, 2010, Cambridge.
2. R. P. Jain, Modern Digital Electronics, 3rd Edition, 2007, Tata McGraw-Hill.
3. Morris Mano, Digital Design, 4th Edition, 2008, Pearson.

REFERENCE BOOKS

1. Fredric J. Hill, Gerald R. Peterson, Introduction to Switching Theory and Logic Design, 3rd Edition, John Wiley & Sons Inc.
2. Charles H. Roth, Fundamentals of Logic Design, 5th Edition, 2004, Cengage Learning.
3. Stephen M. Trimberger, Field Programmable Gate Array Technology, Springer International Edition.
4. A. Anand Kumar, Switching Theory and Logic Design, 3rd Edition, 2016, PHI.

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EC305PC	**Signals and Systems**	3	1	0	4

Course Description: The course presents and integrates the basic concepts for both continuous-time and discrete-time signals and systems and their analysis using various transformation techniques. Further it presents the sampling theorem and its types.

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

C305.1: Analyze the orthogonality of real and complex signals
C305.2: Determine the Spectral characteristics of Periodic and Aperiodic continuous signals
C305.3: Analyze the signal transmission through linear time invariant systems
C305.4: Apply the concepts of correlation for removal of noise
C305.5: Analyze continuous and discrete-time signals and systems using Laplace & Z Transforms respectively
C305.6: Illustrate the need for sampling theorem for analog to digital signal conversion

Unit – I Signal Analysis

Signal Analysis: Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function, Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions.

Unit – II Fourier series and Fourier Transforms

Fourier series: Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

Fourier Transforms: Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform

Unit – III Signal Transmission through Linear Systems

Signal Transmission through Linear Systems: Linear System, Impulse response, Response of a Linear System, Linear Time Invariant (LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and rise time, Convolution and Correlation (Autocorrelation and Cross Correlation) of Signals, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution, Detection of Periodic Signals in the presence of Noise by Correlation, Extraction of Signal from Noise by Filtering.

Unit – IV Laplace Transforms and Z-Transforms

Laplace Transforms: Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis.

Z-Transforms: Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

Unit – V Sampling theorem

Sampling theorem: Graphical and analytical proof for Band Limited Signals, Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling - Aliasing, Introduction to Band Pass Sampling.

TEXT BOOKS

1. B.P. Lathi, Signals, Systems & Communications, 2013, BSP.
2. A.V. Oppenheim, A.S. Willsky and S.H. Nawabi, Signals and Systems, 2nd Edition, 2013, Prentice Hall.

REFERENCE BOOKS

1. Simon Haykin and Van Veen, A. Rama Krishna Rao, Signals and Systems, 2008, TMH.
2. Michel J. Robert, Fundamentals of Signals and Systems, International Edition, 2008, MGH.
3. C. L. Philips, J. M. Parr and Eve A. Riskin, Signals, Systems and Transforms, 3rd Edition, 2004, PE.

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EC306PC	**Analog Circuits Laboratory**	0	0	2	1

Course Description: Analog Circuits lab provides practical knowledge on amplifiers with required Q point and analyze amplifier characteristics, frequency response of multistage amplifiers and feedback concept in amplifiers and oscillators

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

C306.1: Design amplifiers with required Q point.
C306.2: Examine the frequency response of CE amplifier for low and high frequencies.
C306.3: Analyze the frequency response of multistage and feedback amplifiers
C306.4: Design and verify the Colpitts and RC phase shift Oscillators for a given frequency.

List of Experiments (Twelve experiments are to be done):
Verify any twelve experiments in H/W Laboratory

1. Perform an experiment to choose Q-point for a Transistor that operate in active region and observe the effect of external Load resistance on Q-point.
2. Design a Self bias Circuit and determine the Q-point of the Transistor and its Stability factor by both simulation and realization with hardware components.
3. Obtain the I/O Characteristics of CE, CB, CC amplifiers. Calculate h-parameters from the characteristics.
4. Design and Simulate a Common Drain Amplifier with voltage divider bias and determine the Stability factor.
5. Obtain the frequency response of the CS JFET amplifier and find the bandwidth.
6. By experiment prove that the voltage gain of Emitter Follower Circuit is one.
7. Design a Common Emitter Amplifier with a gain of 30db and Bandwidth of 10KHZ and plot the frequency response practically.
8. Design a two stage RC Coupled amplifier and prove that gain is increased and analyze the effects of coupling capacitance.
9. Practically prove that the Darlington pair has high input impedance.
10. Draw the high frequency response of common emitter transistor amplifier and calculate f_α, f_β and gain bandwidth product.
11. Design a cascade amplifier for a given specifications.
12. Design four topologies of feedback amplifiers and draw the frequency response of them with and without feedback.
13. Design an RC phase shift oscillator circuit and derive the gain condition for oscillations practically for given frequency.
14. Design a Colpitts oscillator circuit for the given frequency and draw the output waveform.

Major Equipment required:

1. Regulated Power Suppliers, 0-30V
2. 20 MHz, Dual Channel Cathode Ray Oscilloscopes
3. Functions Generators-Sine and Square wave signals
4. Multimeters
5. Electronic devices

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EC307PC	**Digital Logic Design Laboratory**	0	0	2	1

Prerequisite: Electronic Devices and Circuits

Course Description: This course is about the realization, implementation and verification of Boolean functions, combinational circuits, sequential circuits and logic families.

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

C307.1: Realize different combinational circuits using gates
C307.2: Implement Boolean functions using combinational building blocks
C307.3: Design and verify sequential circuits and state machines using flip flops
C307.4: Realize all logic gates using DTL and TTL logic families

List of Experiments:

1. Realization of Logic circuit to generate r's Compliment using Logic Gates.
2. Realization of given Boolean function using universal gates and minimizing the same. Compare the gate count before and after minimization.
3. Design and realize Full Adder circuit using gates/universal gates. Implement Full Subtractor using full adder.
4. Designing a 2 – bit Comparator using AND, OR and NOT gates. Realize 4 – bit Comparator using 2– bit Comparators.
5. Realize 2:1 MUX using the given gates and Design 8:1 using 2:1 MUX.
6. Implement the given Boolean function using the given MUX (ex: code converters).
7. Realize a 2x4 Decoder using logic gates and implement 3x8 Decoder using 2x4 Decoder.
8. Implement the given Boolean function using given Decoders.
9. Convert Demultiplexer to Decoder and vice versa.
10. Verification of truth tables of flip flops using different clocks (level triggering, positive and negative edge triggering) also converts the given flip flop from one type to other.
11. Designing of Universal n-bit shift register using flip flops and Multiplexers. Draw the timing diagram of the Shift Register.
12. Design a Synchronous binary counter using D-flip flop/given flip flop.
13. Design an asynchronous counter for the given sequence using given flip flops.
14. Designing of MOD 8 Counter using JK flip flops.
15. Designing of sequence detecting State Machine with minimal states using the given flip flops.
16. Designing of Parity Bit (even/odd) generator using the given flip flops.
17. Realize all logic gates with TTL logic.
18. Realize all logic gates with DTL logic.

Note: Minimum of 12 experiments are to be performed

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
EC308ES	**Basic Simulation Laboratory**	0	0	2	1

Course Description: This laboratory course introduces simulation software (MATLAB or equivalent) and its use to implement the various concepts like basic operations on Matrices, analysis of signals and systems using various transformation techniques, Convolution and Correlation operations and related applications

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

C308.1: Perform various operations on signals
C308.2: Verify the properties of LTI system and its response for different inputs.
C308.3: Analyze the signals and systems using various transforms
C308.4: Verify the application of convolution and correlation in signal analysis

List of Programs

1. Basic Operations on Matrices.
2. Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sine.
3. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding.
4. Computation of Energy and Average Power.
5. Finding the Even and Odd parts of Signal / Sequence and Real and Imaginary parts of Signal
6. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum
7. Gibbs Phenomenon Simulation.
8. Verification of Linearity and Time Invariance Properties of a given Continuous / Discrete System.
9. Computation of Unit sample, Unit step and Sinusoidal responses of the given LTI system and verifying its physical realizability and stability properties
10. Design a LPF and HPF
11. Relation between bandwidth and rise time.
12. Convolution for Signals and sequences.
13. Auto Correlation and Cross Correlation for Signals and Sequences.
14. Removal of noise by Autocorrelation / Cross correlation.
15. Extraction of Periodic Signal masked by noise using Correlation.
16. Waveform Synthesis using Laplace Transform.
17. Locating the Zeros and Poles and plotting the Pole-Zero maps in S-plane and Z-Plane for the given transfer function.
18. Verification of Sampling Theorem.
19. Analysis of Spectrogram for Speech Signal

Note: Minimum of 15 Programs are to be executed

Major Equipment required:

1. Computer System with latest specifications
2. Window XP or equivalent
3. Simulation software-MATLAB or any equivalent simulation software

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
MC311	**Environmental Science**	3	0	0	0

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: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies

Unit – III Biodiversity and Biotic Resources

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wild life conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation.

Unit – IV Environmental Pollution and Control Technologies: Environmental Pollution

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards .**Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Waste water 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, Wildlife Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of base line 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, 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, McGraw Hill Education (India) Private Limited.

REFERENCE BOOKS

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