ACADEMIC REGULATIONS (BH25)
COURSE STRUCTURE
AND
DETAILED SYLLABUS

COMPUTER SCIENCE AND ENGINEERING

for

B.Tech. Four Year Degree Course

(Applicable for the batches admitted from A.Y. 2025-26 onwards)

VISHNU
UNIVERSAL LEARNING
BVRIT H
Estd. 2012

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))
Bachupally, Hyderabad -500 090
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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

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

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

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

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

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

2.0 Eligibility for Admission

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

2.2 The medium of instruction for the entire undergraduate programme in Engineering & Technology will be in **English** only.

3.0 B. Tech. Programme Structure

3.1 A student after securing admission shall complete the B.Tech. Programme in a minimum period of **Four** academic years and a maximum period of **Eight** academic years starting from the date of commencement of first year first semester, failing which student shall forfeit seat

in B.Tech. Course. Each student has to secure a minimum of 160 credits out of 164 credits for successful completion of the undergraduate programme and award of the B.Tech. Degree.

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

3.2.1 Semester Scheme

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

3.2.2 Credit Courses

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

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

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

3.2.3 Subject Course Classification

All subjects / courses offered for the undergraduate programme in E & T (B.Tech. Degree programmes) are broadly classified as follows.

S. No.	Broad Course Classification	Course Group / Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes Mathematics, Physics and Chemistry courses
2		ES - Engineering Sciences	Includes Fundamental Engineering Courses
3		HS – Humanities and Social Sciences	Includes courses related to Humanities, Social Sciences and Management
4	Core Courses (CoC)	PC – Professional Core	Includes core courses related to the parent branch of Engineering.
5	Elective Courses (EℓC)	PE – Professional Electives	Includes elective courses related to the parent branch of Engineering.
6		OE – Open Electives	Elective courses which include inter-disciplinary courses or courses in an area outside the parent branch of Engineering.
7	Project Core	Project Work	B.Tech. Project Work
8	Other Core Courses (OCC)	Industry Training / Internship / Industry Oriented Mini- project / Skill Development Courses	Industry Training / Internship / Industry Oriented Mini- Project / Skill Development Courses
9		Seminar	Seminar based on core contents related to parent branch of Engineering.
10	Skill Development Courses (SDC)	-	Courses designed to help individuals gain, improve, or refine specific skills
11	Value Added Courses (VAC)	-	Courses to build professional values, traditional knowledge and sensitization of societal issues

4.0 Mandatory Induction Programme

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

i) Physical Activity, ii) Creative Arts, iii) Imparting Universal Human Values, iv) Litera Activities, v) Lectures by Eminent People, vi) Visits to Local Areas and vii) Familiarization

department as well as entire institute and viii) Making students understand Innovative practic at the college premises etc.

5.0 Course Registration

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

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

5.3 A student can apply for registration, by consulting faculty advisor / mentor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with the Head of the Department.

5.4 A student shall register for all the courses offered in a semester as specified in the course structure.

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

5.6 The Head of the Department / Course Coordinator should review vacant slots in the Time table of each section once in every week or fortnight. The vacant slots in the time-table may be allocated to the subject teachers who could not take classes in proportion to the number of weeks completed from the commencement of the semester.

5.7 Two faculty members may be allocated for the tutorial session of Mathematics-1 course for better interaction / practice and to minimize the failures in the subject.

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

Students have the flexibility to choose from the list of professional electives offered by the Institute or opt to register for the equivalent Massive Open Online Courses (MOOCs) as listed from time to time by the College.

5.9 **Open Electives**: Students have to choose three Open Electives (OE - I, II & III) from three baskets of Open Electives given by other than the parent department. However, the student can

opt for an Open Elective course offered by her parent department, if the student has not studied that course so far. Similarly, Open Elective courses being studied should not match with any courses of the forthcoming semesters.

5.10 Provision for Early Registration of MOOCs:

For a professional elective in a semester, students are allowed to register for an equivalent MOOCs course listed from time to time by the College one semester in advance. For example, a Professional Elective of III Year II Sem shall be allowed to register under MOOCs platform in III year I Sem.

The credits earned in one semester in advance can be submitted in the subsequent semester for the assessment.

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

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

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

5.13 Additional learning resources:

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

6.0 Rules to offer Elective courses

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

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

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

7.0 Attendance requirements

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

7.2 Shortage of attendance in aggregate upto 10% (securing 65% and above but below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.

7.3 A stipulated fee shall be payable for condoning of shortage of attendance as notified by the college.

7.4 Two hours of attendance for each theory course shall be considered, if the student appears for the mid-term examination of that course.

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

7.6 Students, whose shortage of attendance is not condoned in any semester, are not eligible to take their semester-end examinations of that semester. They get detained and will not be promoted to the next semester. Their registration for that semester shall stand cancelled, including internal marks. They may seek re-registration for that semester in the next academic year.

7.7 A student fulfilling the attendance requirement in the present semester shall not be eligible for re-admission into the same semester.

8.0 Criteria for Earning of Credits in a Course

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

8.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Field Based Research Project / Industry Oriented Mini Project / Internship, if the student secures not less than 40% marks (i.e., 40 out of 100 allotted marks) in each of them.

The student is deemed to have failed, if she (i) does not submit a report on Field-Based Research Project / Industry Oriented Mini Project / Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in Field-Based Research Project / Industry Oriented Mini Project / Internship evaluations.

8.3 A student eligible to appear in the semester-end examination for any course, is absent from it or failed (there by failing to secure 'C' grade or above) may re-appear for that course in the supplementary examination as and when it is conducted. In such cases, internal marks assessed in continuous internal evaluation (CIE) earlier for that course will be carried over, and added to the marks obtained in the SEE supplementary / make-up examination. If the student secures sufficient marks for passing, 'C' grade or above shall be awarded as specified in clause 10.3.

9.0 Distribution of Marks and Evaluation

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

9.2 Continuous Internal Evaluation (CIE)

9.2.1 Theory Courses:

For theory courses, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of two parts i) **Part – A** for 10 marks, ii) **Part – B** for 20 marks, totaling to 30 marks. Total duration of mid-term examination is two hours.

1. Mid Term Examination for 30 marks:
    a. Part-A: Objective / quiz paper for10 marks.
    b. Part-B: Descriptive paper for 20 marks.

The objective / quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 10 marks.

The descriptive paper shall contain 6 questions out of which, the student has to answer 4 questions, each carrying 5 marks. The **average of the two Mid Term Examinations** shall be taken as the final marks for Mid Term Examination (for 30 marks).

While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid- term examination shall be conducted on the remaining 50% of the syllabus. Questions will be drawn from the mid-term exam syllabus, ensuring uniform coverage of all topics.

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

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

9.2.2 Engineering Drawing and Computer Aided Drafting Course:

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

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

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

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

9.4 Semester End Examination for theory courses

9.4.1 Theory Courses:

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

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

9.4.2 Engineering Drawing and Computer Aided Drafting Course:

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

9.4.3 Duration of SEE:

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

9.5 Semester End Examination for Practical Courses

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

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

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

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

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

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

9.6 Field-based Research Project:

There shall be a Field – based Research Project in the intervening summer between II-II and III- I Semesters. Students will register for their project immediately after II Year II Semester examinations and pursue it during summer vacation. The Field-based Research Project shall be submitted in a report form and presented before the committee in III year I semester. It shall be evaluated for 100 external marks. The evaluation committee shall consist of an External Examiner, Head of the Department, Supervisor of the Project and a Senior Faculty Member of the department. There shall be no internal marks for Field-based Research Project. Student shall have to earn 40% marks, i.e 40 marks out of 100 marks. The student is deemed to have failed, if she (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the committee as per schedule, or (iii) secures less than 40% marks in this course.

9.7 Internship / Industry Oriented Mini Project:

There shall be an Internship / Industry Oriented Mini Project in collaboration with an industry from their specialization. Students shall register for their project immediately after III Year II Semester Examinations and pursue it during summer vacation. Internship should be carried out at an organization (or) Industry. The Industry Oriented Mini Project shall be submitted in a report form and presented before the committee in IV Year I Semester before the semester end examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project / Internship, and a Senior Faculty Member of the Department.

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

9.8 UG Project Work:

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

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

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

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

Total - 40 Marks

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

The topics for main Project shall be different from the topic of Industry Oriented Mini Project / Internship / SDC. The student is deemed to have failed, if she (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

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

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

9.9 Skill Development Courses:

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

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

9.10 Value Added Courses:

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

other classes on that day. The scheduling of the semester-end examinations shall also be intimated by the Exam Branch time to time.

10.0 Grading Procedure:

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

10.2 Grades will be awarded to indicate the performance of students in each Theory, Laboratory, Industry - Oriented Mini Project / Internship / Skill development course and Project Work. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in clause 8 above, a letter grade shall be given as explained in the following clause.

10.3 To measure the performance of a student, a10-point grading system is followed. The mapping between the percentage of marks secured and the corresponding letter grade is as follows:

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

10.4 A student shall be declared successful or 'passed' in a semester, if she secures **'C'** grade or above in every course (ie GP $\geq$ 5)

10.5 A student who has obtained an '**F'** grade in any course shall be deemed to have '**failed'** and is required to re-appear for a supplementary exam as and when conducted. In such cases, internal marks in those courses will remain the same as those obtained earlier.

10.6 To a student who has not appeared for an examination in any course, '**Ab'** grade will be allocated in that course, and she is deemed to have '**Failed'**. Such student will be required to re-appear for supplementary / make-up exam as and when conducted. The internal marks in those courses will remain the same as those obtained earlier.

10.7 The students earn a Grade Point (GP) in each course, on the basis of letter grade secured in that course. Every student who pass a course will receive grade point **GP ≥5** ('C 'grade or above).

10.8 The 'Credit Points' (C) are computed by multiplying the grade point with credits for a given course.

Credit Points (C) = Grade Point (GP) x Credits

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

$$\text{SGPA} = \left\{\sum_{i=1}^{N} C_i \; G_i\right\} / \left\{\sum_{i=1}^{N} C_i \;\right\}$$

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

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

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

$$\text{CGPA} = \left\{\sum_{j=1}^{M} C_j \, G_j\right\} / \left\{\sum_{j=1}^{M} C_j \;\right\}$$

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

Illustration of the Calculation of SGPA:

Course	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	4 x 8 = 32
Course 2	3	O	10	3 x 10 = 30
Course 3	3	C	5	3 x 5 = 15
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A	8	3 x 8 = 24
Course 6	2	A+	9	2 x 9 = 18
Course 7	1	C	5	1 x 5 = 5
Course 8	1	O	10	1 x10 = 10
	20			152

SGPA=152/20=7.6

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

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

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

11.0 Declaration of Results and issue of Grade Memo

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

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

12.0 With holding of Results

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

13.0 Supplementary Examinations:

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

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

14.0 Promotion Rules

S.No.	Promotion	Conditions to be Fulfilled
1	First year first semester to first Year second semester	Regular course of study of first year first semester and fulfillment of attendance requirement.
2	First year second semester to Second year first semester	i) Regular course of study of first year second semester and fulfillment of attendance requirement ii) Must have secured at least 25% of the total credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3.	Second year first semester to Second year second semester	Regular course of study of second year first Semester and fulfillment of attendance requirement.
4	Second year second semester to Third year first semester	i) Regular course of study of second year second semester and fulfillment of attendance requirement. ii) Must have secured at least 25% of the total credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those Examinations or not.
5	Third year first semester to Third Year second semester	Regular course of study of third year first semester and fulfillment of attendance requirement.
6	Third year second semester to Fourth year first semester	Regular course of study of third year second Semester and fulfillment of attendance requirement.
7	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester and fulfillment of attendance requirement.

15.0 Re-admission after Detention

i) A student detained due to lack of credits, shall be promoted to the next academic year only after acquiring the required number of credits.

ii) A student detained due to shortage of attendance shall be admitted in the same semester in the successive academic years.

iii) When a student is readmitted in the following academic years, the academic regulations under which the student seeks re-admission shall only be applicable to this student, not the academic regulations in which she got admitted in her first year of study.

16.0 Credit Exemption

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

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

17.0 Award of degree

17.1 A student, who registers for all the courses specified in the course structure and secures the required number of 160 credits within 8 academic years from the date of commencement of the first academic year, shall be declared to have qualified for the award of B.Tech. Degree in the branch of Engineering selected at the time of admission**.**

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

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

i) Should have passed all the courses in 'First Appearance'.

ii) Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason. A student not fulfilling any of the above conditions with final CGPA ≥ 7.5 shall be placed in 'First Class'.

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

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

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

17.7 Grace Marks

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

18.0 Award of Gold Medals

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

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

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

19.0 Conversion of CGPA into equivalent Percentage of Marks

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

Percentage (%) of Marks = (Final CGPA – 0.5) x 10

20.0 Honours and Minor Degree Programs

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

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

21.0 Multiple Entry Multiple Exit Scheme (MEME)

21.1 Exit Option after Second Year:

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

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

21.2 Additional Requirements for Diploma Award

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

Work-based Vocational Course:

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

Internship /Apprenticeship:

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

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

21.3 Re-entry into the B.Tech. Programme

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

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

21.4 Break in Study and Maximum Duration

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

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

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

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

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

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

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

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

22.6 Lookup Table of equivalence courses

22.6.1 A lookup table will be provided for the benefit of students. This look up table will include all the courses to be registered by students who have been re-admitted under the BH25Academic Regulations from the BH23 Academic Regulations. Separate look up tables will be provided for the following categories of students:

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

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

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

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

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

23.0 Student Transfers

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

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

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

24.0 Value Added Courses

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

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

i) faculty members must undergo a Faculty Development Program (FDP) organized by UGC – MMTTC (Malaviya Mission Teacher Training Centre), or any other recognized and competent institution / organization offering similar certified programs,

ii) the total instructional duration of the FDP should be around 32 hours or more,

iii) All sessions in the FDP must be conducted by certified and qualified resource persons with recognized expertise in the respective domains,

iv) A formal assessment component must be included as part of the FDP.

25.0 Mapping with the Sustainable Development Goals

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

26.0 Scope

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

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

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

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

FROM THE AY 2026-27

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

1. The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.
2. The student shall register for 123/124 credits and secure 120 credits with CGPA ≥ 5 from II year to IV-year B.Tech. Programme (LES) for the award of B.Tech. Degree.
3. The student can avail exemption of courses ***totaling upto 3/4credits*** other than Professional core courses, Laboratory Courses, Seminars, Project Work and Field Based Research Project / Industry Oriented Mini Project / Internship, for optional dropout.
4. The students, who fail to fulfill the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.
5. The attendance requirements of B.Tech. (Regular) shall be applicable to B.Tech. (LES).
6. **Promotion rule**

S. No	Promotion	Conditions to be fulfilled
1	Second year first semester to Second year second semester	Regular course of study of second year first Semester and fulfillment of attendance requirement.
2	Second year second semester to Third year first semester	i) Regular course of study of second year second semester and fulfillment of attendance requirement. ii) Must have secured at least 25% of the total credits upto second year second semester from all the relevant regular and supplementary examinations, whether the student takes those Examinations or not.
3	Third year first semester to Third year second semester	Regular course of study of third year first semester and fulfillment of attendance requirement.
4	Third year second semester to Fourth year first semester	Regular course of study of third year second Semester and fulfillment of attendance requirement.
5	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester and fulfillment of attendance requirement.

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

Academic Regulations for B.Tech - Acceleration of Course Work

Introduction

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

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

Eligibility

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

Course Registration

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

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

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

B.Tech. in COMPUTER SCIENCE AND ENGINEERING
COURSE STRUCTURE (BH25 Regulations)
Applicable from AY 2025-26 Batch

I Year I Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1.	**MA101BS**	Matrices and Calculus	3	1	0	4
2.	**CH102BS**	Engineering Chemistry	3	0	0	3
3.	**CS103ES**	Programming for Problem Solving	3	0	0	3
4.	**EC104ES**	Fundamentals of Electronics Engineering	3	0	0	3
5.	**EN105HS**	English for Skill Enhancement	3	0	0	3
6.	**CH106BS**	Engineering Chemistry Lab	0	0	2	1
7.	**CS107ES**	Programming for Problem Solving Lab	0	0	2	1
8.	**EN108HS**	English Language and Communication Skills Lab	0	0	2	1
9.	**ME109ES**	Engineering Workshop	0	0	2	1
10.		Induction Program				
		Total Credits	**15**	**1**	**8**	**20**

I Year II Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1.	**MA201BS**	Ordinary Differential Equations and Vector Calculus	3	0	0	3
2.	**PH202BS**	Advanced Engineering Physics	3	0	0	3
3.	**ME203ES**	Engineering Drawing and Computer Aided Drafting	2	0	2	3
4.	**EE204ES**	Basic Electrical Engineering	3	0	0	3
5.	**CS205ES**	Data Structures	3	0	0	3
6.	**PH206BS**	Advanced Engineering Physics Lab	0	0	2	1
7.	**CS207ES**	IT Workshop	0	0	2	1
8.	**CS208ES**	Python Programming Lab	0	0	2	1
9.	**EE209ES**	Basic Electrical Engineering Lab	0	0	2	1
10.	**CS210ES**	Data Structures Lab	0	0	2	1
		Total Credits	**14**	**0**	**12**	**20**

II YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1.	**CS301PC**	Discrete Mathematics	3	0	0	3
2.	**CS302PC**	Computer Organization and Architecture	3	0	0	3
3.	**CS303PC**	Object Oriented Programming through Java	3	0	0	3
4.	**CS304PC**	Software Engineering	3	0	0	3
5.	**CS305PC**	Database Management Systems	3	0	0	3
6.	**CS306PC**	Object Oriented Programming through Java Lab	0	0	2	1
7.	**CS307PC**	Software Engineering Lab	0	0	2	1
8.	**CS308PC**	Database Management Systems Lab	0	0	2	1
9.	**CS309SD**	Node JS/ ReactJS/ Django	0	0	2	1
10.	**VA300ES**	Environmental Science	1	0	0	1
		Total Credits	**18**	**0**	**08**	**20**

II YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1.	**MA401BS**	Computer Oriented Statistical Methods	3	0	0	3
2.	**CS402PC**	Operating Systems	3	0	0	3
3.	**CS403PC**	Algorithm Design and Analysis	3	0	0	3
4.	**CS404PC**	Computer Networks	3	0	0	3
5.	**CS405PC**	Artificial Intelligence	3	0	0	3
6.	**MA406BS**	Computational Mathematics Lab	0	0	2	1
7.	**CS407PC**	Operating Systems Lab	0	0	2	1
8.	**CS408PC**	Computer Networks Lab	0	0	2	1
9.	**CS409PC**	Artificial Intelligence Lab	0	0	2	1
10.	**CS410SD**	Data Visualization -R/Python/Power BI /Tableau	0	0	2	1
11.	**MS411HS**	Innovation and Entrepreneurship	2	0	0	2
		Total Credits	**15**	**0**	**10**	**22**

III YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1.	**CS501PC**	Machine Learning	3	0	0	3
2.	**CS502PC**	Automata Theory and Compiler Design	3	0	0	3
3.	**CS503PC**	DevOps	3	0	0	3
4.		Professional Elective-I	3	0	0	3
5.		Open Elective-I	2	0	0	2
6.	**CS504PC**	Machine Learning Lab	0	0	2	1
7.	**CS505PC**	Compiler Design Lab	0	0	2	1
8.	**CS506PC**	DevOps Lab	0	0	2	1
9.	**CS507PC**	Field - Based Research Project	0	0	4	2
10.	**CS508SD**	UI Design–Flutter/Android Studio	0	0	2	1
11.	**VA500HS**	Indian Knowledge System	1	0	0	1
		Total Credits	**15**	**0**	**12**	**21**

III YEAR II SEMESTER

S.No	Course Code	Course Title	L	T	P	Credits
1.	**CS601PC**	Cryptography and Networks Security	3	0	0	3
2.	**CS602PC**	Deep Learning	3	0	0	3
3.	**MS603HS**	Business Economics and Financial Analysis	3	0	0	3
4.		Professional Elective-II	3	0	0	3
5.		Open Elective–II	2	0	0	2
6.	**CS604PC**	Cryptography and Networks Security Lab	0	0	2	1
7.	**CS605PC**	Deep Learning Lab	0	0	2	1
8.	**CS606PC**	Advanced Data Structures using Python Lab	0	0	2	1
9.	**EN607HS**	English for Employability Skills Lab	0	0	2	1
10.	**CS608SD**	Prompt Engineering	0	0	2	1
11.	**VA600HS/ VA601HS**	Gender Sensitization*/Human Values and Professional Ethics*	1	0	0	0.5+0.5
		Total Credits	**15**	**0**	**10**	**20**

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

IV YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.	**CS701PC**	Natural Language Processing	3	0	0	3
2.	**CS702PC**	Cyber Security	3	0	0	3
3.	**MS703HS**	Fundamentals of Management for Engineers	3	0	0	3
4.		Professional Elective-III	3	0	0	3
5.		Professional Elective–IV	3	0	0	3
6.		Open Elective–III	2	0	0	2
7.	**CS704PC**	Natural Language Processing Lab	0	0	2	1
8.	**CS705PC**	Cyber Security Lab	0	0	2	1
9.	**CS706PC**	Industry Oriented Mini Project/Internship	0	0	4	2
		Total Credits	**17**	**0**	**08**	**21**

IV YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.		Professional Elective–V	3	0	0	3
2.		Professional Elective–VI	3	0	0	3
3.	**CS801PC**	Project Work	0	0	42	14
		Total Credits	**6**	**0**	**42**	**20**

PROFESSIONAL ELECTIVES

Professional Elective-I	**CS511PE**	Computer Graphics
	CS512PE	Introduction to Data Science
	CS513PE	Software Testing Methodologies
	CS514PE	Data Mining
	CS515PE	Web Programming
	CS516PE	Distributed Systems
Professional Elective-II	**CS611PE**	Image Processing
	CS612PE	Scripting Languages
	CS613PE	Software Project Management
	CS614PE	Augmented Reality & Virtual Reality
	CS615PE	Full Stack Development
	CS616PE	Generative AI
Professional Elective-III	**CS711PE**	Computer Vision
	CS712PE	Blockchain Technology
	CS713PE	Vulnerability and Penetration Testing
	CS714PE	Data Stream Mining
	CS715PE	Cloud Computing
	CS716PE	Information Retrieval Systems
Professional Elective-IV	**CS721PE**	Mining Massive Dataset
	CS722PE	Agile Methodology
	CS723PE	Big Data Analytics
	CS724PE	Quantum Computing
	CS725PE	Robotic Process Automation
	CS726PE	Cyber Forensics

Professional Elective-V	**CS811PE**	Social Media Mining
	CS812PE	Nature Inspired Computing
	CS813PE	Internet of Things
	CS814PE	Game Theory
	CS815PE	Mobile Application Development
	CS816PE	Human Computer Interaction
Professional Elective-VI	**CS821PE**	High Performance Computing
	CS822PE	Edge Computing
	CS823PE	Graph Theory
	CS824PE	Adhoc and Sensor Networks
	CS825PE	Sustainable Engineering
	CS826PE	Distributed Databases

Open Electives

Open Electives	Department Offering	Course Code	Course Name
OE-I	EEE	**EE500OE**	Fundamentals of Electric Vehicles
		EE501OE	Industrial Automation and Control
		EE502OE	Renewable Energy Sources
	ECE	**EC500OE**	Principles of Communication
		EC501OE	Fundamentals of IoT
	CSE/ CSE (AI & ML)	**CS500OE**	Algorithms Design and Analysis
		CS501OE	Database Management Systems
		CS502OE	Prompt Engineering
OE-II	EEE	**EE600OE**	Digital Energy
		EE601OE	Energy Audit
		EE602OE	Principles of Power Systems
	ECE	**EC600OE**	Fundamentals of Image Processing
		EC601OE	Embedded System Design
	CSE/ CSE (AI & ML)	**CS600OE**	Introduction to Data Science
		CS601OE	Software Engineering
		CS602OE	Generative AI
OE-III	EEE	**EE700OE**	Sustainable Energy
		EE701OE	Smart Grid Systems
		EE702OE	Basics of Power Plant Engineering
	ECE	**EC700OE**	Introduction to Unmanned Aerial Vehicles
		EC701OE	FPGA based System Design
	CSE/ CSE (AI & ML)	**CS700OE**	Scripting Languages
		CS701OE	Web Technologies
		CS702OE	Augmented Reality & Virtual Reality

B. Tech I year I Sem

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

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

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

C101.1: Apply matrix techniques to solve system of linear equations.

C101.2: Apply the concept of Eigenvalues and Eigenvectors to reduce the Quadratic form to canonical form.

C101.3: Examine the Mean value theorems for a single variable function.

C101.4: Trace the curve by applying properties of geometry.

C101.5: Analyze the given function of several variables for maxima and minima.

C101.6: Evaluate the multiple integrals to find areas and volumes for the given regions.

Unit – I Matrices

Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

Unit – II Eigen Values and Eigen Vectors

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

Unit– III Single Variable Calculus

Limit and Continuous of functions and its properties. Mean value theorems: Rolle's theorem – Lagrange's Mean value theorem with their Geometrical Interpretation and applications – Cauchy's Mean value Theorem – Taylor's Series (All the theorems without proof).

Curve Tracing: Curve tracing in cartesian coordinates.

Unit – IV Multivariable Calculus (Partial Differentiation and Applications)

Definitions of Limit and continuity. Partial Differentiation: Introduction to Partial Differentiation, Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers**.**

Unit – V Multivariable Calculus (Integration)

Evaluation of Double Integrals (Cartesian and polar coordinates) – change of order of integration (only Cartesian form) – Change of variables for double integrals (Cartesian to polar). Evaluation of Triple Integrals – Change of variables for Triple Integrals (Cartesian to Spherical & cylindrical polar coordinates) - Applications: Areas by double integrals and volumes by Triple integrals.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

B. Tech. I Year I Sem

Course Code	Course Title	L	T	P	Credits
CH102BS	**Engineering Chemistry**	**3**	**0**	**0**	**3**
Pre - Requisite	Intermediate Chemistry				

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

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

C102.1: Understand the basic properties of waters and their applications in both domestic and industrial purpose.

C102.2: Acquire the fundamental knowledge of electrochemistry and relate the electrochemical reactions for corrosion and its control.

C102.3: Analyse the synthesis, working mechanisms, and significance of batteries and electronic materials, exploring their applications in various fields.

C102.4: Illustrate the concepts, properties of advanced engineering polymers, functional materials and their applications in various industries.

C102.5: Propose and interpret solutions for the challenges related to green and sustainable technologies.

C102.6: Comprehend and apply the working principles of spectroscopy in analyzing pollutants in dye industries and biomedical field.

Unit – I Water and its Treatment

Introduction- Hardness, types, degree of hardness and units. Estimation of hardness of water by complexometric method - Numerical problems. Potable water and its specifications (WHO) - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and break-point chlorination. Defluoridation - Nalgonda technique.

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

Unit – II Electrochemistry and Corrosion

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

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

Unit– III Energy storage and Electronic Materials

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

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

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

Unit – IV Functional Materials and Green Chemistry

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

Biodegradable polymers: Synthesis, Properties and applications of Polylactic acid

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

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

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

Unit – V Principles of Spectroscopy and Analysis

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

B. Tech. I Year I Sem

Course Code	Course Title	L	T	P	Credits
CS103ES	Programming for Problem Solving (Common to all)	3	0	0	3

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

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

C103.1: Understand the elements of the C programming language.

C103.2: Implement control structures using the C programming language.

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

C103.4: Illustrate fundamentals, basic operations on arrays and strings with suitable examples.

C103.5: Demonstrate the purpose and usage of user defined data types like structures, unions.

C103.6: Explore File handling functions using C.

Unit – I

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

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

Case study on Decision Steps in Algorithms.

Unit – II

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

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

Unit – III

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

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

Unit – IV

Strings: String Basics, String Library Functions: Assignment and Substrings.
Longer Strings: Concatenation and Whole-Line Input, String Comparison, Arrays of Pointers.
Recursion: The Nature of Recursion, Tracing a Recursive Function, Recursive Mathematical Functions, Recursive Functions with Array and String Parameters.

Unit – V

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

B.Tech. I Year I Sem

Course Code	Course Title	L	T	P	Credits
EC104ES	Fundamentals of Electronics Engineering	3	0	0	3

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

C104.1: Analyze the characteristics of PN junction diode.
C104.2: Construct diode circuits for various applications.
C104.3: Illustrate the transistor working in different configurations.
C104.4: Differentiate between FET and BJT devices.
C104.5: Illustrate the operation and characteristics of special purpose diodes.
C104.6: 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, MOSFET 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. Millman Jacob and Christos C. Halkias, Electronic Devices and Circuits, 1st Edition, 1991, Tata McGraw-Hill.
2. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits theory, 11th Edition, 2009, Pearson.

REFERENCE BOOKS:

1. David A Bell, Electronic Devices and Circuits, 5th Edition, 2008, Oxford University Press.
2. Chinmoy Saha, Arindam Halder and Debaati Ganguly, Basic Electronics-Principles and Applications, 1st Edition, 2018, Cambridge University Press.
3. Thomas L. Floyd, Electronic Devices, 9th Edition, 2012, Pearson.
4. A. Anand Kumar, Pulse and Digital Circuits, 2nd Edition, 2011, PHI Learning.

B. Tech. I Year I Sem

Course Code	Course Title	L	T	P	Credits
EN105HS	**English For Skill Enhancement (Common to CSE, ECE, EEE)**	**3**	**0**	**0**	**3**
Pre - Requisite	Intermediate English				

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

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

C105.1: Choose appropriate vocabulary in their oral and written communication.
C105.2: Demonstrate their understanding of the rules of functional grammar and sentence structures.
C105.3: Develop comprehension skills from known and unknown passages.
C105.4: Compose paragraphs, essays, précis and draft letters.
C105.5: Write abstracts and reports in various contexts.
C105.6: Develop key competencies to hone the humane traits.

Unit – I Theme: Perspectives

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

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Words Often Misspelt - Synonyms and Antonyms
Grammar: Identifying Common Errors in Writing with Reference to Parts of Speech particularly Articles and Prepositions – Degrees of Comparison
Reading: Reading and Its Importance- Sub Skills of Reading – Skimming and Scanning.
Writing: Sentence Structures and Types -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing Precisely –Nature and Style of Formal Writing.

Unit – II Theme: Digital Transformation

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

Vocabulary: Homophones, Homonyms and Homographs
Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.
Reading : Reading Strategies-Guessing Meaning from Context – Identifying Main Ideas – Exercises for Practice.

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

Unit – III Theme: Attitude and Gratitude

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

Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English.
Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.
Reading: Sub-Skills of Reading – Identifying Topic Sentence and Providing Supporting Ideas – Exercises for Practice.
Writing : Format of a Formal Letter-Writing Formal Letters E.g., Letter of Complaint, Letter of Requisition, Job Application with CV/Resume –Difference between Writing a Letter and an Email - Email Etiquette.

Unit – IV Theme : Entrepreneurship

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

Vocabulary: Standard Abbreviations in English – Inferring Meanings of Words through Context – Phrasal Verbs – Idioms.
Grammar: Redundancies and Clichés in Written Communication – Converting Passive to Active Voice and Vice-Versa.
Reading : Prompt Engineering Techniques– Comprehending and Generating Appropriate Prompts - Exercises for Practice
Writing: Writing Practices- Note Making-Précis Writing.

Unit – V Theme : Integrity and Professionalism

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

Vocabulary: Technical Vocabulary and their Usage– One Word Substitutes – Collocations.
Grammar: Direct and Indirect Speech - Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous units)
Reading : Survey, Question, Read, Recite and Review (SQ3R Method) – Inferring the Meaning and Evaluating a Text- Exercises for Practice

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

B. Tech. I Year I Sem

Course Code	Course Title	L	T	P	Credits
CH106BS	**Engineering Chemistry Lab**	**0**	**0**	**2**	**1**
Pre – Requisite	Intermediate Chemistry				

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

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

C106.1: To develop practical skills through hands-on chemistry experiments relevant to engineering.

C106.2: To analyze parameters related to water and the rate of corrosion of mild steel.

C106.3: To understand the working principle in the determination of concentrations or absorbance using different instrumentation techniques.

C106.4: To apply the principle of polymerization procedures in the synthesis of polymers.

LIST OF EXPERIMENTS

I. Water analysis:

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

II. Conductometry:

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

III. Potentiometry:

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

IV. Colorimetry: Verification of Lambert-Beer's law using $KMnO_4$.

V. Preparations:

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

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

VII. Virtual lab experiments:

1. Construction of Fuel cell and it's working.
2. Smart materials for Biomedical applications
3. Batteries for electrical vehicles.
4. Functioning of solar cell and its applications.

TEXT BOOKS:

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

B. Tech. I Year I Sem

Course Code	Course Title	L	T	P	Credits
CS107ES	Programming for Problem Solving Lab (Common to all)	0	0	2	1

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

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

C107.1: Build programs using control structures to solve simple mathematical problems.

C107.2: Handle arrays and strings with pointers for efficient memory usage and faster operations.

C107.3: Utilize modular programming techniques to improve program readability and maintainability.

C107.4: Implement programs involving file handling operations for effective data processing.

LIST OF PROGRAMS

CYCLE 1:

Simple numeric problems:

a) Write a program for finding the max and min from the three numbers.

b) Write the program for the simple, compound interest.

c) Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be:

5 x 1 = 5

5 x 2 = 10

5 x 3 = 15

d) Write a program that shows the binary equivalent of a given positive number between 0 to 255.

Expression Evaluation:

a) Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement).

b) Write a program that finds if a given number is a prime number.

c) Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.

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

e) Write a C Program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

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

Arrays, Pointers and Functions:

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

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

i. Addition of Two Matrices
ii. Multiplication of Two Matrices

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

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

CYCLE 2:

Recursion:

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

i) To find the factorial of a given integer

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

iii)To generate Fibonacci series

Arrays (Contd.)

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

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

Strings:

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

i. To insert a sub-string into a given main string from a given position.
ii. To delete n Characters from a given position in a given string.

b) Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)

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

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

Files:

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

B. Tech. I Year I Sem

Course Code	Course Title	L	T	P	Credits
EN108HS	**English Language and Communication Skills Lab (Common to CSE, ECE, EEE)**	**0**	**0**	**2**	**1**
Pre - Requisite	Intermediate English				

Course Description: The English Language and Communication Skills (ELCS) Lab focuses on listening and speaking skills, particularly on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

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

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

C108.2: Use neutralized accent for intelligibility

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

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

Listening kills Objectives

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

Speaking Skills Objectives

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

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

a. Computer Assisted Language Learning (CALL) Lab which focusses on listening skills

b. Interactive Communication Skills (ICS) Lab which focusses on speaking skills

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

Exercise-1

CALL Lab:

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

ICS Lab:

Diagnostic Test – Activity titled 'Express Your View'

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

Practice: Any Ice-Breaking Activity and creating LinkedIn Profile

Exercise II

CALL Lab:

Instruction: Listening vs. Hearing - Barriers to Listening

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

ICS Lab:
Instruction: Features of Good Conversation – Strategies for Effective Communication-Chat Etiquette
Practice: Role Play Activity - Situational Dialogues –Expressions used in Various Situations – Making Requests and Seeking Permissions – Taking Leave - Telephone Etiquette.

Exercise-III

CALL Lab:
Instruction: Errors in Pronunciation – Tips for Neutralizing Mother Tongue Influence (MTI)
Practice: Differences between British and American Pronunciation –Listening Comprehension Exercises
ICS Lab:
Instruction: Picture Description
Practice: Looking at a Picture and Describing Objects, Situations, Places, People and Events (A wide range of Materials / Handouts are to be made available in the lab.)

Exercise-IV

CALL Lab:
Instruction: Techniques for Effective Listening
Practice: Listening for Specific Details - Listening - Gap Fill Exercises - Listening Comprehension Exercises (It is essential to identify a suitable passage with exercises for practice.)
ICS Lab:
Instruction: How to Tell a Good Story - Story Star- Sequencing-Creativity
Practice: Activity on Telling and Retelling Stories - Collage

Exercise-V

CALL Lab:
Instruction: Identifying the literal and implied meaning
Practice: Listening for Evaluation - Write the Summary –Listening Comprehension Exercises
(It is essential to identify a suitable passage with exercises for practice.)
ICS Lab:
Instruction: Understanding Non-Verbal Communication
Practice: Silent Speech - Dumb Charades Activity
Post-Assessment Test on 'Express Your View'

REFERENCE BOOKS:

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

B.Tech. I Year I Sem

Course Code	Course Title	L	T	P	Credits
ME109ES	Engineering Workshop	0	0	2	1

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

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

C109.1: Identify and distinguish basic manufacturing processes such as carpentry, fitting, and welding.

C109.2: Develop household and engineering components using metallic sheets through tin smithy practices.

C109.3: Apply fundamental electrical engineering concepts in house wiring, including the installation of switches and tube lights.

C109.4: Construct sand moulds using single and split patterns with foundry tools for casting applications.

1. Trades for Exercises

At least two exercises should be performed from each trade.

Cycle 1:

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

Cycle 2:

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

2. Trades for Demonstration & Exposure

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

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

TEXTBOOKS:

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

REFERENCE BOOKS:

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

B. Tech I Year II Sem

Course Code	Course Title	L	T	P	Credits
MA201BS	**Ordinary Differential Equations and Vector Calculus (Common to all)**	**3**	**0**	**0**	**3**
Pre – Requisite	Intermediate Mathematics				

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

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

C201.1: Apply first-order and first-degree differential equations in solving real-time and Engineering problems.

C201.2: Solve higher-order linear differential equations with constant coefficients using appropriate techniques.

C201.3: Utilize Laplace transforms and inverse Laplace transforms to solve initial value problems in engineering applications.

C201.4: Analyze the vector fields with respect to the vector differentiation.

C201.5: Solve the line, surface and volume integrals.

C201.6: Analyze the relation between the vector integral theorems.

Unit – I First Order and First-Degree Ordinary Differential Equations

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

Unit – II Ordinary Differential Equations of Higher Order

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

Unit– III Laplace Transforms

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

Unit – IV Vector Differentiation

Vector point functions and scalar point functions – Gradient – Divergence and Curl – Directional derivatives – Scalar potential functions – Solenoidal and Irrotational vectors.

Unit – V Vector Integration

Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes (without proofs) and their applications.

TEXT BOOKS:

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

REFERENCES BOOKS:

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

B. Tech. I Year II Sem

Course Code	Course Title	L	T	P	Credits
PH202BS	**Advanced Engineering Physics**	**3**	**0**	**0**	**3**
Pre-Requisite	10+2 Physics				

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

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

C202.1: Understand the crystal structures and characterize materials using XRD and SEM techniques.

C202.2: Apply quantum mechanics principles to explain particle behaviour and energy band formation in solids.

C202.3: Utilize quantum computing concepts to demonstrate the operation of quantum gates and basic quantum algorithms.

C202.4: Classify magnetic and dielectric materials and explain their properties, synthesis, and applications.

C202.5: Apply laser concepts to practical devices like barcode scanners and LIDAR systems.

C202.6: Make use of the principles of fibre optics to analyze applications in communication.

Unit – I Crystallography & Materials Characterization

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

Unit – II Quantum Mechanics

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

Unit – III Quantum Computing

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

Unit – IV Magnetic and Dielectric Materials

Introduction to magnetic materials, origin of magnetic moment-classification of magnetic materials, Weiss domain theory of ferromagnetism, hysteresis, soft and hard magnetic materials, synthesis of ferrimagnetic materials using co-precipitation method, applications: magnetic hyperthermia for cancer treatment, magnets for EV.
Introduction to dielectric materials, types of polarization (qualitative): electronics, ionic & orientation; ferroelectric, piezoelectric, pyroelectric materials and their applications: Ferroelectric Random-Access Memory (Fe-RAM) and load cell.

Unit – V Laser and Fibre Optics

Introduction to laser, characteristics of laser, Einstein coefficients and their relations, metastable state, population inversion, pumping, lasing action, Ruby laser, He-Ne laser, CO_2 laser, applications: Bar code scanner, LIDAR for autonomous vehicle.
Introduction to fibre optics, total internal reflection, construction of optical fibre, acceptance angle, numerical aperture, classification of optical fibres, losses in optical fibre, application: optical fibre for communication system.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

B.Tech. I Year II Sem

Course Code	Course Title	L	T	P	Credits
ME203ES	Engineering Drawing and Computer Aided Drafting	2	0	2	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 engineering applications.

C203.2: Demonstrate the principles of orthographic projections for points and lines.

C203.3: Apply the projections of planes by conventional mode and the projection of solids with CAD.

C203.4: Interpret the interior features of the objects by means of sectional planes.

C203.5: Develop the surfaces to fabricate the objects.

C203.6: Analyze orthographic and isometric projections using CAD.

Unit-I Introduction to Engineering Graphics (Conventional)

Principles of Engineering Graphics and their Significance, Geometrical Constructions.

Scales: Plain & Diagonal.

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

Cycloidal Curves: Cycloid, Epicycloids, and Hypocycloid.

Unit-II Orthographic Projections (Conventional)

Principles of orthographic projections – conventions. Projections of points in all positions. **Projection of straight lines:** Projections of straight lines parallel to both reference planes, perpendicular to one reference plane, and parallel to the other reference plane, inclined to one reference plane, and parallel to the other reference plane. Projections of a Straight Line Inclined to both the reference planes.

Unit-III Projections of Planes& Solids

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

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

Unit-IV Sections of Solids & Development of Surfaces

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

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

B. Tech. I Year II Sem

Course Code	Course Title	L	T	P	Credits
EE204ES	**Basic Electrical Engineering**	**3**	**0**	**0**	**3**

Course Description: Basic Electrical Engineering introduces the fundamental concepts and applications of electrical engineering essential for all disciplines. The course covers DC and AC circuit analysis, along with the construction and operation of commonly used electrical machines. It also provides an overview of key components in electrical installations, fostering a practical understanding of electricity's role in everyday life.

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

C204.1: Analyze DC electric circuits with basic electrical components.
C204.2: Analyze single phase and three phase AC circuits.
C204.3: Evaluate the performance of transformers.
C204.4: Explain the construction of DC and AC machines.
C204.5: Explain the working principles of DC and AC machines.
C204.6: Explain 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, Simple mesh and nodal Analysis. Superposition, Thevenin and Norton Theorems. (Problems with independent sources only).

Unit – II A.C. Circuits

Representation of sinusoidal waveforms, peak, rms, and average values (only for sinusoidal waveforms), phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac series circuits consisting of R, L, C, RL, RC, RLC combinations, resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections

Unit – III Transformers

Transformers: Construction and working principle of Transformer, Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency, working principle of Auto-transformer.

Unit – IV Electrical Machines

Construction and working principle of dc generator and 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, Construction and working principle of Single-phase induction motor.

Unit – V Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Earthing. Elementary calculations for energy consumption, 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 Pillai, M. Suryakalavathi, G.T. Chandrasheker, Basic Electrical Engineering, 2nd Edition, 2019, S. Chand.

REFERENCE BOOKS:

1. MS Naidu and S Kamakshaiah, Basic Electrical Engineering, 2nd Edition, 2008, Tata McGraw Hill.
2. D. C. Kulshreshtha, Basic Electrical Engineering, 2nd Edition 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, 2nd Edition, 2011, Oxford University Press.

B. Tech. I Year II Sem

Course Code	Course Title	L	T	P	Credits
CS205ES	**Data Structures (Common to CSE & CSE(AI & ML))**	**3**	**0**	**0**	**3**

Pre - Requisite Programming for Problem Solving

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

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

C205.1: Understand the significance of time and space complexity in data structures.
C205.2: Apply linked lists to perform operations relevant to real-world problems.
C205.3: Analyze the use of stacks and queues in solving real-world problems.
C205.4: Implement various kinds of trees and their operations.
C205.5: Describe graph representations and implement traversals.
C205.6: Identify problems where Hashing and Hash Tables can be applied.

Unit – I

Introduction to Computational Complexity: Introduction, Characteristics of algorithm, Performance analysis, Growth of Functions, Asymptotic notations.
Introduction to Data Structures: Basic Terminology, Classification of Data Structures, Operations on Data Structures, abstract data types, selecting a Data Structure, Linear list – Introduction, Singly linked list, Circular Linked Lists, Doubly Linked List.

Unit – II

Stacks: Operations, Stack algorithm, Stack ADT, Stack applications.
Queues: Operations, Queue Algorithm, Queue ADT, Circular Queue, Dequeue, Queue Applications.
Trees: Definition, Terminology, Binary trees-definition, Properties of Binary Trees, Binary Tree ADT, representation of Binary Trees- array and linked representations, Binary Tree traversals, Threaded binary trees.

Unit – III
Binary Search Trees (BST): BST Operations-Searching, Insertion and Deletion, BST ADT, BST Application, AVL Trees.
Multi way Search Trees: Introduction, B Trees, B Trees ADT.
Searching: Binary Search, Interpolation Search.

Unit – IV

Graphs: Introduction, Directed Graphs, Representation of Graphs, Graph Traversal Algorithms, Graph ADT, Applications of Graphs.
Sorting: Bubble Sort, Insertion Sort, Radix Sort.

Unit – V

Hashing: Introduction, Hash Tables, Hash Functions, Different Hash Functions: Division Method, Multiplication Method, Mid-square Method, Folding Method.
Collision: Collision Resolution by Open Addressing, Collision Resolution by Chaining.

TEXT BOOKS:

1. R. F. Gilberg and B.A. Forouzan, Data Structures: A Pseudocode Approach with C, 2nd Edition, Cengage Learning.
2. Reema Thareja, Data Structures using C, 3rd Edition, Oxford University Press.

REFERENCE BOOKS:

1. A. S. Tanenbaum, Y. Langsam, and M.J. Augenstein, Data Structures using C, 1st Edition, PHI/Pearson Education.
2. Mark Allen Weiss, Data structures and algorithm analysis in C, 2nd Edition, Pearson.

B. Tech. I Year II Sem

Course Code	Course Title	L	T	P	Credits
PH206BS	**Advanced Engineering Physics Lab**	**0**	**0**	**2**	**1**
Pre-Requisite	10+2 Physics				

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

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

C206.1: Synthesize and analyze nanomaterials using chemical methods.
C206.2: Determine key electrical, magnetic, and optical properties of semiconductors and other functional materials.
C206.3: Characterize semiconductors using Hall effect and energy gap measurement techniques.
C206.4: Demonstrate working knowledge of photoelectric effect, laser systems and optical fiber parameters through experimental study.

LIST OF EXPERIMENTS

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

REFERENCE BOOK:

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

B. Tech. I Year II Sem

Course Code	Course Title	L	T	P	Credits
CS207ES	**IT Workshop**	**0**	**0**	**2**	**1**

Course Description: This course describes various OS installation procedures. It enables the student to get hands on with various Productivity tools including Word, Excel, PowerPoint and Latex. It introduces the concepts of the Internet & World Wide Web. It also introduces Julia programming with a focus on arrays, string operations, and functions for technical computing.

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

C207.1: Identify and configure computer hardware, install operating systems, and apply cyber safety practices.

C207.2: Create and format professional documents using MS Word and LaTeX with advanced formatting features.

C207.3: Organize, analyze, and automate data using MS Excel and create engaging presentations in PowerPoint.

C207.4: Install and configure the Julia environment, and develop basic programs demonstrating data types, array manipulation, string processing, and user-defined functions.

LIST OF PROGRAMS

CYCLE 1:
PC Hardware

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva.

Internet & World Wide Web

Task 3: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 5 – Tool Orientation: Overview of LaTeX and MS Word (or equivalent FOSS tools like LibreOffice Writer). Importance of LaTeX in academic/scientific documentation (IEEE, Springer templates). Importance of Word in professional/business documentation. Accessing and navigating toolbars/ribbons, file management, help resources. Using rulers, format painter, and

document templates.

Task 6 – Project Certificate Creation LaTeX: Document class, page formatting, basic text formatting, inserting date/time. Word: Fonts, drop caps, text effects, character spacing, borders, and colors. Header and footer insertion in both LaTeX and Word.

Task 7 – Project Abstract Creation Formatting styles and applying templates. Creating and formatting tables (LaTeX tabular, Word tables). Bullets and numbering, text direction, and cell alignment. Adding footnotes, hyperlinks, symbols, and running spell/grammar check. Using Track Changes and commenting for collaborative editing.

Task 8 – Newsletter Creation Table of contents and cross-references (Word & LaTeX). Creating multi-column layouts (newspaper style). Inserting and formatting images, clipart, and figures. Using WordArt, shapes, textboxes, and paragraph formatting. Mail merge (letters, labels) in Word. LaTeX: figure inclusion, captions, and referencing.

CYCLE 2:

Excel

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 9: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text.

Task 10: Calculating GPA - Features to be covered: - Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP.

Task 11: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting.

PowerPoint

Task 12: Students will be working on basic power point utilities and tools which help them create basic PowerPoint presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 13: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 14: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

Task 15: Install Julia, set up the development environment, and explain its basic data types.

Task 16: Write programs to create and manipulate arrays using various operations.

Task 17: Write a Julia program to demonstrate string interpolation, concatenation, and various string manipulation techniques.

Task 18: Write a program to define and use a simple function in Julia.

TEXT BOOKS:

1. Leslie Lamport, LaTeX: A Document Preparation System, 2nd Edition, PHI/Pearson.
2. Noel Kalicharan, Julia – Bit by Bit, Programming for Beginners, 1st Edition, 2021, Springer.
3. Lee Phillips, Practical Julia: A Hands-On Introduction for Scientific Minds, 2023, No Starch Press.

REFERENCE BOOKS:

1. Vikas Gupta, Comdex Information Technology course tool kit, Wiley.
2. Cheryl A Schmidt, The Complete Computer upgrade and repair book, 3rd Edition, Dreamtech.
3. Introduction to Information Technology, ITL Education Solutions limited, 7th Edition, Pearson Education.
4. Kate J. Chase, PC Hardware – A+ Handbook, 1st Edition, 2004, Microsoft Press.
5. Frank Mittelbach and Ulrike Fischer, LaTeX Companion, 3rd Edition, Addison-Wesley Professional.
6. David Anfinson, Ken Quamme, IT Essentials PC Hardware and Software Companion Guide, 3rd Edition, Pearson Education.
7. Patrick Regan, IT Essentials PC Hardware and Software Labs and Study Guide, 3rd Edition, CISCO Press, Pearson Education.

B. Tech. I Year II Sem

Course Code	Course Title	L	T	P	Credits
CS208ES	Python Programming Lab (Common to CSE & CSE(AI & ML))	0	0	2	1

Course Description: This Course Covers Installation procedure of python and packages. Course focuses on implementation of different control structures, data structures and files in Python. It also helps to implement GUI applications using TKinter.

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

C208.1: Build basic programs using fundamental programming constructs.

C208.2: Make use of Data Structures in Python.

C208.3: Develop reusable code and GUI application using standard Library.

C208.4: Implement File I/O and Digital Logic Gates using Python.

LIST OF PROGRAMS

CYCLE 1:

1.
   i. Use a web browser to go to the Python website http://python.org. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.

   ii. Start the Python interpreter and type help () to start the online help utility.

2. Start a Python interpreter and use it for arithmetic operations.
3. Write a program to calculate compound interest when principal, rate, frequency of compounding and number of years are given.
4. Read the name, address, email and phone number of a person through the keyboard and print the details.
5. Print the below pattern using a for loop.

```
5
4 4
3 3 3
2 2 2 2
1 1 1 1 1
```

6. Write a program to check whether the given input is digit or lowercase character or uppercase character or a special character (use 'if-else-if' ladder).

7. Python program to print all prime numbers in a given interval (use break).

8. Write a program to convert a list and tuple into arrays.

9. Write a program to find common values between two arrays.

10. Write a function called palindrome that takes a string argument and returns True if it is a palindrome and False otherwise. Remember that you can use the built-in function len to check the length of a string.

11. Write a function called is_sorted that takes a list as a parameter and returns True if the list is sorted in ascending order and False otherwise.

12. Write a function called has_duplicates that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.

13. Write a function called remove_duplicates that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.

14. Create a text file named word.txt containing a list of words, one per line and it should not include single-letter words or an empty string. Write a Python function that adds "I", "a", and the empty string to the word list.

15. Write a python code to read dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys.

16. Write a python code to add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e' .

17. Write a python program to remove the given word in all the places in a string.

CYCLE 2:

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

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

20. Write a python program that defines a matrix and prints.

21. Write a python program to perform multiplication of two square matrices.

22. Import Numpy and explore their functionalities.
    a) Creating a matrix of given order *m x n* containing *random numbers* in the range 1 to 99999.
    b) Write a program that adds, subtracts and multiplies two matrices. Provide an interface such that, based on the prompt, the function (addition, subtraction, multiplication) should be performed.

c) Write a program to solve a system of *n* linear equations in *n* variables using matrix inverse.

23. Import Plotpy and Scipy and explore their functionalities.
    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.

24. Write a Python file named geometry_module.py that acts as your module. This module should contain classes for at least two different geometric shapes (like Rectangle and Circle). Each class must have methods to calculate its area and perimeter. The module should also include a standalone function, display_shape_info (), that takes a shape object as input and prints its area and perimeter. In a separate Python file named lab_exercise.py, import your geometry_module. In this file, create instances of the Rectangle and Circle classes from your module. Then, call the display_shape_info () function on each of your shape instances to prove that your module works as expected.

25. Write a Python program for a university case study that demonstrates the use of general-purpose exceptions (try-except) while processing student data. The program should accept basic student details such as name, roll number, and marks, and then attempt to calculate the student's average marks. While doing so, it must be able to handle unexpected errors, including cases where data is missing or entered in an invalid format (e.g., marks entered as text), errors like division by zero during average calculation, as well as any other unforeseen exceptions that may occur during execution.

26. Write a function called draw_rectangle that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.

27. Write a Python program to add an attribute named color to your Rectangle objects and modify draw_rectangle so that it uses the color attribute as the fill color.

28. Write a function called draw_point that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas.

29. Define a new class called Circle with appropriate attributes and instantiate a few Circle objects. Write a function called draw_circle that draws circles on the canvas.

30. Write a python code to read a phone number and email-id from the user and validate it for correctness.

31. Write a python code to merge two given file contents into a third file.

32. Write a python code to determine if two strings are anagrams, find the first non-repeating character, and count character frequencies.

33. Write a Python code to read text from a text file, find the word with most number of occurrences.

34. Write a function that reads a file and displays the number of words, number of vowels, blank

spaces, lower case letters and uppercase letters.

35. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR.

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

TEXT BOOKS:

1. Overland, Brian, Bennett, John, Supercharged Python: Take your code to the next level,1st Edition, Pearson Education.
2. Mark Lutz, Learning Python, 4th Edition, O'Reilly.

REFERENCE BOOKS:

1. Vamsi Kurama, Python Programming: A Modern Approach, 1st Edition, Pearson Education.
2. Sheetal Taneja, Naveen Kumar, Python Programming A Modular Approach with Graphics, Database, Mobile, and Web Applications, 1st Edition, 2017, Pearson Education.
3. Gowrishankar S., Veena A, Introduction to Python Programming, 1st Edition, CRC Press.
4. Michael Dawson, Programming with Python, A User's Book, India Edition, 3rd Edition, Cengage Learning.
5. Dr. Mohd Abdul Hameed, Python for Data Science, 1st Edition, Wiley Publications.
6. Dr. R. Nageswara Rao, Core Python Programming, 2nd Edition, 2018, Dreamtech Press.

B.Tech. I Year II Sem

Course Code	Course Title	L	T	P	Credits
EE209ES	**Basic Electrical Engineering Lab**	**0**	**0**	**2**	**1**

Course Description: This 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 modelled 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 student will be able to

C209.1: Verify electrical laws and theorems using circuit experiments.

C209.2: Analyze the performance of AC circuits.

C209.3: Measure voltage, current and power in Single-Phase Transformers.

C209.4: Evaluate performance DC Motors and Induction Motors.

The following experiments are required to be conducted compulsorily:

1. Verification of KVL and KCL.
2. Verification of Thevenin's theorem.
3. Verification of Superposition theorem.
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.

1. Verification of Norton's theorem.
2. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation).
3. Measurement of Energy in a Single-Phase AC Circuit.
4. Measurement of Active Power in a balanced Three-phase circuit
5. Simulation of a basic electrical circuit.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. MS Naidu and S Kamakshaiah, Basic Electrical Engineering, 2nd Edition, 2008, Tata McGraw Hill.
2. D. C. Kulshreshtha, Basic Electrical Engineering, 2nd Edition 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, 2nd Edition, 2011, Oxford University Press.

B. Tech. I Year II Sem

Course Code	Course Title	L	T	P	Credits
CS210ES	Data Structures Lab (Common to CSE & CSE(AI & ML))	0	0	2	1

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

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

C210.1: Implement various kinds of linked list and their operations.

C210.2: Design programs to implement stack and queue ADT.

C210.3: Implement programs for sorting & searching algorithms.

C210.4: Implement trees and graph traversal and Hash functions.

LIST OF PROGRAMS

CYCLE 1:

1. Write a program that uses functions to perform the following operations on singly linked list:

   i) Creation ii) Insertion iii) Deletion iv) Traversal

2. Write a program that uses functions to perform the following operations on doubly linked list:

   i) Creation ii) Insertion iii) Deletion iv) Traversal

3. Write a program that uses functions to perform the following operations on circular linked list:

   i) Creation ii) Insertion iii) Deletion iv) Traversal

4. Write a program that implement stack (its operations) using

   i) Arrays ii) Linked List

5. Write a program that implement Queue (its operations) using

   i) Arrays ii) Linked List

6. Write a program that takes a string (e.g., "((a+b)*c)-d)") and uses a stack to determine whether the parentheses are balanced.

7. Write a program to reverse a Linked list using stack.

8. Write a program that implements Circular Queue (its operations) using arrays.

CYCLE 2:

9. Write a program that implements DeQueue (its operations) using arrays.
10. Write a program that implements the following search methods.

    i) Binary Search ii) Interpolation Search
11. Write a program that implements the following sorting methods to sort a given list of integers in ascending order

    i) Bubble Sort ii) Insertion Sort iii) Radix Sort
12. Write a program to implement the tree traversal methods (Recursive and Non-Recursive).
13. Write a program to implement

    i) Binary Search tree ii) B Trees iii) AVL trees
14. Write a program to implement the graph traversal methods.
15. Write a program to implement the following Hash Functions:

    i) Division Method ii) Multiplication Method iii) Mid-square Method iv) Folding Method

TEXT BOOKS:

1. R. F. Gilberg and B.A. Forouzan, Data Structures: A Pseudocode Approach with C, 2nd Edition, Cengage Learning.
2. Reema Thareja, Data Structures using C, 3rd Edition, Oxford University Press.

REFERENCE BOOKS:

1. A. S. Tanenbaum, Y. Langsam, and M.J. Augenstein, Data Structures using C, 1st Edition, PHI/Pearson Education.
2. Mark Allen Weiss, Data structures and algorithm analysis in C, 2nd Edition, Pearson.

BH25 B.Tech. CSE Syllabus	B. Tech. II Year I Sem	BVRITHCEW			
Course Code	Course Title	L	T	P	Credits
CS301PC/ CS401PC	Discrete Mathematics	3	0	0	3

Course Description: This course introduces students to formal logic and methods of proof, set theory and relations, and fundamental algebraic structures such as semigroups, lattices, and boolean algebra, combinatorial principles, along with an in-depth study of graph theory.

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

C301.1: Understand the principles of mathematical logic to construct and validate logical arguments.

C301.2: Demonstrate proficiency in set theory, relations, functions, and ordering.

C301.3: Apply algebraic structures to computational and logical problems.

C301.4: Solve counting problems using elementary combinatorics.

C301.5: Formulate and solve linear recurrence relations to problem solving techniques.

C301.6: Apply concepts of graph theory and trees to model and solve real-world problems.

Unit – I

Mathematical logic: Introduction, Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, The Predicate Calculus, Inference Theory of the Predicate Calculus, Methods of Proof -Direct Proof, Proof by Contradiction, Contrapositive.

Unit – II

Set theory: Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions.

Unit – III

Algebraic Structures: Introduction, Algebraic Systems, Semi groups and Monoids, Lattices as Partially Ordered Sets, Boolean Algebra-Sub algebra, Direct Product, Homomorphism.

Unit – IV

Elementary Combinatorics and Recurrence Relations: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutation with Constrained Repetitions, Binomial Coefficient, The Binomial and Multinomial Theorems, The Principle of Inclusion and Exclusion**.** Recurrence Relations, Solving homogenous linear Recurrence Relations.

Unit – V

Graph Theory: Basic Concepts, Isomorphism and Subgraphs, connectivity, matching, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs.

Trees: Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Chromatic Numbers, The Four-Color Problem**.**

TEXT BOOKS:

1. Joe l. Mott, Abraham Kandel, Teodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Prentice Hall of India.
2. Kenneth H. Rosen, Discrete Mathematics and its applications, 11th Edition, 2019, McGraw Hill Education ,India.
3. J.P. Tremblay, R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, 1st Edition, McGraw-Hill.

REFERENCE BOOKS:

1. Ralph. P. Grimald, Discrete and Combinatorial Mathematics - an applied introduction, 5th Edition, Pearson Education.
2. Thomas Kosy, Discrete Mathematical Structures, Tata McGraw Hill Publishing co.

BH25 B.Tech. CSE Syllabus	B. Tech. II Year I Sem				BVRITHCEW
Course Code	Course Title	L	T	P	Credits
CS302PC	Computer Organization and Architecture (Common to CSE and CSE (AI & ML))	3	0	0	3

Course Description: This course introduces digital system design, computer design, organization, and architectural concepts, usage of register transfer language, instruction sets. It also consists of hardware algorithms on diverse topics such as computer arithmetic, memory organization, I/O organization to understand fundamental computing principles effectively.

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

C302.1: Understand the concepts of logic gates and the functional units of a digital computer system.

C302.2: Design Combinational and Sequential circuits.

C302.3: Demonstrate the use of micro-operations and instruction formats in basic computer organization.

C302.4: Illustrate the design of a control unit and central processing unit.

C302.5: Implement data transfer with appropriate IO Interface and Interrupt mechanism.

C302.6: Analyze suitable type of Memory for a given application.

Unit – I

Boolean Algebra and Logic Gates: Binary codes, Binary Storage and Registers, Binary logic.
Digital logic gates and Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation.
Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.

Unit – II

Combinational Logic: Combinational Circuits, Analysis procedure Design procedure, Half Adder, Full adder, Decimal Adder, magnitude comparator, Decoders, Encoders, Multiplexers, HDL for combinational circuits.
Sequential Logic: Sequential circuits, latches, Flip-Flops Analysis of clocked sequential circuits, state Reduction and Assignment, Design Procedure. Registers, shift Registers, Ripple counters, synchronous counters, other counters.

Unit – III

Register Transfer Language and Micro operations: Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro-operations, shift micro operations, Arithmetic logic shift unit.
Basic Computer Organization and Design: Instruction codes, Computer Registers Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt.

Unit – IV

Microprogrammed Control: Control memory, Address sequencing, micro program example, design of control unit.
Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.
Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.

Unit – V

Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt , Direct memory Access.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.

TEXT BOOKS:

1. M. Morris Mano, Digital Design, 3rd, Pearson/PHI
2. M. Morris Mano, Computer System Architecture, 3rd, Pearson/PHI.
3. William Stallings, Computer Organization and Architecture, 6th Edition, Pearson/PHI.
4. Andrew S. Tanenbaum, Structured Computer Organization, 4th Edition, PHI/Pearson.

REFERENCE BOOKS:

1. ZVI. Kohavi, Switching and Finite Automata Theory, Tata Mc Graw Hill.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, McGraw Hill Education.
3. John L. Hennessy, David A. Patterson, Christos Kozy, Computer Architecture: A Quantitative Approach, 6th Edition, 2012, Morgan Kaufmann Publishers Inc.

BH25 B.Tech. CSE Syllabus	B. Tech. II Year I Sem				BVRITHCEW
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
CS303PC	**Object Oriented Programming Through Java (Common to CSE and CSE(AI & ML))**	**3**	**0**	**0**	**3**

Course Description: This course provides a comprehensive introduction to Java programming, focusing on object-oriented principles, inheritance, packages, and interfaces. Participants will gain practical skills in exception handling, multithreading, and the Java Collection Framework. Additionally, the curriculum covers modern Java 8 features to enhance code efficiency and functionality.

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

C303.1: Apply Java fundamentals and core OOP concepts to develop simple Java programs.

C303.2: Design object-oriented Java applications using classes, inheritance, interfaces, and polymorphism.

C303.3: Implement exception handling techniques to ensure reliable and robust Java programs.

C303.4: Develop multithreaded Java applications using thread management and synchronization mechanisms.

C303.5: Use Java Collections and Java 8 features for efficient data processing.

C303.6: Develop GUI applications using Swing and event handling

Unit – I

Object oriented thinking and Java Basics - Need for OOP paradigm, summary of OOP concepts, Coping with complexity, History of Java, Java buzzwords, JVM architecture, keywords, data types, variables, scope and lifetime of variables, operators, expressions, control statements, Arrays, type conversion and casting, simple java programs, concepts of classes, objects, constructors, methods, access control, garbage collection, parameter passing, recursion, Exploring String handling classes.

Unit – II

Inheritance: Hierarchical abstractions, base class object, sub class, sub type, Forms of Inheritance specialization, specification, construction and extension, benefits of inheritance, super keyword, final keyword, this keyword, nested and inner classes.

Polymorphism: constructor and Method overloading, Method overriding, abstract classes.

Packages: Understanding CLASSPATH**,** Creating Packages, importing Packages, Member Access rules**.**

Interfaces: Differences between classes and interfaces**,** defining an Interface, implementing interface, Applying Interfaces, variables in interface and extending interfaces, default method, static method, main method.

Unit – III

Exception handling and Multithreading: Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception subclasses. Differences between multithreading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication, thread groups, daemon threads.

Unit –IV

Collections: List - ArrayList, LinkedList, Stack, Generics, Iterator, Set - HashSet, LinkedHashSet, TreeSet, Queue - ArrayDeque, Map - HashMap, LinkedHashMap, TreeMap, Utility classes - Arrays and Collections.

Java 8 Features: Functional interfaces, Lambda expressions, Streams, Stream map, Optional class, method References, forEach() on Iterable, Collectors Utility.

Unit – V

Swing: Introduction, MVC architecture, exploring swing- JFrame and JComponent, JLabel, ImageIcon, JTextField, JButton, JCheckBox, JRadioButton, JList, JComboBox, Tabbed Panes, Scroll Panes, Trees, and Tables. Menu Basics, Menu related classes - JMenuBar, JMenu, JMenuItem, JCheckBoxMenuItem, JRadioButtonMenuItem, JSeperator. creating a popup menu, layout managers.

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model.

TEXT BOOKS:

1. Herbert Schildt, Dr. Denny Coward Java the complete reference, 13th Edition, Mc Graw Hill.
2. T. Budd, Understanding OOP with Java, updated Edition, Pearson Education.

REFERENCE BOOKS:

1. J.Nino and F.A. Hosch, An Introduction to programming and OO design using Java, John Wiley & Sons.
2. T. Budd, An Introduction to OOP, 3rd Edition, Pearson Education.
3. Y. Daniel Liang, Introduction to Java programming, Pearson Education.
4. R.A. Johnson, An introduction to Java programming and object-oriented application development, Thomson.
5. Cay.S. Horstmann and Gary Cornell, Core Java 2, Vol 1, Fundamentals, 8th Edition, Pearson Education.
6. Cay.S. Horstmann and Gary Cornell, Core Java 2, Vol 2, Advanced Features, 8th Edition, Pearson Education.
7. R.Buyya, S.T.Selvi, X.Chu, Object Oriented Programming with Java, TMH.
8. John Hunt, Java and Object Orientation : An Introduction, 2nd Edition, Springer.
9. Doug Lowe , Joel Murach , Andrea Steelman, Maurach's, Beginning Java2 JDK 5 (Java Developer's Guide), Shroff Publishers & Distributors.

BH25 B.Tech. CSE Syllabus	B. Tech. II Year I Sem	BVRITHCEW			
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
CS304PC	**Software Engineering (Common to CSE and CSE (AI & ML))**	**3**	**0**	**0**	**3**

Course Description: This course discusses principles of software engineering, process models and software requirements and also explores design principles, testing strategies and risks in software development.

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

C304.1: Illustrate software process framework and models for the development of software application.

C304.2: Analyze and validate the requirement engineering strategy for developing software requirement specification documents.

C304.3: Choose an appropriate model to create an architectural design.

C304.4: Apply various testing strategies to verify the software quality.

C304.5: Illustrate the importance of framework for product metrics.

C304.6: Identify the risk strategy and QA techniques for developing quality software.

Unit – I

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths.

A Generic view of process: Software engineering- a layered technology, a process framework, the Capability Maturity Model Integration (CMMI).

Process models: The waterfall model, Spiral model, Incremental Process Models, Concurrent Models, Component based development and Agile Development.

Unit – II

Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document.

Requirements Engineering Process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.

Unit – III

Design Engineering: Design process and design quality, design concepts, the design model.

Creating an architectural design: software architecture, data design, Data Flow Diagrams, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modelling**.**

UML Diagrams: Class Diagram, Object Diagram, Use Case Diagram, Sequence Diagram, Collaboration Diagram, State-Chart Diagram, Activity Diagram, Component Diagram and Deployment Diagram.

Unit – IV

Testing Strategies: A strategic approach to software testing, test strategies for conventional software.

Testing Techniques: Manual and Automation Testing, black-box and white-box testing, validation testing, system testing, the art of debugging.

Metrics for Process and Products: Software measurement, metrics for software quality.

Unit – V

Risk Management: Reactive vs Proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM.

Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

TEXT BOOKS:

1. Roger S. Pressman, Software Engineering, A practitioner's Approach, 6th Edition, McGraw Hill International Edition.
2. Sommerville, Software Engineering, 7th Edition, Pearson Education.
3. Grady Booch, James Rumbaugh, Ivar Jacobson, The unified modeling language user guide, Pearson Education.

REFERENCE BOOKS:

1. James F. Peters, Witold Pedrycz, John Wiley, Software Engineering, An Engineering Approach.
2. Waman S Jawadekar, Software Engineering principles and practice, The McGraw-Hill Companies.
3. Meiler page-Jones, Fundamentals of object-oriented design using UML Pearson Education.
4. Rajib Mall, Fundamentals of Software Engineering, PHI.

BH25 B.Tech. CSE Syllabus	B. Tech. II Year I Sem	BVRITHCEW			
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
CS305PC	**Database Management Systems (Common to CSE and CSE (AI & ML))**	**3**	**0**	**0**	**3**

Prerequisite Data Structures

Course Description: This course covers database system fundamentals with emphasis on design, relational modelling, SQL, Normalization, Transaction processing, and indexing.

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

C305.1	Explain the fundamentals of database systems, architectures, and data models.
C305.2	Design conceptual and logical database models using ER and relational models.
C305.3	Apply SQL queries, constraints, views and triggers for data manipulation.
C305.4	Develop relational database schemas and apply normalization techniques to minimize redundancy.
C305.5	Analyze transaction processing, concurrency control and recovery mechanisms in database systems.
C305.6	Evaluate file organization and indexing techniques for efficient data storage and retrieval.

Unit – I

Database System Applications: A Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS, Introduction to NoSQL, NoSQL databases , Relational DBMS vs NoSQL DBMS.

Introduction to Database Design: Database Design Process and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional features of the ER Model, Conceptual Design with the ER Model .

Unit – II

Introduction to the Relational Model: Integrity Constraints over Relations, enforcing integrity Constraints, querying relational data, logical database design, introduction to Views, destroying/altering tables and views. Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus.

Unit - III

SQL: Queries, Constraints and Triggers: form of basic SQL Query, UNION, INTERSECT, EXCEPT, nested queries, aggregation operators, NULL Values, complex integrity constraints in SQL, Functions and Procedures, Triggers, Advanced Aggregation Features.

Schema Refinement: Problems Caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, multivalued dependencies, FOURTH normal form, FIFTH normal form.

Unit IV

Transaction Processing: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularity, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions.

Unit V

Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data structures , Hash-Based Indexing, Tree-Based Indexing. Comparison of File Organizations, Indexes- Intuitions for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, Database System Concepts,6th Edition, McGraw Hill Education.
2. Raghurama Krishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, Tata McGraw Hill.

REFERENCE BOOKS:

1. Peter Rob and Carlos Coronel, Database Systems: Design, Implementation, and Management, 7th Edition, Cengage Learning.
2. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education.
3. C. J. Date, An Introduction to Database Systems, Pearson Education.
4. S. Shah and V. Shah, Oracle for Professionals, SPD.
5. Shah, Database Systems Using Oracle: A Simplified Guide to SQL and PL/SQL, PHI Learning.
6. M. L. Gillenson, Fundamentals of Database Management Systems, Wiley Student Edition.
7. Making Sense of NoSQL, Dan McCreary and Ann Kelly, Making Sense of NoSQL: A Guide for Managers and the Rest of Us, Manning Publications.

BH25 B.Tech. CSE Syllabus	B. Tech. II Year I Sem	BVRITHCEW			
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
CS306PC	**Object Oriented Programming Through Java Lab (Common to CSE and CSE (AI & ML))**	**0**	**0**	**2**	**1**

Course Description: This Course introduces Implementing OOPs principles, Solving problems using various concepts - OOPs features, Collections, Multi threading concepts and Java 8 features.

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

C306.1: Implement Java fundamentals and OOP principles to solve programming problems

C306.2: Design applications using interfaces, GUI components, and event-driven programming

C306.3: Develop robust applications using multithreading and exception handling mechanisms.

C306.4: Utilize Collections Framework and Java 8 features to solve real-world programming problems.

LIST OF PROGRAMS

CYCLE 1:

1) Use Eclipse or Net bean platform and acquaint yourself with the various menus. Create a test project, add a test class, and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods, and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.

2) Java program to generate electricity bill. (use if-else-if ladder) inputs are old reading and current reading and generate the bill by following slabs/ranges: Scan the inputs using Scanner class. 0-50: Rs.1, 50-100: Rs2, 100-200: Rs.3, 200-400: Rs.4, >400: Rs.5. Example if the number of units are 120 then the consumption charge is (50*1)+(50*2)+(20*3)=Rs.210.

3) Program to make a simple calculator using switch...case. should be able to add, subtract, multiply and divide two numbers. Scan the two numbers and operator using Scanner class**.**

4) Program that reads a set of integers, and then prints the sum of the even and odd integers separately (use for loop)

5) Print the following patterns (use for/while loop)

a)

```
*
* *
* * *
* * * *
* * * * *
* * * * * *
* * * * * * *
```

b)

```
      *
    * *
  * * *
* * * *
  * * * * *
    * * * * * *
      * * * * * * *
```

c)

```
      *
    * *
  * * *
* * * *
  * * * * *
    * * * * * *
      * * * * * * *
    * * * * * *
  * * * * *
* * * *
  * * *
    * *
      *
```

d)

```
A B C D E F G
  A B C D E F
    A B C D E
      A B C D
        A B C
          A B
            A
```

e)

```
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
1 2 3 4 5 6
1 2 3 4 5 6 7
1 2 3 4 5 6
1 2 3 4 5
1 2 3 4
1 2 3
1 2
1
```

5) Develop a menu-driven Bank Application for bank employees that provides options such as account creation by capturing customer details including name, Aadhaar number, and PAN number; crediting an amount using the account number; debiting an amount from an account; viewing a mini statement or balance enquiry; and transferring funds between accounts by specifying the source account number, destination account number, and transfer amount. After selecting an option, the corresponding operation should be performed and an appropriate success message should be displayed. The application should repeatedly display the menu until the user chooses to continue or exit, making use of all applicable Java control structures such as conditional statements, loops, and switch cases.

7) Arrays: Program using Arrays.
   a) Find duplicate values in an array of integer values.
   b) Multiplication of two matrices (Use arrays and for loop).
   c) Find common elements between two arrays (string values).

8) Program to check whether the given String is Palindrome or not (use String only).

9) Program to print all prime numbers between 1 to n, only if it is part of the Fibonacci series. For example: n value is 10, 1 to 10 prime numbers are : 2, 3, 5, 7. Fibonacci series : 0, 1, 1, 2, 3, 5, 8, 13, 21. output is: 2,3,5.

10) Program to implement the following. A Boy has his money deposited $1000, $1500 and $2000 in banks-Bank A, Bank B and Bank C respectively. We have to print the money deposited by him in a particular bank. Create a class 'Bank' with a method 'getBalance' which returns 0. Make its three subclasses named 'BankA', 'BankB' and 'BankC' with a method with the same name 'getBalance' which returns the amount deposited in that particular bank. Call the method 'getBalance' by the object of each of the three banks.

11) Create an interface named Bank with the services (use proper input parameters and return types) - create account, credit amount, debit amount, transfer amount, mini statement and with fixed rate of interest. Provide two implementation classes SBI, Axis with necessary implementations. Use Late binding to create respective objects and call the methods.

12) Create an interface named Restaurant. create a method that will print the name of the restaurant when called. Create an abstract method called addItem which adds the Item objects to the menu (item array). create an abstract method named getmenu which returns an item array. create an abstract method placeOrder to generate order. create an abstract method named generateBill which takes orderid and returns totalAmount with 6% tax. create a class called KFC that implements Restaurant. (Create Item and Order bean classes having required data).

13) Create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle, and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape.

CYCLE 2:

14) Create and Raise the exception CreditsNotSufficientException if credits are less than 50 with different caller methods. and handle them.

15) Design an application called ATM PIN Validator which will read the account holder name and PIN number. Create an exception class PinMismatchException to print the given message through the constructor. if pin no is incorrect while trying in 3 times PinMisMatchException object will throw an exception called Sorry..Your Account Has been Locked.

16) A multi-thread application that has three threads. The first thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.

17) Write a Java program that correctly implements the producer – consumer problem using the concept of inter thread communication.

18) Develop an E-commerce application in Java where the Seller adds product details such as product ID, name, and price using a Java Bean, and stores these products in a HashSet. The Customer can place orders by selecting products, which are then compared with the stored product data. Upon a successful match, the application should display the product details along with the total price of the ordered items. The program should be implemented using appropriate Bean and Client classes.

19) Write a Java program that loads names and phone numbers. It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use HashMap).

20) Replace Arrays with ArrayList in program 12.

21) Write a Java program for the following:
   a) Create a doubly linked list of elements.
   b) Delete a given element from the above list.
   c) Display the contents of the list after deletion.

22) Read a paragraph from the user and count the frequency of each word using HashMap <String, Integer>.

23) Given a list of integers, use Stream API to filter even numbers and display them.

24) Given a list of student names, convert all names to uppercase using streams and map().

25) Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.

26) Develop a Java swing app that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named "Compute" is clicked.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2nd Edition, Prentice Hall.
2. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw Hill.
3. Yashavant Kanetkar, Let Us C, 18th Edition, BPB.
4. R.G. Dromey, How to solve it by Computer, Low Price Edition, Pearson Education.
5. Programming in C, Stephen G. Kochan, 4th Edition, Pearson Education.
6. Herbert Schildt, C: The Complete Reference, 4th Edition, McGraw Hill.
7. Byron Gottfried, Schaum's Outline of Programming with C, 2nd Edition, McGraw Hill.
8. Paul J. Deitel, Harvey M. Deitel, Java How to Program: Early Objects, 11th Edition, Pearson Education

BH25 B.Tech. CSE Syllabus	B. Tech. II Year I Sem	BVRITHCEW			
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
CS307PC	**Software Engineering Lab (Common to CSE and CSE (AI & ML))**	**0**	**0**	**2**	**1**

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

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

C307.1: Translate end-user requirements into system and software requirements

C307.2: Generate a high-level design of the system from the software requirements.

C307.3: Will have experience and/or awareness of testing tools and testing techniques

C307.4: Develop simple testing reports.

LIST OF EXPERIMENTS

Do the following seven exercises for any two projects given in the list of sample projects or any other Projects:

1. Development of problem statements.
2. Preparation of Software Requirement Specification Document, Design Documents and Testing
3. Phase related documents.
4. Preparation of Software Configuration Management and Risk Management related documents.
5. Study and usage of any Design phase CASE tool.
6. Performing the Design by using any Design phase CASE tools.
7. Develop test cases for unit testing and integration testing.
8. Develop test cases for various white box and black box testing techniques.

Sample Projects:

1. Passport Automation System.
2. Stock Maintenance System.
3. Online course reservation system.
4. Credit Card Processing.
5. Recruitment system.
6. Chatbot for College / Hospital / Banking.
7. Emotion Detection from Text or Speech.
8. Web-Based Learning Management System (LMS).
9. Policy Management System (Insurance Project).
10. Food Waste Management System.

TEXT BOOKS:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, McGraw Hill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson Education.
3. The unified modeling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education.

REFERENCE BOOKS:

1. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
2. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill.

BH25 B.Tech. CSE Syllabus	B. Tech. II Year I Sem	BVRITHCEW			
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
CS308PC	**Database Management Systems Lab (Common to CSE and CSE (AI & ML))**	**0**	**0**	**2**	**1**

Course Description: This course covers relational database design using ER modeling and normalization to ensure data integrity and scalability. It provides practical skills in SQL for database creation, manipulation, and advanced querying. Additionally, it includes database automation through triggers, stored procedures, and cursors for efficient business logic implementation and transaction management.

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

C308.1: Design and normalize database schemas using ER modeling to maintain data integrity.

C308.2: Ability to formulate Queries using SQL DDL/DML commands.

C308.3: Apply advanced SQL queries for efficient data retrieval.

C308.4: Develop triggers, stored procedures, and cursors to automate and manage database operations.

LIST OF PROGRAMS

CYCLE 1:

1. Concept design with E-R Model.
2. Relational Model.
3. Normalization.
4. Practicing DDL commands.
5. Practicing DML commands.

CYCLE 2

6. a) Querying (using ANY, ALL, UNION, INTERSECT, JOIN, Constraints etc.)
   b) Nested, Correlated sub queries.
7. Queries using Aggregate functions, Window Functions, GROUP BY, HAVING and Creation and dropping of Views.
8. Triggers (Creation of insert trigger, delete trigger, update trigger).
9. Procedures.
10. Usage of Cursors.

Sample Databases:

1. College Student Result Management System.
2. Library Management System.
3. Hospital Appointment and Billing System.
4. Bank Management and Transaction System.
5. Online Shopping (E-Commerce) Database System.

TEXT BOOKS:

1. Raghurama Krishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, Tata McGraw Hill.
2. Abraham Silberschatz and Henry F. Korth, Database System Concepts, 5th Edition, McGraw Hill.

REFERENCE BOOKS:

1. Peter Rob and Carlos Coronel, Database Systems Design, Implementation, and Management, 7th Edition, Pearson Education.
2. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education.
3. C. J. Date, Introduction to Database Systems, Pearson Education.
4. S. Shah and V. Shah, Oracle for Professionals, SPD.

BH25 B.Tech. CSE Syllabus	B. Tech. II Year I Sem	BVRITHCEW			
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
CS309SD	**NodeJS/ ReactJS/ Django (Common to CSE and CSE(AI & ML))**	**0**	**0**	**2**	**1**

Course Description: This course covers building modern web applications using a robust node with express JS or Django as backend and a dynamic React/JavaScript frontend, often incorporating Node.js for dependency management. Students will learn to create RESTful APIs (via node or Django REST Framework), build interactive user interfaces (SPA), manage databases and deploy applications

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

C309.1: Build a custom website with HTML, CSS, Bootstrap and JavaScript.

C309.2: Demonstrate Advanced features of JavaScript and learn about JDBC.

C309.3: Develop Server – side implementation using Java technologies.

C309.4: Develop the server – side implementation using Node JS/React/DJango.

LIST OF PROGRAMS

CYCLE-I

1. Build a static web application for E-Book management system with registration, login, catalog and cart pages using HTML, CSS3 features, flex and grid.
2. Make the above web application responsive web application using Bootstrap framework.
3. Use JavaScript for doing client – side validation of the pages implemented in experiment 1 and experiment 2.
4. Explore the features of ES6 like arrow functions, callbacks, promises, async/await. Implement an application for reading the weather information from openweathermap.org and display the information in the form of a graph on the web page.
5. Maintaining the transactional history of any user is very important. Explore the various session tracking mechanism (Cookies, HTTP Session)

CYCLE-II

6. Create a custom server using http module and explore the other modules of Node JS like OS, path, event.
7. Develop an express web application that can interact with REST API to perform CRUD operations on student data. (Use Postman)
8. For the above application create authorized end points using JWT (JSON Web Token).
9. Create a react application for the student management system having registration, login, contact, about pages and implement routing to navigate through these pages.
10. Create a Django app using startapp and display a message from app view
11. Create a TODO application using Django with necessary components and deploy it into Github.

REFERENCE BOOKS:

1. Jon Duckett, Beginning HTML, XHTML, CSS, and JavaScript, Wrox Publications, 2010.
2. Bryan Basham, Kathy Sierra and Bert Bates, Head First Servlets and JSP, O'Reilly Media, 2nd Edition, 2008.
3. Vasan Subramanian, Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React and Node, 2nd Edition, APress.

BH25 B.Tech. CSE Syllabus	B.Tech. II Year I Sem				BVRITHCEW
Course Code	Course Title	L	T	P	Credits
VA300ES	ENVIRONMENTAL SCIENCE	3	0	0	1
	Common to CSE,EEE,ECE				
Pre-Requisite	Intermediate Chemistry/ 10+2 Chemistry knowledge				

Course Description

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

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

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

Unit–I ECOSYSTEMS (9Hours)

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Foodchains, foodwebs, 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 (9Hours)

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems, Water Foot print. **Mineral resources:** use and exploitation, environmental effects of extracting mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies

Unit–III Biodiversity and Biotic Resources (7Hours)

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 (11Hours)

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management.

Pollution control technologies: Wastewater Treatment methods: Primary, secondary and Tertiary./Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

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

Unit– V Environmental Policy, Legislation & EIA (9Hours)

Environmental Policy, Legislation& EIA: Environmental Protection act, Legal aspects Air Act-1981,Water Act, Forest Act, Wildlife Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Concepts of Environmental Management Plan (EMP).**Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Concept of Green Building, Ecological Foot Print, Life Cycle assessment(LCA), Low carbon life style.

TEXTBOOKS:

1. Erach Bharucha.Text book of Environmental Studies for Undergraduate Courses.1st edition,Universitiespress,2005.

2. Anubha Kaushik,C.P.Kaushik. Perspectives in EnvironmentalStudies.4thedition,New age international publishers,2014.

3. S.Deswaland, A.Deswal, A basic course in environmental studies, 2ndedition, Dhanapathi rai& Co.,2004.

4. Bennyjoseph, Environmentalstudies, 3rdedition, McGraw Hill Education(India)Private Limited,2005.

REFERENCE BOOKS:

1. Daniel B.Botkinand, Edwards, A.Keller, Environmental science, 8thedition, Wiley India(P) Ltd.

2. Richard T.Wright. Environmental Science: towards a sustainable future.4thedition,PHL Learning Private Ltd.

3. P.D.Sharma, Ecology And Environment, 5thedition, Rastogi Publications.

BH25 B.Tech. CSE syllabus	B. Tech. II Year II Sem	BVRITHCEW			
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
MA401BS	**COMPUTER ORIENTED STATISTICAL METHODS**	3	0	0	3
Pre - Requisite	Mathematics courses of first year of study.				

Course Description

The course contains the Random variable, Probability distributions of single variable, The sampling theory, testing of hypothesis and making statistical inferences, Methods of Estimation, Stochastic process and Markov chains.

Course Outcomes

C401.1 Compute the mean and variance of a given probability distribution of a random variable
C401.2 Solve real-world problems using discrete or continuous probability models.
C401.3 Apply the concepts of sample to find the sampling distributions of mean for the given data.
C401.4 Estimate the value for a given parameter by choosing appropriate method
C401.5 Test statistical hypothesis for large and small samples involving means, proportions, and variances using appropriate tests.
C401.6 Apply Stochastic process and Markov process to solve real world problems.

Unit – I Random Variables and Probability Distributions (8 Hours)

Concept of a Random Variable – Discrete Probability Distributions – Continuous Probability Distributions – Mean of a Random Variable – Variance of a Random Variable. Discrete Probability Distributions: Binomial Distribution – Poisson distribution

Unit – II Continuous Distributions and Sampling (10 Hours)

Uniform Distribution – Normal Distribution – Areas under the Normal Curve – Applications of the Normal Distribution – Normal Approximation to the Binomial Distributions. Fundamental Sampling Distributions: Random Sampling – Some Important Statistics – Sampling Distributions – Sampling Distribution of Means – Central Limit Theorem.

Unit – III Estimation (10 Hours)

Introduction – Statistical Inference – Classical Methods of Estimation – Single Sample: Estimating the mean – Standard error of a point estimate. Two samples: Estimating the difference between two means– Single sample: Estimating a proportion – Two samples: Estimating the difference between two proportions– Two samples: Estimating the ratio of two variances.

Unit – IV Tests of Hypotheses (10 Hours)

Statistical Hypotheses: General Concepts – Testing a Statistical Hypothesis. Single sample: Tests concerning a single mean. Two samples: Tests on two mean (Unknown for equal variance). One sample: Test on a single proportion. Two samples: Tests on two proportions. Two- sample tests concerning variances: F-distribution

Unit – V Stochastic Processes and Markov Chains (10 Hours)

Introduction to Stochastic processes- Markov process. Transition Probability, Transition Probability Matrix, First order and Higher order Markov process, n-step transition probabilities, Markov chain, Steady state condition, Markov analysis.

TEXT BOOKS:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics For Engineers & Scientists, 9th Ed. Pearson Publishers.
2. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications.
3. S.D. Sharma, Operations Research, Kedarnath and Ramnath Publishers, Meerut, Delhi.

REFERENCE BOOKS:

1. T.T. Soong, Fundamentals of Probability and Statistics for Engineers, John Wiley & Sons, Ltd, 2004.
2. Sheldon M Ross, Probability and statistics for Engineers and scientists, academic press.
3. Miller and Freund's, Probability and Statistics for Engineers, 8th Edition, Pearson Educations

BH25 B.Tech. CSE Syllabus	B. Tech. II Year II Sem	BVRITHCEW			
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
CS402PC	**Operating Systems (Common to CSE and CSE(AI & ML))**	**3**	**0**	**0**	**3**
Pre-requisites	**1.** Data Structures **2.** Computer Organization and Architecture				

Course Description: This course covers the fundamental concepts of managing computer hardware and software resources. It explores key concepts such as process coordination, memory allocation, file management, security, and concurrency control. It helps students understand how to develop efficient, secure, and reliable operating system solutions.

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

C402.1: Explore basic concepts of System Structures, Process, and Threads.
C402.2: Evaluate CPU scheduling algorithms and deadlock handling mechanisms
C402.3: Apply various mechanisms to achieve synchronization.
C402.4: Identify suitable mechanisms for Inter Process Communication.
C402.5: Choose appropriate Memory Management techniques.
C402.6: Implement efficient File Management techniques through System Calls.

UNIT - I

Operating System: Introduction, Structures - Simple Batch, Multiprogrammed, Time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating System services, System Calls.

Process - Process concepts and scheduling, Operations on processes, Threads.

UNIT - II

CPU Scheduling: Scheduling Criteria, Scheduling Algorithms, Multiple -Processor Scheduling. System call interface for process management-fork, exit, wait, waitpid, exec.

Deadlocks: System Model, Deadlocks Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock.

UNIT - III

Process Management and Synchronization: The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors.

Interprocess Communication Mechanisms: IPC between processes on a single computer system, IPC between processes on different systems, using pipes, FIFOs, message queues, and shared memory.

UNIT - IV

Memory Management and Virtual Memory: Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging, Demand Paging, Page Replacement, Page Replacement Algorithms.

UNIT - V

File System Interface and Operations -Access methods, Directory Structure, Protection, File System Structure, Allocation methods, Free-space Management. Usage of open, create, read, write, close, lseek, stat, ioctl system calls.

TEXT BOOKS:

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Operating System Principles, 7th Edition, John Wiley.
2. W.R. Stevens, Advanced Programming in the UNIX Environment, Pearson Education.

REFERENCE BOOKS:

1. William Stallings, Operating Systems- Internals and Design Principles, 5th Edition, 2005, Pearson Education/PHI.
2. Crowley, Operating System A Design Approach, TMH.
3. Andrew S. Tanenbaum, Modern Operating Systems, 2nd Edition, Pearson/PHI
4. Kernighan and Pike, UNIX Programming Environment, Pearson Education/PHI.
5. U. Vahalia, UNIX Internals -The New Frontiers, Pearson Education.

BH25 B.Tech. CSE Syllabus	B. Tech. II Year II Sem	BVRITHCEW			
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
CS403PC	**Algorithm Design and Analysis (Common to CSE and CSE (AI & ML))**	3	0	0	3

Pre - Requisite Data Structures

Course Description: This course covers performance of algorithms, algorithmic design paradigms, modelling of problems using disjoint sets, priority queues and graphs, introducing the concepts of P & NP classes.

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

C403.1: Analyze the performance of the algorithms and represent using relevant notations.

C403.2: Apply the concepts of disjoint sets and priority queues to solve real world problems.

C403.3: Choose appropriate algorithmic design paradigms to solve various real world problems.

C403.4: Identify the issues in graph connectivity and resolve them.

C403.5: Reduce the search space of a problem using bounding functions.

C403.6: Categorize problems into NP hard & NP Complete.

Unit – I

Introduction: Algorithm, Performance Analysis-Space complexity, Time complexity, Asymptotic Notations**.**

Disjoint Sets: Disjoint set operations, union and find algorithms, Priority Queue- Heaps, Heapsort.

Unit – II

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication.

Greedy method: General method, applications-Job sequencing with deadlines, knapsack problem, Single source shortest path problem.

Unit – III

Dynamic Programming: General method, Multistage Graph problem, Applications- Optimal binary search tree, 0/1 knapsack problem, All pairs shortest path problem, Traveling salesperson problem, Reliability design.

Unit – IV

Traversals: Basic Traversal and Search Techniques: Techniques for Binary Trees, Techniques for Graphs, Connected components, Biconnected components.

Backtracking: General method, applications, n-queen's problem, sum of subsets problem, graph coloring, hamiltonian cycles.

Unit – V

Branch and Bound: General method, applications - Traveling salesperson problem, 0/1 knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution.

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP-Hard and NP-Complete classes, Cook's theorem.

TEXT BOOKS:

1. Ellis Horowitz, Satraj Sahni and Rajasekharan, Fundamentals of Computer Algorithms, 1998, University Press.

REFERENCE BOOKS:

1. Aho, Ullman and Hopcroft, Design and Analysis of Algorithms, Pearson Education.
2. T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, 2nd Edition, PHI Pvt. Ltd./ Pearson Education.
3. M.T. Goodrich and R. Tamassia, Algorithm Design: Foundations, Analysis and Internet Examples, John Wiley and Sons.
4. Anany Levitin, Introduction to The Design and Analysis of Algorithms , 3rd Edition, Pearson Education.
5. Sara Baase and Allen Van Gelder, Computer Algorithms: Introduction to Design and Analysis, 3rd Edition, Addison-Wesley.

BH25 B.Tech. CSE Syllabus	B. Tech. II Year II Sem				BVRITHCEW
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
CS404PC	**Computer Networks (Common to CSE and CSE(AI & ML))**	**3**	**0**	**0**	**3**

Course Description: This course explains to equip the students with a solid foundation in computer networking concepts, introduce standard layered network architectures, and facilitate understanding of the design, operation, and implementation of protocols at various layers of the protocol stack.

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

CS404.1: Analyze the fundamentals of computer networks and reference models.

CS404.2: Design effective network applications by applying application layer protocols and services.

CS404.3: Assess the transport-layer protocols and congestion control methods in a network.

CS404.4: Choose the appropriate routing algorithm suitable for a given network topology based on network layer principles and mechanisms.

CS404.5: Analyze various link-control and access control mechanisms available in the data link layer.

CS404.6: Apply the knowledge of error detection mechanisms and link layer protocols to determine the most appropriate solutions for efficient data transfer.

UNIT - I

Introduction: The Internet, Protocol, Network Edge-Topologies, Media & Access networks, Network Core, Packet Switching, Circuit Switching, Delay, Loss, and Throughput vs Latency in Packet-Switched Networks, Protocol reference models: ISO-OSI, TCP/IP, Network under attacks, History of Computer Networking and the Internet.

UNIT – II

Application Layer: Principles of Network Applications, Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols, The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, SMTP, DNS, Peer-to-Peer Applications, Socket Programming: Creating Network Applications.

UNIT - III

Transport Layer: Transport-Layer Services, Multiplexing and Demultiplexing, Connectionless Transport: UDP, Principles of Reliable Data Transfer, Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N (GBN), Selective Repeat (SR), Connection-Oriented Transport: TCP, The TCP Connection, Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control, TCP Congestion Control, Fairness.

UNIT - IV

Network Layer: Data and Control plane**,** Forwarding and Routing,Virtual Circuit and Datagram Networks, Router working, The Internet Protocol (IP): Forwarding and Addressing in the Internet, Datagram Format, IPv4 Addressing, Subnet Masking, Internet Control Message Protocol (ICMP), IPv6, IP Security, Routing Algorithms- The Link-State (LS) Routing Algorithm, The Distance- Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet-Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter-AS Routing: BGP, Broadcast and Multicast Routing.

UNIT - V

The Link Layer: The Services Provided by the Link Layer, Error-Detection and -Correction Techniques- Parity Checks, Checksum Methods, Cyclic Redundancy Check (CRC), Hamming code, Multiple Access Links and Protocols, Channel Partitioning Protocols, Random Access Protocols, Taking-Turns Protocols, DOCSIS: The Link-Layer Protocol for Cable Internet Access, Switched Local Area Networks, Link-Layer Addressing and ARP, Ethernet, Link-Layer Switches, Virtual Local Area Networks (VLANs), Link Virtualization-Multiprotocol Label Switching (MPLS), Data Center Networking, A Day in the Life of a Web Page Request. Wireless network characteristics, Wireless LAN.

TEXT BOOKS:

1. James F.Kurose, Keith W. Ross -"Computer Networking: A Top-Down Approach", 8th Edition, Pearson.
2. Andrew S Tanenbaum, David. J. Wetherall - "Computer Networks", 5th Edition, Pearson.

REFERENCE BOOKS:

1. Behrouz A. Forouzan-"Data Communications and Networking", 3rd Edition, McGraw Hill India.
2. S.Keshav- "An Engineering Approach to Computer Networks", 2nd Edition Addison-Wesley/ Pearson Education.

BH25 B.Tech. CSE Syllabus	B. Tech. II Year II Sem	BVRITHCEW			
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
CS405PC	**Artificial Intelligence (Common to CSE and CSE (AI & ML)**	**3**	**0**	**0**	**3**

Course Description: This course explains the theory and development of computer systems capable of performing tasks that historically required human intelligence, such as recognizing speech, making decisions, and identifying patterns.

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

C405.1: Understand the concept of intelligent agents and classical search strategies.

C405.2: Apply adversarial search and CSP techniques.

C405.3: Demonstrate propositional logic for Knowledge-Based Agents.

C405.4: Perform inference using First-Order Logic techniques.

C405.5: Apply knowledge representation and classical planning methods.

C405.6: Design probabilistic models for reasoning under uncertainty.

Unit – I

Introduction to Artificial Intelligence: Introduction to AI: Intelligent Agents, problem-solving Agents, searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform cost search, Depth-first search, Iterative deepening Depthfirst search, Bidirectional search, informed (Heuristic) Search Strategies: Greedy best-first search, A* search, Heuristic Functions, Beyond Classical Search: Hill-climbing search, Simulated annealing search, Local Search in continuous spaces.

Unit – II

Problem Solving by Search-II and Propositional Logic: Adversarial Search: Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real - Time Decisions. Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

Propositional Logic: Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses, Forward and backward chaining, Effective Propositional Model Checking, Agents Based on Propositional Logic.

Unit – III

Logic and Knowledge Representation First-Order Logic: Representation, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

Unit – IV

Knowledge Representation: Ontological Engineering, Categories and Objects, Events. Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.

Classical Planning: Definition of Classical Planning, Algorithms for Planning with State-Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.

Unit – V

Uncertain knowledge and Learning Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Bayes' Rule and its use Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First-Order Probability, Other Approaches to Uncertain Reasoning: Dempster-Shafer theory.

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson Education.

REFERENCE BOOKS:

1. E. Rich and K. Knight Artificial Intelligence, 3rd Edition, TMH.
2. Patrick Henry Winston, Artificial Intelligence, 3rd Edition, Pearson Education.
3. Shivani Goel, Artificial Intelligence, Pearson Education.
4. Patterson, Artificial Intelligence and Expert Systems, Pearson Education.

BH25 B.Tech. CSE Syllabus	B. Tech. II Year II Sem	BVRITHCEW			
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
MA406BS	**COMPUTATIONAL MATHEMATICS LAB (using Python)**	0	0	2	1

Pre - Requisite Mathematics courses of first year of study and Python programming.

Course Description:

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

Course Outcomes

C406.1	Compute eigenvalues and eigenvectors of matrices using programming tools.
C406.2	Develop programs to compute roots of algebraic and transcendental equations using Bisection and Newton–Raphson methods.
C406.3	Develop programs for solving systems of linear equations using Jacobi and Gauss–Seidel iteration methods.
C406.4	Implement algorithms to solve first order & first degree and higher-order linear differential equations with constant coefficients.

Unit – I **Eigen values and Eigenvectors:** **(6 Hours)**

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

Unit – II **Solution of Algebraic and Transcendental Equations** **(6 Hours)**

Programs:

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

Unit – III **Linear system of equations:** **(6 Hours)**

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

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

Unit – IV **First-Order ODEs** **(8 Hours)**

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

Unit – V **Higher order linear differential equations with constant coefficients** **(6 Hours)**

- Solving homogeneous ODEs
- Solving non-homogeneous ODE

TEXT BOOKS:

1. MATLAB and its Applications in Engineering, Rajkumar Basal, Ashok Kumar Geo, Manoj Kumar Sharma, Pearson publication.
2. Kenneth A. Lambert, The fundamentals of Python: First Programs, 2011, Cengage Learnings.
3. Think Python First Edition, by Allen B. Downey, Orielly publishing.
4. Introduction to Python Programming, William Mitchell, Povel Solin, Martin Novak et al., NCLab Public Computing, 2012.
5. Introduction to Python Programming, ©Jacob Fredslund, 2007.

REFERENCE BOOKS:

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

BH25 B.Tech. CSE Syllabus	B. Tech. II Year II Sem	BVRITHCEW			
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
CS407PC	**Operating Systems Lab (Common to CSE and CSE (AI & ML))**	**0**	**0**	**2**	**1**
Pre-requisites	1. Programming for Problem Solving 2. Computer Organization and Architecture				

Course Description: This course introduces practical exposure to fundamental OS concepts including CPU scheduling algorithms, memory and file management, deadlock handling, and process synchronization.

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

C407.1:	Analyze CPU scheduling and memory management techniques by implementing algorithms to evaluate system performance and resource utilization.
C407.2:	Evaluate deadlock management techniques such as prevention, avoidance, and detection using suitable algorithms.
C407.3:	Develop semaphore-based solutions for classical synchronization problems to ensure correct process interaction and efficient use of shared resources.
C407.4:	Develop programs using Unix system calls to perform process control, file operations, and inter-process communication.

LIST OF PROGRAMS

CYCLE 1:

1. Write C programs to simulate the following CPU Scheduling algorithms
   a) FCFS b) SJF c) Round Robin d) Priority.
2. Write a program to implement a process management system calls viz., fork, exit.
3. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.
4. Write a C program to implement the Producer - Consumer problem using semaphores using UNIX/LINUX system calls.

CYCLE 2:

5. Write C programs to illustrate the following IPC mechanisms.
   a) Pipes b) FIFOs c) Message Queues d) Shared Memory
6. Write C programs to simulate the following memory management techniques.
   a) Paging b) Segmentation
7. Write C programs to simulate Page Replacement policies.
   a) FCFS b) LRU c) Optimal
8. Write programs using the I/O system calls of UNIX/LINUX operating system (open, read, write, close, lseek, stat).

TEXT BOOKS:

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Operating System Principles, 7th Edition, John Wiley.
2. W. R. Stevens, Advanced Programming in the Unix Environment, Pearson Education.

REFERENCE BOOKS:

1. William Stallings, Operating Systems - Internals and Design Principles, 5th Edition, 2005, Pearson Education/PHI.
2. Crowley, Operating System - A Design Approach, TMH.
3. Andrew S Tanenbaum, Modern Operating Systems, 2nd Edition, Pearson/PHI.
4. Kernighan and Pike, UNIX Programming Environment, PHI/Pearson Education.
5. U. Vahalia, UNIX Internals: The New Frontiers, Pearson Education.

BH25 B.Tech. CSE Syllabus	B. Tech. II Year II Sem				BVRITHCEW
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
CS408PC	**Computer Networks lab (Common to CSE and CSE(AI & ML))**	**0**	**0**	**2**	**1**

Pre - Requisite Programming for problem solving

Course Description: This course introduces, implementation of various framing methods, error detection and correction mechanisms. Design and implementation of various routing protocols and congestion control mechanisms. It helps in providing & monitoring security using tools like Nmap, Wireshark and NS2.

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

C408.1: Analyze real-time network traffic and security vulnerabilities by using tools like Wireshark for protocol analysis and Nmap for operating system detection.

C408.2: Implement functional networking applications using Socket Programming and congestion control mechanisms.

C408.3: Apply mathematical models to solve routing, framing methods,error detection and correcting methods.

C408.4: Model network topologies using the NS2 Simulator to evaluate performance metrics.

LIST OF EXPERIMENTS

CYCLE 1:

1. Program to implement client-server interaction using socket programming.
2. Wireshark
    i. Starting Wireshark
    ii. Interface Selection
    iii. Packet Capture using Wireshark
    iv. Viewing Captured Traffic
    v. Protocol Dissection
    vi. Analysis and Statistics & Filters
    vii. Follow Stream
    viii. Performance Analysis
    ix. Security Analysis
    x. Exporting and Reporting
    xi. Customization and Visualization
3. Take an example subnet of hosts and obtain a broadcast tree for the subnet.
4. Write a program for congestion control using Leaky bucket algorithm.
5. Write a program for frame sorting techniques used in buffers
6. Nmap
    i. How to run Nmap scan
    ii. Operating System Detection using Nmap

CYCLE 2:

7. Implement Dijsktra's algorithm to compute the shortest path through a network
8. Implement distance vector routing algorithm for obtaining routing tables at each node.
9. Implement the data link layer framing methods such as character count, character stuffing and bit stuffing.
10. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC-CCIP.
11. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.
12. Do the following using NS2 Simulator
    i. Simulator-Introduction
    ii. Find the Number of Packets Dropped
    iii. Find the Number of Packets Dropped by TCP/UDP
    iv. Find the Number of Packets Dropped due to Congestion.
    v. Compare Data Rate & Throughput.
    vi. Plot Congestion for Different Source/Destination
    vii. Determine the Performance with respect to Transmission of Packets

TEXT BOOKS:

1. Andrew S Tanenbaum, David. J. Wetherall -"Computer Networks", 5th Edition Pearson.
2. James F.Kurose, Keith W. Ross -"Computer Networking: A Top-Down Approach", 8th Edition, Pearson.

REFERENCE BOOKS:

1. S.Keshav-"An Engineering Approach to Computer Networks", 2nd Edition Addison-Wesley/Pearson.
2. Behrouz A. Forouzan-"Data Communications and Networking" , 3rd Edition, Mc Graw Hill India.

BH25 B.Tech. CSE Syllabus	B. Tech. II Year II Sem	BVRITHCEW			
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
CS409PC	**Artificial Intelligence Lab (Common to CSE and CSE (AI & ML))**	**0**	**0**	**2**	**1**

Course Description: This course introduces hands-on experience in implementing, experimenting with, and understanding various AI techniques and algorithms.

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

C409.1: Demonstrate a deep understanding of fundamental search algorithms.

C409.2: Apply algorithmic techniques to implement games.

C409.3: Exhibit proficiency in solving complex problems through heuristic search algorithms.

C409.4: Apply evaluation skills, to assess and select appropriate optimization techniques.

LIST OF PROGRAMS

CYCLE 1:

1. Implement a program to find the shortest path from a start position to a goal position in a maze/grid using the Breadth-First Search (BFS) algorithm.
2. Design a program in which an agent navigates a graph or grid using the Depth-First Search (DFS) algorithm to collect rewards or energy points, and calculate the total reward collected.
3. Develop a two-player Tic-Tac-Toe game using BFS Algorithm. Allow users to make moves on a 3x3 grid, and implement the logic to determine the winner or declare a draw.
4. Implement the A* algorithm to solve the 8-Puzzle problem.
5. Solve the classic Water-Jug Problem using the DFS algorithm. Given two jugs with different capacities, determine the sequence of actions needed to measure a specific quantity of water.

CYCLE 2:

6. Design a program to solve the Travelling Salesman Problem using Nearest Neighbour algorithm.
7. Write a program to solve the Tower of Hanoi problem.
8. Solve the Monkey Banana Problem using A* algorithm.
9. Implement the Alpha-Beta Pruning algorithm for optimizing the search in a minimax game tree.
10. Solve the 8-Queens Problem using DFS algorithm. Implement a program to find a placement of eight queens on a chessboard such that no two queens attack each other.

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence a Modern Approach, 3rd Edition, Pearson Education.

REFERENCE BOOKS:

1. Rich and K. Knight (TMH), Artificial Intelligence, 3rd Edition.
2. Patrick Henny Winston, Artificial Intelligence, 3rd Edition, Pearson Education.
3. Shivani Goel, Artificial Intelligence, Pearson Education

BH25 B.Tech. CSE Syllabus **B. Tech. II Year II Sem** **BVRITHCEW**

Course Code	Course Title	L	T	P	Credits
CS410SD	Data Visualization – R/Python/ Power BI/Tableau (Common to CSE and CSE(AI & ML))	0	0	2	1

Course Description: This course introduces data visualization concepts and Business Intelligence (BI) tools using R Programming and Power BI/Tableau. The course focuses on transforming raw data into meaningful visual representations, identifying patterns and relationships, and developing interactive dashboards for real-world decision-making.

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

C410.1: Understand how to import data into R and Tableau.

C410.2: Apply Tableau concepts of Dimensions and Measures.

C410.3: Develop programs and implement visual layout and graphical properties.

C410.4: Create a dashboard, custom charts and publish to tableau online for any dataset.

LIST OF PROGRAMS

CYCLE 1:

1. Understanding data, What is data, where to find data, Foundations for building Data Visualizations, creating your first visualization in R.
2. Getting started with Tableau Software using Data file formats, connecting your Data to Tableau, creating basic charts (line, bar charts, Tree maps), using the Show Me Pane.
3. Tableau Calculations, Overview of SUM, AVG, and Aggregate features, Creating custom calculations and fields.
4. Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view.
5. Editing and Formatting Axes, Manipulating Data in Tableau data, Pivoting Tableau data.

CYCLE 2:

6. Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data.
7. Advanced Visualization Tools: using Filters, using the Data pane, using the Size pane,customizing filters, using and Customizing tooltips, Formatting your data with colors.
8. Creating Dashboards & Storytelling: Creating your first dashboard and Story, Design for different displays, adding interactivity to your Dashboard, Distributing & Publishing your Visualization.
9. Tableau file types, publishing to Tableau Online, Sharing your visualizations, printing, and exporting.
10. Creating custom charts, cyclical data and circular area charts, Dual Axis charts.

REFERENCE BOOKS:

1. Microsoft Power BI Cookbook, Brett Powell, 2nd Edition.
2. Roger D. Peng , R Programming for Data Science.
3. Norman Matloff, The Art of R Programming, Cengage Learning India.

Sample Datasets:

1.	Agriculture	https://data.telangana.gov.in/search/?theme=Agriculture
2.	Water Resources	https://data.telangana.gov.in/dataset/telangana-ground-water-department-water-level-data
3.	Education	https://data.telangana.gov.in/search/?theme=Education
4.	Pollution	https://data.telangana.gov.in/search?theme=Pollution
5.	Health	https://data.telangana.gov.in/search?theme=Health
6.	Social Media	https://www.kaggle.com/datasets/prince7489/mental-health-and-social-media-balance-dataset
7.	Household Survey	https://www.data.gov.in/search?query=household%20consumer%20expenditure%20nsso

BH25 B.Tech. Syllabus	B. Tech. II Year II Sem	BVRITHCEW			
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
MS411HS	**Innovation and Entrepreneurship**	2	0	0	2

Pre-Requisites: Nil

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

Course Outcomes:

C411.1: Understand the entrepreneurship and the entrepreneurial process and its significance in economic development.
C411.2: Assess the problem from an industry perspective and generate solutions using the design thinking principles.
C411.3: Assess market competition, estimate market size and develop a prototype.
C411.4: Analyze Business and financial planning models and Go-to-Market strategies.
C411.5: Able to build a start-up, register IP and identify funding opportunities.
C411.6: Able to develop and present a comprehensive business plan for an innovative and scalable start-up venture.

Unit-I Fundamentals of Innovation and Entrepreneurship: (8 Hours)

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

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

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

Unit-II Problem and Customer Identification: **(6 Hours)**

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

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

Unit-III Opportunity assessment and Prototype development: (6 Hours)

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

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

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

Unit-IV Business & Financial Models (7 Hours)

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

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

Unit-V Startups and IPR (7 Hours)

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

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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