

# **JBLET Academic Regulations –R25**

Applicable to

## **B.Tech Regular Four-Year Degree Programme**

(For the Batches admitted from the Academic Year 2025- 26)

&

## **B.Tech (Lateral Entry Scheme)**

(For the Batches admitted from the Academic Year 2026-27)



**J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY**

(UGC AUTONOMOUS)

Bhaskar Nagar, Yenkapally (V), Moinabad (M), Hyderabad – 500075,  
Telangana, India



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(UGC Autonomous)

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(For the Batches admitted from the Academic Year 2026- 27)

Offered under **Choice Based Credit System (CBCS)**

J. B. Institute of Engineering and Technology (hereinafter referred to as JBIET) Academic Regulations JB-R25 are given here under. These regulations approved by the Academic Council shall be in force and applicable from the academic year 2025-26 onwards.

## **1.0 Under-Graduate Degree Programme in Engineering & Technology**

J. B. Institute of Engineering and Technology (JBIET) offers a 4-Year (8 Semesters) Bachelor of Technology (B. Tech) Degree Programme for regular students under Choice Based Credit System (CBCS) in the following branches of Engineering with effect from the academic year 2025-26.

S. No.	Branch Code	Branch Name
1	01	Civil Engineering (CE)
2	02	Electrical and Electronics Engineering (EEE)
3	03	Mechanical Engineering (ME)
4	04	Electronics and Communication Engineering (ECE)
5	05	Computer Science and Engineering (CSE)
6	12	Information Technology (IT)
7	19	Electronics and Computer Engineering (ECM)
8	66	Computer Science and Engineering (Artificial Intelligence and Machine Learning)-CSE(AI&ML)
9	67	Computer Science and Engineering (Data Science)-CSE(DS)
10	72	Artificial Intelligence and Data Science (AI&DS)
11	73	Artificial Intelligence and Machine Learning (AI&ML)

## **2.0 Eligibility for Admission**

**2.1.** Admission to the undergraduate (UG) programme shall be made either on the basis of the merit rank obtained by the qualified student in entrance test conducted by the Telangana State Government (EAPCET) or the University or on the basis of any other order of merit approved by the College, 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 is 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/NEP-2020/JNTUH specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms.

**3.2.1 Semester Scheme:** The 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 midterm 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/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, totalling 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- Engg. 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 (EIC)	PE – Professional Electives	Includes elective courses related to the parent branch of Engineering.
6		OE – Open Electives	Elective courses which include interdisciplinary courses or courses in an area outside the parent branch of Engineering.
5	Project Core	PW- Project Work	B.Tech. Project Work

6	Other Core Courses (OCC)	Industry Training/ Internship/ Industry Oriented Mini project/ Skill Development Courses	Industry Training/ Internship/ Industry Oriented Mini-Project/Skill Development Courses
7		Seminar	Seminar based on core contents related to parent branch of Engineering.
8	Skill Development Courses (SDC)	--	Courses designed to help individuals gain, improve, or refine specific skills
9	Value Added Courses (VAC)	--	Courses to build professional values, traditional knowledge and sensitization of societal issues

#### 4.0 Mandatory Induction Programme

An induction program of one week duration for the UG students entering the institution, right at the start shall be implemented. Normal classes commence only after the induction programme is conducted. Following activities could be part of the induction programme: i) Physical Activity, ii) Creative Arts, iii) Imparting Universal Human Values, iv) Literary Activities, v) Lectures by Eminent People, vi) Visits to Local Areas and vii) Familiarization to department as well as entire institute and viii) Making students understand Innovative practices at the college premises etc.

#### 5.0 Course Registration

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

5.2 The academic section of the college invites 'registration forms' from students before the beginning of the semester ensuring 'date and time stamping'. The registration requests for semester courses shall be completed two weeks before the commencement of SEEs (Semester End Examinations) of the preceding semester.

5.3 A student can apply for registration, only after obtaining the 'written approval' from 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, faculty advisor/ mentor and the student.

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 classwork of the semester.

**5.6** The Head of the Department / Course Coordinator should review vacant slots in the timetable of each section once in every week or fortnight. The vacant slots in the timetable 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 minimise the failures in the subject.

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

Students have the flexibility to choose from the list of professional electives offered by the JBIET or opt to register for the equivalent Massive Open Online Courses (MOOCs) with prior approval of the courses from Board of Studies and Academic Council.

**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 his 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 University 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. 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 50% 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 number of students 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.

**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 readmission 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 he/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 (thereby 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, totalling to 30 marks. Total duration of mid-term examination is two hours.

### **1. Mid Term Examination for 30 marks:**

**a. Part - A: Objective/quiz paper for 10 marks.**

**b. Part - B: Descriptive paper for 20 marks.**

The objective/quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 10 marks. The descriptive paper shall contain 6 questions out of which, the student has to answer 4 questions, each carrying 5 marks. The average of the two Mid Term Examinations shall be taken as the final marks for Mid Term Examination (for 30 marks).

While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus. Questions will be drawn from the mid-term exam syllabus, ensuring uniform coverage of all topics. The remaining 10 marks of Continuous Internal Evaluation are distributed as follows:

**2. Five marks for the assignment for 5 marks.** 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.

#### **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 from 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.

## **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 from the college outside their cluster and not from a group colleges.

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

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

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

#### **9.6 Field-based Research Project:**

There shall be a Field-based Research Project in the intervening summer between II-II and III-I Semesters. Students will register for this 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 he (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 this 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 his/her supervisor, the title, objective and plan of action of his/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 his/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 he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

**9.8.5** For conducting viva-voce exam of project work, University appoints an external examiner. The external examiner may be selected from the list of experts submitted by the Principal of the College.

**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, he/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-1, II-2, III-1 and III-2 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 University time to time.

## **10.0 Grading Procedure**

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

**10.2** Grades will be awarded to indicate the performance of students in each Theory, Laboratory, Industry-Oriented Mini Project/ Internship/ Skill development course and

Project Work. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in clause 8 above, a letter grade shall be given as explained in the following clause.

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

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

**10.4** A student shall be declared successful or ‘passed’ in a semester, if he/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 he/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 (G) in each course, on the basis of letter grade secured in that course. Every student who passes a course will receive grade point  $GP \geq 5$  ( ‘C’ grade or above).

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

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

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

$$SGPA = \frac{\sum_{i=1}^N C_i G_i}{\sum_{i=1}^N C_i} \text{ for each Semester}$$

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  $i^{\text{th}}$  course, and  $G_i$  represents the grade points (GP) corresponding to the letter grade awarded for that  $i^{\text{th}}$  course.

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

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

$$CGPA = \frac{\sum_{j=1}^M C_j G_j}{\sum_{j=1}^M C_j} \text{ for all S number of semesters registered}$$

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  $j^{\text{th}}$  course, and  $G_j$  represents the grade points (GP) corresponding to the letter grade awarded for that  $j^{\text{th}}$  course.



### Illustration of calculation of SGPA:

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

$$SGPA = \frac{152}{20} = 7.6$$

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' value 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 he passed his 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 students 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 Withholding of Results

**12.1** If the student has not paid the fees to the JBIET 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 may be 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 fulfilment of attendance requirement.
2	First year second semester to second year first semester	(i) Regular course of study of first year second semester and fulfilment 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 fulfilment of attendance requirement.
4	Second year second semester to third year first semester	(i) Regular course of study of second year second semester and fulfilment 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 fulfilment of attendance requirement.
6	Third year second semester to fourth year	Regular course of study of third year second semester and fulfilment of attendance

	first semester	requirement.
7	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester and fulfilment 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 he got admitted in his/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 by JNTUH in the branch of Engineering selected at the time of admission.

**17.2** A student who qualifies for award of the degree by JNTUH 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 undergraduate programme)  $\geq 7.5$ , 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  $\geq 7.5$  shall be placed in 'First Class'.

**17.4** Students with final CGPA (at the end of the undergraduate programme)  $\geq 6.5$  but  $< 7.5$  shall be placed in 'First Class'.

**17.5** Students with final CGPA (at the end of the undergraduate programme)  $\geq 5.5$  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 undergraduate programme)  $\geq 5.00$  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 R-25 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' during Graduation Day.

**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: 1) more number of times secured highest SGPA's, ii) more number of O and A+ grades in that order and iii) highest SGPA in the order of first semester to eight semester.

### **19.0 Conversion of CGPA into equivalent Percentage of Marks**

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

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

## **20.0 Honours and Minor Degree Programs**

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

Only the JNTUH approved Minors and Honors shall be offered.

## **21.0 Multiple Entry Multiple Exit Scheme (MEME)**

### **21.1 Exit Option after Second Year:**

Students enrolled in the 4-Year B.Tech. program are 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 fulfil 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:**

Completion of 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 schedule and guidelines.

### **21.3 Re-entry into the B.Tech. Program**

Students who have exited the B.Tech. program with a 2-Year UG Diploma may apply for re-entry 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. Before rejoining, students should check for continuation of the same branch at the college. If the specific branch is closed then student 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 his/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. program).

#### **22.0 Transitory Regulations for the students re-admitted in R-25 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 R-25 regulations are in force.

**22.2** A student detained due to shortage of attendance and re-admitted in R-25 regulations: Such students shall be permitted to join the same semester, but in R-25 Regulations.

**22.3** A student detained due to shortage of credits and re-admitted in R-25 regulations: Such students shall be promoted to the next semester in R-25 regulations, only after acquiring the required number of credits as per the corresponding regulations of his/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 R-25 Regulations and has any course with 80% of syllabus common with his/her previous regulations, that particular course in R-25 Regulations will be substituted by an equivalent course of R-24 or R-22 regulations approved by BOS, AC followed by JNTUH. All these details are summarized in a set of look-up Table; one set for each B. Tech. branch.

## **22.6 Look Up Table of equivalence courses**

**22.6.1** A lookup table will be provided for the benefit of students. This lookup table will include all the courses to be registered by students who have been re-admitted under the R-25 Academic Regulations from the R-24 and R-22 Academic Regulations. Separate lookup tables will be provided for the following categories of students:

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

For every B.Tech. branch there shall be separate set of seven lookup tables.

**22.7** The R-25 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** Transfer of students from other Colleges or Universities are permitted subject to the rules and regulations of Telangana State Council for Higher Education (Technical Education Department) and JNTUH in vogue.

**23.2** The transferred students 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 JNTUH.

## **24.0 Value Added Courses**

**24.1** Faculty members who have received a certificate in Innovation and Entrepreneurship / Entrepreneurship from a reputed foundation/organization may be given preference to teach the "Innovation and Entrepreneurship" course. This certificate course should include an assessment. Total training duration (online or physical), excluding assessment, should be at least 30 hours. Faculty members from all disciplines with innovative mindset and aptitude to co-create an entrepreneurial ecosystem are eligible to teach this subject.

**24.2** Faculty members who have credited a course on Intellectual Property Rights in their UG or PG programme or credited an equivalent course in MOOCs platform/ reputed foundation/ organization in which assessment is a part, may be given preference to teach the elective course on Intellectual Property Rights.



**24.3** 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 a 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 Principal, JBIET is final.

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

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

## **27.0 Malpractices Rules**

### **Disciplinary Action For / Improper Conduct in Examinations**

	<b>Nature of Malpractices/Improper conduct</b>	<b>Punishment</b>
	<b>If the student:</b>	
1.(a)	Possesses any item accessible in the examination hall like paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
	Gives assistance or guidance or receives it from any other student	Expulsion from the examination hall



(b)	orally or by any nonverbal cues or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	and cancellation of the performance in that subject only of all the students involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year.
3.	Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all End examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
4.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
5.	Refuses to obey the orders of the chief superintendent/ assistant superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or	In case of students of the college, they are expelled from examination halls and cancellation of their performance in that subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a Police case is registered against them.

	outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination	
6.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year. The student is also debarred for two consecutive semesters from class work and all End examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
7.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.
8.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to police and, a police case will be registered against them.
9.	Comes in a drunken condition to the	Expulsion from the examination hall

	examination hall.	and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year
10.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the student has appeared including practical examinations and project work of that semester/year examinations.

- ❖ *If any malpractice is detected which is not covered in the above clauses 1 to 10 shall be referred to the Malpractice Committee for further action and to impose suitable punishment.*

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<b>JBLET-R25</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech-CE</b>
<b>B. Tech – Civil Engineering</b>		

<b>I Year I Semester [ 25 Hours]</b>									
<b>S. No</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>	<b>Common Subject (Y/N)</b>	<b>Approving BOS</b>
1	N1100A	Matrices and Calculus	3	1	0	4	BS	Y	MATHS
2	N1100B	Advanced Engineering Physics	3	0	0	3	BS	Y	PHYSICS
3	N1105B	C Programming and Data Structures	3	0	0	3	ES	Y	CSE
4	N1100D	English for Skill Enhancement	3	0	0	3	HS	Y	ENGLISH
5	N1103A	Engineering Drawing and Computer Aided Drafting	2	0	2	3	ES	Y	ME
6	N11001	Advanced Engineering Physics Lab	0	0	2	1	BS	Y	PHYSICS
7	N11052	C Programming and Data Structures Lab	0	0	2	1	ES	Y	CSE
8	N11031	Engineering Workshop	0	0	2	1	ES	Y	ME
9	N11003	English Language and Communication Skills Lab	0	0	2	1	HS	Y	ENGLISH
10		Induction Program							
<b>Total</b>			<b>14</b>	<b>01</b>	<b>10</b>	<b>20</b>			

<b>I Year II Semester [27 Hours]</b>									
<b>S. No</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>	<b>Common Subject (Y/N)</b>	<b>Approving BOS</b>
1	N1200A	Ordinary Differential Equations and Vector Calculus	3	0	0	3	BS	Y	MATHS
2	N1200E	Applied Chemistry	3	0	0	3	BS	Y	CHEM
3	N1201A	Engineering Geology	2	0	0	2	PC	N	CIVIL
4	N1202B	Elements of Electrical and Electronics Engineering	3	0	0	3	ES	Y	EEE
5	N1201B	Civil Engineering Materials	2	0	0	2	PC	N	CIVIL
6	N1201C	Engineering Mechanics for Civil Engineers	3	1	0	4	PC	N	CIVIL
7	N12004	Chemistry Lab for Engineers	0	0	2	1	BS	Y	CHEM
8	N12053	Python Programming Lab	0	0	2	1	ES	Y	CSE
9	N12022	Elements of Electrical and Electronics Engineering	0	0	2	1	ES	Y	EEE

		Lab							
10	N12011	Engineering Geology and Materials Laboratory	0	0	2	1	PC	N	CIVIL
11	N1200F	Lingua Skills for Professionals-B1	2	0	0	0	HS	Y	ENG
<b>Total</b>			<b>18</b>	<b>1</b>	<b>08</b>	<b>21</b>			

<b>JBiet-R25</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech-CE</b>
<b>B. Tech – Civil Engineering</b>		

<b>II Year I Semester [24 Hours]</b>									
<b>S. No</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>	<b>common Subject (Y/N)</b>	<b>Approving BOS</b>
1	N2100B	Probability and Statistics	3	0	0	3	BS	Y	MATHS
2	N2101A	Concrete Technology	3	0	0	3	PC	N	CIVIL
3	N2101B	Strength of Materials	3	0	0	3	PC	N	CIVIL
4	N2101C	Surveying and Geomatics	3	0	0	3	PC	N	CIVIL
5	N2101D	Fluid Mechanics	3	1	0	4	PC	N	CIVIL
6	N21001	Computational Mathematics Lab	0	0	2	1	PC	N	MATHS
7	N21011	Material Testing Lab	0	0	2	1	PC	N	CIVIL
8	N21012	Strength of Materials Lab	0	0	2	1	PC	N	CIVIL
9	N21013	Surveying & Geomatics Lab	0	0	2	1	PC	N	CIVIL
<b>Total</b>			<b>15</b>	<b>1</b>	<b>08</b>	<b>20</b>			

<b>II Year II Semester [ 27 Hours]</b>									
<b>S. No</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>	<b>common Subject (Y/N)</b>	<b>Approving BOS</b>
1	N2201A	Structural Mechanics	3	0	0	3	PC	N	CIVIL
2	N2201B	Water Resources and Irrigation Engineering	3	0	0	3	PC	N	CIVIL
3	N2201C	Hydraulics & Hydraulic Machinery	3	0	0	3	PC	N	CIVIL
4	N2201D	Theory of Structures	3	0	0	3	PC	N	CIVIL
5	N2201E	Building Planning and Construction	2	0	0	2	PC	N	CIVIL
5	N220EA	Innovation and Entrepreneurship	2	0	0	2	HS	Y	MBA
6	N22011	Design Thinking and Tinkering Lab	0	0	2	1	SD	N	CIVIL

7	N22012	Hydraulics & Hydraulic Machinery Lab	0	0	2	1	PC	N	CIVIL
8	N22013	Computer Aided Building Drafting Lab	0	0	2	1	PC	N	CIVIL
9	N22014	Digital Surveying Lab	0	0	2	1	SD	N	CIVIL
10	N2200C	Indian Knowledge System	1	0	0	1	HS	Y	ENGLISH
11	N2200D	Lingua Skills for Professionals-B2	2	0	0	0	HS	Y	ENGLISH
<b>Total</b>			<b>19</b>	<b>0</b>	<b>08</b>	<b>21</b>			

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>I Year-I Sem</b>			
Course Code: N1100A	<b>MATRICES AND CALCULUS</b> (COMMON TO: CE, EEE, ME, ECE, CSE, IT, ECM, CSE(AIML), CSE(DS), AIDS & AITML)	L	T	P	C
Credits: <b>4</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Pre-Requisites:** Mathematical Knowledge at pre-university level

**Module 1: Matrices:** [08L]

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. Gauss Seidel Iteration Method.

**Module 2: Eigen values and Eigen vectors:** [10L]

Eigen values – Eigen vectors and their properties – Diagonalization of a matrix – Cayley-Hamilton Theorem (without proof) – Finding inverse and power of a matrix by Cayley-Hamilton Theorem. Quadratic forms and Nature of the Quadratic Forms – Reduction of Quadratic form to canonical form by Orthogonal Transformation.

**Module 3: Single Variable Calculus:** [10L]

Limits and Continuity 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 and Maclaurin's series (All the theorems without proof).

**Curve Tracing:** Curve tracing in cartesian coordinates.

**Module 4: Multivariable Calculus-I:** [10L]

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

**Module 5: Multivariable Calculus-II:** [10L]

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 and Cylindrical polar coordinates). Applications: Areas by double integrals and volumes by triple integrals.

**Text Books**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 45<sup>th</sup> Edition, 2020.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5<sup>th</sup> Edition, 2019.

**Reference Books**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10<sup>th</sup> Edition, John Wiley & Sons, 2020.
2. Maurice D. Weir, Joel Hass, Christopher Heil, Przemyslaw Bogacki, Thomas' Calculus, 13<sup>th</sup> Edition, Pearson, Reprint, 2024.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 8<sup>th</sup> Edition, 2016.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand and Company

## E-Resources

- <https://nptel.ac.in/courses/111/108/111108098/>
- [https://en.wikipedia.org/wiki/Eigenvalues\\_and\\_eigenvectors](https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors)
- <https://nptel.ac.in/courses/111/107/111107108/>
- <https://www.cheric.org/files/education/cyberlecture/e200303/e200303-301.pdf>
- [https://www.whitman.edu/mathematics/calculus\\_online/chapter16.html](https://www.whitman.edu/mathematics/calculus_online/chapter16.html)

## Course Objectives:

To learn

1. Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
2. Concept of eigen values and eigen vectors and to reduce the quadratic form to canonical form.
3. Geometrical approach to the mean value theorems and their application to the mathematical problems.
4. Finding maxima and minima of functions of two and three variables.
5. Evaluation of multiple integrals and their applications.

## Course Outcomes:

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

CO1: Compute the rank of a matrix and analyze the solution of the system of equations.

CO2: Determine Eigenvalues and Eigenvectors of matrices and apply orthogonal transformations to reduce quadratic forms into canonical form.

CO3: Apply the Mean Value Theorems to solve engineering problems.

CO4: Find the extreme values of functions of two variables with/ without constraints.

CO5: Evaluate the multiple integrals and apply the concept to find areas, volumes.

## CO-PO/PSO Mapping

Course Outcomes	Program Outcomes (POs)/Program Specific Outcomes (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	2	1	-	-	1	1	-	2	1	-	2	-	-
<b>CO2</b>	3	2	2	1	-	1	1	-	2	1	-	2	-	-
<b>CO3</b>	3	2	2	-	-	1	1	-	2	1	-	2	-	-
<b>CO4</b>	3	2	1	1	-	1	1	-	2	1	-	2	-	-
<b>CO5</b>	3	2	1	-	-	1	1	1	2	1	-	2	-	-
<b>Average</b>	3	2	1.4	1	-	1	1	1	2	2	-	2	-	-

Correlation: 3–Strong; 2–Medium; 1–Weak



<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech -I Year</b> <b>I &amp; II Sem</b>			
Course Code: N1100B	<b>ADVANCED ENGINEERING PHYSICS</b> (COMMON TO: CE, EEE, ME, ECE, CSE, IT, ECM, CSE(AIML), CSE(DS), AIDS, AIML)	L	T	P	C
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites: 10+2 Physics**

### Course Objectives:

The students should be able to

1. To study crystal structures, defects, and material characterization techniques like XRD and SEM.
2. To understand fundamental concepts of quantum mechanics and their applications in solids and nanomaterials.
3. To introduce quantum computing principles, quantum gates, and basic quantum algorithms.
4. To learn the properties and applications of magnetic and dielectric materials.
5. To explore the working and applications of lasers and fibre optics in modern technology.

### UNIT - I: Crystallography & Materials Characterization

[10L]

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: Bragg's law, powder method, calculation of average crystallite size using Debye Scherrer's formula, scanning electron microscopy (SEM): block diagram, working principle.

### UNIT - II: Quantum Mechanics

[10L]

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, concepts of group velocity and phase velocity, formation of energy bands, origin of bandgap, classification of solids, concept of discrete energy levels and quantum confinement in nanomaterials.

### UNIT - III: Quantum Computing

[9L]

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, Grover.

### UNIT - IV: Magnetic and Dielectric Materials

[10L]

Introduction to magnetic materials, origin of magnetic moment-classification of magnetic materials, hysteresis, Weiss domain theory of ferromagnetism, soft and hard magnetic materials, synthesis of ferrimagnetic materials using sol-gel method, applications: magnetic hyperthermia for cancer treatment, magnets for EV, Giant Magneto Resistance (GMR) device.

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

### UNIT - V: Laser and Fibre Optics

[9L]

Introduction to laser, characteristics of laser, Einstein coefficients and their relations, metastable state, population inversion, pumping, lasing action, Ruby laser, He-Ne laser, Nd:YAG laser, semiconductor diode 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, applications: optical fibre for communication system, sensor for structural health monitoring.

### Text Books

1. Walter Borchardt-Ott, Crystallography: An Introduction, Springer.
2. Charles Kittel, Introduction to Solid State Physics, John Wiley & Sons, Inc.
3. Thomas G. Wong, Introduction to Classical and Quantum Computing, Rooted Grove

### Reference Books

1. Jozef Gruska, Quantum Computing, McGraw Hill
  2. Michael A. Nielsen & Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press.
  3. John M. Senior, Optical Fiber Communications Principles and Practice, Pearson Education Limited.
- Introduction to Solid State Physics, Charles Kittel, Wiley Eastern, 2019.

### E-Resources

- <https://shijuinpallotti.wordpress.com/wp-content/uploads/2019/07/optical-fiber-communications-principles-and-pr.pdf>
- [https://www.geokniga.org/bookfiles/geokniga-crystallography\\_0.pdf](https://www.geokniga.org/bookfiles/geokniga-crystallography_0.pdf)
- <https://dpcbck.ac.in/wp-content/uploads/2022/10/Introduction-to-Solid-State-PhysicsCharles-Kittel.pdf>
- <https://www.thomaswong.net/introduction-to-classical-and-quantum-computing-1e4p.pdf>
- <https://www.fi.muni.cz/usr/gruska/qbook1.pdf>
- <https://profmcrz.wordpress.com/wp-content/uploads/2017/08/quantum-computation-and-quantum-information-nielsen-chuang.pdf>

### Course Outcomes

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

- CO1:** Analyze crystal structures, identify defects, and apply XRD and SEM techniques for material characterization.
- CO2:** Apply quantum mechanical principles to explain particle behaviour and energy band formation in solids.
- CO3:** Understand quantum computing concepts, use quantum gates, and explain basic quantum algorithms.
- CO4:** Classify magnetic and dielectric materials and explain their properties, synthesis, and applications.
- CO5:** Explain the principles of lasers and fibre optics and their applications in communication and sensing.

### CO-PO/PSO Mapping

Course Outcomes	Program Outcomes (POs)/Program Specific Outcomes (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	2	2	1	-	-	-	-	-	-	-	-	-	1	-
<b>CO2</b>	3	1	2	-	-	-	-	-	-	-	-	-	1	-
<b>CO3</b>	2	1	2	-	-	-	-	-	-	-	-	-	1	-
<b>CO4</b>	2	2	1	-	-	-	-	-	-	-	-	-	1	-
<b>CO5</b>	2	2	1	-	-	-	-	-	-	-	-	-	2	-
<b>Average</b>	-	-	-	-	-	-	-	-	-	-	-	-		-

**Correlation: 3-Strong; 2-Medium; 1-Weak**

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>I Year-I Sem</b>			
Course Code: N1105B	<b>C PROGRAMMING AND DATA STRUCTURES</b>	L	T	P	C
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites:** Mathematical Knowledge at pre-university level

**Course Objectives:**

Introduce the importance of programming, C language constructs, program development, data structures, searching and sorting.

**Unit 1:** [10L]

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Software Development

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

Structure of a C Program – Operators, Bit-wise operators, Expressions, Precedence and Associativity, Expression Evaluation, Type conversions, Statements.

**Unit 2:** [8 L]

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

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

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

**Unit 3:** [8 L]

Pointers – Introduction, Pointers for inter function communication, pointers to pointers, compatibility, Pointer Applications – Passing an array to a function, Memory allocation functions, array of pointers Strings – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion.

**Unit 4:** [12 L]

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

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

**Unit 5:** [12L]

Sorting- selection sort, bubble sort, insertion sort,

Searching-linear and binary search methods.

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

**Text Books**

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.

2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M. Ritchie, PHI/Pearson Education

#### Reference Books

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

#### Course outcomes:

**At the end of the course, student will be able to**

**CO1:** Describe the basic concepts of computers and simple C programs using variables, data types, and operators.

**CO2:** Apply control statements, functions, and arrays to develop structured C programs.

**CO3:** Use pointers and strings effectively for memory management and data manipulation.

**CO4:** Implement programs using structures, unions, and perform file operations in C.

**CO5:** Apply sorting, searching algorithms, and basic data structures like linked lists, stacks, and queues.

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>I Year- I Sem /</b> <b>II Sem</b>			
Course Code: N1100D	<b>ENGLISH FOR SKILL ENHANCEMENT</b> (COMMON TO ALL)	L	T	P	C
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites: NIL**

**Course Objectives:**

This course will enable the students to:

1. Improve their vocabulary.
2. Use appropriate sentence structures in their oral and written communication.
3. Develop their reading and study skills.
4. Equip students to write paragraphs, essays, précis and draft letters.
5. Acquire skills for Technical report writing.

**Unit 1**

**(10L)**

**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 2**

**(9L)**

**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 3**

**(8L)**

**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 4**

**(8L)**

**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 5**

**(8L)**

**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**

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

#### **Reference Books**

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

## E-Resources

1. [https://mdu.ac.in/UpFiles/UpPdfFiles/2021/Mar/4\\_03-02-2021\\_11-35-30\\_English-I%20BA1001-1\).pdf](https://mdu.ac.in/UpFiles/UpPdfFiles/2021/Mar/4_03-02-2021_11-35-30_English-I%20BA1001-1).pdf)
2. <https://www.swansea.ac.uk/media/Leisure---W-H-Davies.pdf>
3. <https://www.entrepreneur.com/en-in/starting-a-business/overcome-this-grave-mistake-and-ensure-guaranteed-success/327761>
4. Cambridge English
5. BBC Learning English - Learn English with BBC Learning English - Homepage

## Course Outcomes

At the end of the course, Students will be able to:

**CO1:** Choose appropriate vocabulary in their oral and written communication.

**CO2:** Demonstrate their understanding of the rules of functional grammar and sentence structures.

**CO3:** Develop comprehension skills from known and unknown passages.

**CO4:** Write paragraphs, essays, précis and draft letters.

**CO5:** Write abstracts and reports in various contexts.

## CO-PO/PSO Mapping

Course Outcomes	Program Outcomes (POs)/Program Specific Outcomes (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-
<b>CO2</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-
<b>CO3</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-
<b>CO4</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-
<b>CO5</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-
<b>Average</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-

**Correlation: 3–Strong; 2–Medium; 1–Weak**

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year-II Sem</b>			
<b>Course Code:</b> N1103A	<b>ENGINEERING DRAWING AND COMPUTER AIDED DRAFTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

### Course Objectives:

1. To introduce the fundamentals of engineering drawing and projection systems.
2. To develop skills in constructing orthographic, isometric, and sectional views.
3. To train students in interpreting and creating technical drawings using CAD tools.
4. To familiarize students with dimensioning standards and drafting conventions.
5. To bridge manual drafting techniques with computer-aided drafting practices.

### Module 1: Introduction to Engineering Graphics (Conventional)

**Conventional:** Principles of Engineering Graphics and their Significance, Geometrical Constructions, Scales, Plain and Diagonal, Conic Sections including the Rectangular Hyperbola, General method only. Cycloid, Epicycloid and Hypocycloid.

### Module 2: Orthographic Projections (Conventional and Computer Aided)

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

**Computer Aided:** Introduction to Computer aided drafting, views, commands and conics.

### Module 3: Projections of Regular Solids (Conventional and Computer Aided)

**Conventional:** Projection of regular solids - Prism, Cylinder, Pyramid, Cone. Sections or Sectional views of Right Regular Solids, Prism, Cylinder, Pyramid, Cone.

**Computer Aided:** Computer aided projections of solids, sectional views.

### Module 4: Development of Surfaces (Conventional)

**Conventional:** Prism, Cylinder, Pyramid and Cone.

### Module 5: Isometric Projections (Conventional and Computer Aided)

**Conventional and Computer Aided:** Principles of Isometric Projection, Isometric Scale, Isometric Views, Conventions, Isometric Views of Lines, Plane Figures, Simple Solids. Conversion of Isometric Views to Orthographic Views and Vice- versa i.e. Conversion of orthographic projection into isometric view.

### Note:

1. The End Semester Examination will be in conventional mode.
2. CIE – I will be in conventional mode.
3. CIE – II will be using Computer

### Text Books

1. Engineering Drawing, N. D. Bhatt, Charotar, 54th Edition, 2023.



2. Engineering Drawing and graphics Using AutoCAD, T. Jeyapoovan and Vikas, S. Chand and company Ltd., 3rd Edition, 2010.

#### REFERENCE BOOKS:

1. Engineering Drawing, Basant Agrawal and C.M. Agrawal, McGraw Hill, 3rd Edition, 2019.
2. Engineering Graphics and Design, WILEY, John Wiley and Sons Inc, 3rd Edition, 2020.
3. Engineering Drawing, M. B. Shah and B.C. Rane, Pearson, 2nd Edition, 2009.
4. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford, 1st Edition, 2015.
5. Computer Aided Engineering Drawing, K. Balaveera Reddy, CBS Publishers, 2nd Edtn, 2015.

#### Course Outcomes

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

- CO1. Understand and apply the principles of orthographic and isometric projections.
- CO2. Create sectional views and dimensioned drawings using BIS standards.
- CO3. Use CAD software to generate 2D engineering drawings.
- CO4. Visualize and construct solid models from 2D views.
- CO5. Interpret and produce engineering drawings of mechanical components and assemblies.
- CO6. Demonstrate drafting skills for practical and industrial applications.

#### CO-PO/PSO Mapping

Course Outcomes	Program Outcomes (POs)/Program Specific Outcomes (PSOs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	2	-	-	-	-	-	-	-	3	2	-
CO2	3	2	2	2	-	-	-	-	-	-	-	3	2	-
CO3	3	2	2	2	-	-	-	-	-	-	-	3	2	-
CO4	3	2	1	3	-	-	-	-	-	-	-	3	3	-
CO5	3	2	1	3	-	-	-	-	-	-	-	3	3	-
Average	3	2	1.6	2.4	-	-	-	-	-	-	-	3	2.4	-

Correlation: 3-Strong; 2-Medium; 1-Weak

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>I Year-I &amp; I Sem</b>			
Course Code: N11001	<b>ADVANCED ENGINEERING PHYSICS LAB</b>	L	T	P	C
Credits: <b>1</b>	COMMON TO: CE, EEE, ME, ECE, CSE, IT, ECM, CSE(AIML), CSE(DS), AIDS, AIML	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Pre-Requisites:** 10+2 Physics basic concepts.

### **Course Objectives:**

1. To provide practical exposure to advanced concepts in solid-state and modern physics.
2. To synthesize and study the physical properties of materials like semiconductors, ferromagnetic, and ferroelectric substances.
3. To perform semiconductor characterization using Hall effect and band gap experiments.
4. To explore the working principles of lasers and optical fibers through hands-on experiments.
5. To develop skills in data analysis, interpretation, and scientific reporting.

### **List of Experiments:**

1. Synthesis of magnetite ( $\text{Fe}_3\text{O}_4$ ) powder using sol-gel 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. Study of P-E loop of a given ferroelectric crystal.
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.

Note: Any 8 experiments are to be performed.

### **Text Books**

1. Dr. Narendra, L. Mathakari, "Experiments in Applied Physics" (Physics Lab Manual 4<sup>th</sup> edition),

### Course Outcomes

At the end of the course, students will be able to

1. Synthesize and analyze nanomaterials such as magnetite ( $\text{Fe}_3\text{O}_4$ ) using chemical methods.
2. Determine key electrical, magnetic, and optical properties of semiconductors and other functional materials.
3. Characterize semiconductors using Hall effect and energy gap measurement techniques.
4. Demonstrate working knowledge of laser systems and optical fiber parameters through experimental study.
5. Apply scientific methods for accurate data collection, analysis, and technical report writing.

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CSE</b> <b>I Year-I Sem</b>			
Course Code: N11052	<b>C PROGRAMMING &amp; DATA STRUCTURES LAB</b>	L	T	P	C
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

Pre-Requisites: NIL

### List of Experiments:

1. Write a C program to find the sum of individual digits of a positive integer.
2. Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
3. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
4. Write a C program to find the roots of a quadratic equation.
5. Write a C program to find the factorial of a given integer.
6. Write a C program to find the GCD (greatest common divisor) of two given integers.
7. Write a C program to solve Towers of Hanoi problem.
8. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, \*, /, % and use Switch Statement)
9. Write a C program to find both the largest and smallest number in a list of integers.
10. Write a C program that uses functions to perform the following:
  - i) Addition of Two Matrices
  - ii) Multiplication of Two Matrices
11. Write a C program that uses functions to perform the following operations:
  - i) To insert a sub-string in to a given main string from a given position.
  - ii) To delete n Characters from a given position in a given string.
12. Write a C program to determine if the given string is a palindrome or not
13. Write a C program that displays the position or index in the string S where the string T begins, or - 1 if S doesn't contain T.
14. Write a C program to count the lines, words and characters in a given text.
15. Write a C program to generate Pascal's triangle.
16. Write a C program to construct a pyramid of numbers.
17. Write a C program that uses functions to perform the following operations:
  - i) Reading a complex number
  - ii) Writing a complex number
  - iii) Addition of two complex numbers
  - iv) Multiplication of two complex numbers
 (Note: represent complex number using a structure.)
18.
  - i. Write a C program which copies one file to another.

- ii. Write a C program to reverse the first n characters in a file. (Note: The file name and n are specified on the command line.)
19.
  1. Write a C program to display the contents of a file.
  2. 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)
20. Write a C program that uses functions to perform the following operations on singly linked list.:
  - i) Creation      ii) Insertion      iii) Deletion      iv) Traversal
21. Write C programs that implement stack (its operations) using
  - i) Arrays      ii) Pointers
22. Write C programs that implement Queue (its operations) using
  - i) Arrays      ii) Pointers
23. Write a C program that implements the following sorting methods to sort a given list of integers in ascending order    i) Bubble sort    ii) Selection sort    iii) Insertion sort
24. Write C programs that use both recursive and non recursive functions to perform the following searching operations for a Key value in a given list of integers:
  - i) Linear search    ii) Binary search

#### **Text Books**

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

#### **Course Objectives:**

1. To introduce students to basic manufacturing processes and workshop practices.
2. To provide hands-on training in carpentry, fitting, welding, sheet metal, and machining
3. To develop skills in using hand tools and measuring instruments.
4. To enhance safety awareness and proper handling of workshop equipment.
5. To build a foundational understanding of industrial production and fabrication.

#### **Course outcomes:**

1. Understand the basic manufacturing processes and operations.
2. Use hand tools and equipment safely and efficiently.
3. Perform basic operations in carpentry, fitting, welding, sheet metal work, and machining
4. Read and interpret workshop drawings
5. Develop teamwork, time management, and quality awareness in a workshop environment.

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year – I Sem</b>			
<b>Course Code:</b> N11031	<b>ENGINEERING WORKSHOP</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Pre-Requisites:** Practical skill

### Course Objectives:

1. To introduce students to basic manufacturing processes and workshop practices.
2. To provide hands-on training in carpentry, fitting, welding, sheet metal, and machining
3. To develop skills in using hand tools and measuring instruments.
4. To enhance safety awareness and proper handling of workshop equipment.
5. To build a foundational understanding of industrial production and fabrication.

### 1. TRADES FOR EXERCISES:

At least two exercises from each trade:

- Carpentry:** T- Lap Joint, Dovetail Joint, Mortise and Tenon Joint
- Fitting:** V- Fit, Square Fit and Straight Fit
- Tin Smithy:** Square Tin, Rectangular Tray and Conical Funnel
- Foundry:** Preparation of Green Sand Mould using Single Piece and Split Pattern
- Welding Practice:** Arc Welding
- House wiring:** Parallel and Series, Two-way Switch and Tube Light
- Black Smithy:** Round to Square, Fan Hook and S- Hook

### 2. TRADES FOR DEMONSTRATION AND EXPOSURE:

3D Printing and Machine Shop

### TEXT BOOKS:

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

### REFERENCE BOOKS:

1. Workshop Manual, K. Venugopal, Anuradha Publications, 2012th edition, 2012.

### Course Outcomes:

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

- CO1. Understand the basic manufacturing processes and operations.
- CO2. Use hand tools and equipment safely and efficiently.
- CO3. Perform basic operations in carpentry, fitting, welding, sheet metal work, and machining
- CO4. Read and interpret workshop drawings
- CO5. Develop teamwork, time management, and quality awareness in a workshop environment.

**CO-PO/PSO Mapping**

Course Outcomes	Program Outcomes (POs)/Program Specific Outcomes (PSOs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>C01</b>	-	-	-	-	-	-	-	-	2	2	2	3	3	3
<b>C02</b>	-	-	-	-	-	-	-	-	2	2	2	3	3	1
<b>C03</b>	-	-	-	-	-	-	-	-	2	2	2	3	3	3
<b>C04</b>	-	-	-	-	-	-	-	-	2	2	2	3	3	3
<b>C05</b>	-	-	-	-	-	-	-	-	2	2	2	3	3	2
<b>Average</b>	-	-	-	-	-	-	-	-	2	2	2	3	3	2.4

**Correlation: 3–Strong; 2–Medium; 1-Weak**

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>I Year-I / II Sem</b>			
Course Code: N11003	<b>ENGLISH LANGUAGE COMMUNICATION</b> <b>SKILLS LAB</b> COMMON TO: All Branches	L	T	P	C
Credits: 1		0	0	2	1

**Pre-Requisites:** NIL

### Course Objectives

To train students:

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.
3. To improve their pronunciation and neutralize accent.
4. To enable students express themselves fluently and appropriately.
5. To practise speaking in social and professional contexts.

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

- a) **Computer Assisted Language Learning (CALL) Lab:**
- b) **Interactive Communication Skills (ICS) Lab:**

### Module 1: (9L)

#### 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

### Module 2: (9L)

#### CALL Lab:

**Instruction:** Listening vs. Hearing - Barriers to Listening

**Practice:** Listening for General Information - Multiple Choice Questions - Listening Comprehension Exercises

#### ICS Lab:

**Instruction:** Features of Good Conversation — Strategies for Effective Communication

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

### Module 3: (9L)

#### 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:** Describing Objects, Situations, Places, People and Events



**Practice:** Picture Description Activity — Looking at a Picture and Describing Objects, Situations, Places, People and Events

**Module 4: (9L)**

**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

**Module 5: (9L)**

**CALL Lab:**

**Instruction:** Identifying the literal and implied meaning

**Practice:** Listening for Evaluation - Write the Summary — Listening Comprehension Exercises

**ICS Lab:**

**Instruction:** Understanding Non-Verbal Communication

**Practice:** Silent Speech - Dumb Charades Activity

**Post-Assessment Test** on 'Express Your View'

**Text Books**

1. Board of Editors. (2016). ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities. Orient BlackSwan Pvt. Ltd.

**Reference Books**

2. Shobha, KN & Rayen, J. Lourdes. (2019). Communicative English — A workbook. Cambridge University Press
3. Mishra, Veerendra et al. (2020). English Language Skills: A Practical Approach. Cambridge University Press
4. (2022). English Language Communication Skills — Lab Manual cum Workbook. Cengage Learning India Pvt. Ltd.
5. Ur, Penny and Wright, Andrew. 2022. Five Minute Activities — A Resource Book for Language Teachers. Cambridge University Press.

**E-Resources**

1. <https://dictionary.cambridge.org/dictionary/english/>
2. <https://www.oxfordlearnersdictionaries.com/definition/english/>
3. <https://www.scribd.com/doc/310229959/English-in-Mind-1-Workbook-110-pdf>
4. [https://ia801409.us.archive.org/27/items/cambridge-english-pronunciation-in-use-elementary/Cambridge%20-%20English%20Pronunciation%20in%20Use%20-%20Elementary\\_text.pdf](https://ia801409.us.archive.org/27/items/cambridge-english-pronunciation-in-use-elementary/Cambridge%20-%20English%20Pronunciation%20in%20Use%20-%20Elementary_text.pdf)
5. [https://dn720003.ca.archive.org/0/items/4.-cambridge-english-vocabulary-in-use-advanced-3rd-edition/4.%20Cambridge%20English%20Vocabulary%20in%20Use%20\(Advanced\)%203rd%20Edition.pdf](https://dn720003.ca.archive.org/0/items/4.-cambridge-english-vocabulary-in-use-advanced-3rd-edition/4.%20Cambridge%20English%20Vocabulary%20in%20Use%20(Advanced)%203rd%20Edition.pdf)

## Course Outcomes

At the end of the course, Students will be able to:

**CO1:** Listen actively and identify important information in spoken texts

**CO2:** Interpret the speech and infer the intention of the speaker

**CO3:** Improve their accent for intelligibility

**CO4:** Speak fluently with clarity and confidence

**CO5:** Use the language in real life situations

## CO-PO/PSO Mapping

Course Outcomes	Program Outcomes (POs)/Program Specific Outcomes (PSOs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO4	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	2	-	-
Average	-	-	-	-	-	-	-	-	3	3	-	2	-	-

**Correlation: 3–Strong; 2–Medium; 1-Weak**

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>I Year-II Sem</b>			
Course Code: N1200A	<b>ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS</b> (COMMON TO: CE, EEE, ME, ECE, CSE, IT, ECM, CSE(AIML), CSE(DS), AIDS & AIML)	L	T	P	C
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites:** Mathematical Knowledge at pre-university level

**Module 1: First Order Ordinary Differential Equations:** [08L]

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

**Module 2: Ordinary Differential Equations of Higher Order:** [10L]

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

**Module 3: Laplace Transforms:** [10L]

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 special functions (Unit step function, Dirac delta function and Periodic functions)– Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

**Module 4: Vector Differentiation:** [10L]

Vector point functions and scalar point functions – Gradient – Divergence and Curl – Directional derivatives– Scalar potential functions – Solenoidal and Irrotational vectors- Vector Identities (without proofs).

**Module 5: Vector Integration:** [10L]

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

**Text Books**

3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 45<sup>th</sup> Edition, 2020.
4. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5<sup>th</sup> Edition, 2019.

**Reference Books**

5. Erwin Kreyszig, Advanced Engineering Mathematics, 10<sup>th</sup> Edition, John Wiley & Sons, 2020.
6. Maurice D. Weir, Joel Hass, Christopher Heil, Przemyslaw Bogacki, Thomas' Calculus, 13<sup>th</sup> Edition, Pearson, Reprint, 2024.
7. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 8<sup>th</sup> Edition, 2016.
8. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand and Company

## E-Resources

- <https://nptel.ac.in/courses/111108098>
- <https://www.math.hkust.edu.hk/~machas/differential-equations.pdf>
- <https://engineeringmath.online>
- <https://www.cheric.org>
- [https://www.whitman.edu/mathematics/calculus\\_online](https://www.whitman.edu/mathematics/calculus_online)

## Course Objectives:

To learn

1. Methods of solving the differential equations of first order and learn about its applications to basic engineering problems.
2. Methods of solving higher order differential equations and learn about its applications to basic engineering problems.
3. The Concepts, properties of Laplace transforms and demonstrate their application in solving ordinary differential equations.
4. The physical quantities involved in engineering field related to vector valued functions.
5. The basic properties of vector valued functions and their applications to line, surface and volume integrals.

## Course Outcomes:

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

CO1: Identify whether the given differential equation of first order is exact or not.

CO2: Solve higher differential equation and apply the concept of differential equation to real world problems.

CO3: Use the Laplace Transforms techniques for solving Ordinary Differential Equations.

CO4: Find the gradient, divergence, curl and its physical interpretations.

CO5: Evaluate the Line, Surface and Volume integrals and converting them from one to another.

## CO-PO/PSO Mapping

Course Outcomes	Program Outcomes (POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	2	1	-	-	1	1	-	2	1	-	2	-	-
<b>CO2</b>	3	2	2	1	-	1	1	-	2	1	-	2	-	-
<b>CO3</b>	3	2	2	-	-	1	1	-	2	1	-	2	-	-
<b>CO4</b>	3	2	1	1	-	1	1	-	2	1	-	2	-	-
<b>CO5</b>	3	2	1	-	-	1	1	1	2	1	-	2	-	-
<b>Average</b>	3	2	1.4	1	-	1	1	1	2	1	-	2	-	-

Correlation: 3–Strong; 2–Medium; 1-Weak

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>I Year-II Sem</b>			
<b>Course Code:</b> <b>N1200E</b>	<b>Applied Chemistry</b> (CE, ME)	L	T	P	C
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites: Chemistry Knowledge at pre-university level**

**Course Objectives:**

1. To develop adaptability to new advances in Engineering Chemistry and acquire the essential skills to become a competent engineering professional.
2. To understand the industrial significance of water treatment, fundamental principles of battery chemistry, and the impact of corrosion along with its control methods for structural protection.
3. To impart foundational knowledge of various energy sources and their practical applications in engineering.
4. To equip students with an understanding of smart materials, biosensors, and analytical techniques applicable in engineering, industrial, environmental, and biomedical fields.

**Module 1: Water and its treatment: [11L]**

Introduction, types 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.

**Module 2: Electrochemistry and Corrosion: [12L]**

Introduction - Electrode potential, standard electrode potential, types of electrodes, Nernst equation (no derivation), Galvanic cell, cell representation, EMF of cell- Numerical problems. Reference electrodes - Primary reference electrode – Standard Hydrogen Electrode (SHE), Secondary reference electrode - Calomel electrode. Determination of pH of an unknown solution using SHE and Calomel electrode.

**Corrosion:** Introduction - Definition, causes and effects of corrosion - Theories of corrosion, chemical and electrochemical corrosion - Mechanism of electrochemical 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.

### Module 3: Energy Sources: [9L]

**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).

**Fuels:** Introduction and characteristics, Calorific value of fuel - HCV, LCV- Dulong's formula - Numerical problems.

**Fossil fuels:** Introduction, classification, Petroleum - Refining of Crude oil, Cracking - Moving bed catalytic cracking. LPG and CNG - composition and uses.

**Synthetic Fuels:** Fischer-Tropsch process, Introduction and applications of Hythane and Green Hydrogen.

### Module 4: Polymers: [10L]

Definition, classification of polymers: Based on origin and tacticity with examples - Types of polymerization - Addition (free radical addition mechanism) and condensation polymerization.

**Plastics, Elastomers and Fibers:** Definition and applications (PVC, Buna-S, Nylon-6,6). Thermoplastics and thermo setting plastics, Fiber reinforced plastics (FRP).

**Conducting polymers:** Definition and classification with examples - Mechanism of conduction in trans- polyacetylene and applications of conducting polymers.

**Biodegradable polymers:** Polylactic acid(PLA) and its applications.

### Module 5: Applications of Materials: [8]

**Cement:** Portland cement, its composition, setting and hardening.

**Phase rule:** Definition – Phase, component, degrees of freedom. Phase rule equation. Phase diagrams - One component system - water. Two component system - Lead silver system.

**Lubricants:** Definition and characteristics of a good lubricant – thin film mechanism of lubrication, properties of lubricants - viscosity, cloud and pour point, flash and fire point.

**Interpretative spectroscopic applications** of UV-Visible spectroscopy for Analysis of pollutants in dye industry, IR spectroscopy in night vision-security, Pollution Under Control-CO sensor (Passive Infrared detection).

### TEXT BOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010.
2. Engineering Chemistry by Rama Devi, Dr. P. Aparna and Rath, Cengage learning, 2025.

### REFERENCE BOOKS:

1. Engineering Chemistry: by Thirumala Chary Laxminarayana & Shashikala, Pearson Publications (2020).
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi 2011.
3. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi 2015.

4. Engineering Analysis of Smart Material Systems by Donald J. Leo, Wiley, 2007.
5. Challenges and Opportunities in Green Hydrogen by Editors: Paramvir Singh, Avinash Kumar Agarwal, Anupma Thakur, R.K Sinha.
6. Raman Spectroscopy in Human Health and Biomedicine, <https://www.worldscientific.com/doi/epdf/10.1142/13094>

#### E-Resources:

1. <https://doi.org/10.1142/13094> | October 2023
2. <https://archive.org/details/EngineeringChemistryByShashiChawla/page/n11/mode/2u>

#### Course Outcomes:

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

**CO1:** Understand the fundamental properties of water and its applications in both domestic and industrial purposes.

**CO2:** Gain basic knowledge of electrochemical processes and their relevance to corrosion and its control methods.

**CO3:** Comprehend the significance and practical applications of batteries and various energy sources, enhancing their potential as future engineers and entrepreneurs.

**CO4:** Learn the basic concepts and properties of polymers, lubricants and other engineering materials.

**CO5:** Apply the principles of UV-Visible, IR spectroscopy and Raman spectroscopy in analyzing pollutants in dye industries and biomedical applications.

#### CO-PO/PSO Mapping

Course Outcomes	Program Outcomes (POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	2	-	-	-	3	2	-	-	-	-	3	-	-
<b>CO2</b>	3	1	-	-	-	3	2	-	-	-	-	3	-	-
<b>CO3</b>	3	1	-	-	-	3	3	-	-	-	-	3	-	-
<b>CO4</b>	2	-	-	-	-	3	2	-	-	-	-	2	-	-
<b>CO5</b>	3	-	-	-	-	2	3	-	-	-	-	1	-	-
<b>Average</b>	<b>2.8</b>	<b>1.3</b>	-	-	-	<b>2.8</b>	<b>2.4</b>	-	-	-	-	<b>2.4</b>	-	-

**Correlation: 3–Strong; 2–Medium; 1-Weak**

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: CE</b> <b>I Year-II Sem.</b>			
Course Code: N1201A	<b>ENGINEERING GEOLOGY</b>	L	T	P	C
		2	0	0	2

### Course Objectives:

The objective of this Course is to

- Give the basics knowledge of Geology that is required for constructing various Civil Engineering Structures, basic Geology, Geological Hazardous and Environmental Geology.
- Focus on the core activities of engineering geologists—site characterization and geologic hazard identification and mitigation. Planning and construction of major Civil Engineering projects.

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

- Site characterization and how to collect, analyze, and report geologic data using standards in engineering practice.
- Understand the fundamentals of the engineering properties of Earth materials
- Understand the fundamentals of the engineering properties of fluids.
- Understand the rock mass characterization of rock slides and topples.
- Understand the mechanics of rock slides and topples.

### UNIT-1

**Introduction:** Importance of geology from Civil Engineering point of view. Brief study of case histories of failure of some Civil Engineering constructions due to geological drawbacks. Importance of Physical geology, Petrology and Structural geology.

**Weathering of Rocks:** Its effect over the properties of rocks importance of weathering with reference to dams, reservoirs and tunnels weathering of common rock like “Granite”

### UNIT - II

**Mineralogy:** Definition of mineral, Importance of study of minerals, Different methods of study of minerals. Advantages of study of minerals by physical properties. Role of study of physical properties of minerals in the identification of minerals. Study of physical properties of following common rock forming minerals: Feldspar, Quartz, Flint, Jasper, Olivine, Augite, Hornblende, Muscovite, Biotite, Asbestos, Chlorite, Kyanite, Garnet, Talc, Calcite. Study of other common economics minerals such as Pyrite, Hematite, Magnetite, Chlorite, Galena, Pyrolusite, Graphite, Magnesite, and Bauxite.

**Petrology:** Definition of rock: Geological classification of rocks into igneous, Sedimentary and metamorphic rocks. Dykes and sills, common structures and textures of igneous. Sedimentary and metamorphic rocks. Their distinguishing features, Megascopic and microscopic and microscopic study of Granite, Dolerite, Basalt, Pegmatite, Laterite, Conglomerate, Sandstone, Shale, Limestone, Gneiss, Schist, Quartzite, Marble and Slate.



**UNIT - III Structural Geology:** Out crop, strike and dip study of common geological structures associating with the rocks such as folds, faults unconformities, and joints-their important types and case studies. Their importance Insitu and drift soils, common types of soils, their origin and occurrence in India, Stabilization of soils. Ground water, Water table, common types of ground water, springs, cone of depression, geological controls of ground water movement, ground water exploration.

#### **UNIT - IV**

**Earth Quakes:** Causes and effects, shield areas and seismic belts. Seismic waves, Richter scale, precautions to be taken for building construction in seismic areas. Landslides, their causes and effect; measures to be taken to prevent their occurrence.

**Importance of Geophysical Studies:** Principles of geophysical study by Gravity methods. Magnetic methods, Electrical methods. Seismic methods, Radio metric methods and geothermal method. Special importance of Electrical resistivity methods, and seismic refraction methods. Improvement of Competence of sites by grouting etc. Fundamental aspects of Rock mechanics and Environmental Geology.

**UNIT - V Geology of Dams, Reservoirs, and Tunnels:** Types of dams and bearing of Geology of site in their selection, Geological Considerations in the selection of a dam site. Analysis of dam failures of the past. Factors contributing to the success of a reservoir. Geological factors influencing water Lightness and life of reservoirs - Purposes of tunnelling, Effects of Tunnelling on the ground, Role of Geological Considerations (i.e. Lithological, structural and ground water) in tunnelling over break and lining in tunnels.

#### **TEXT BOOKS:**

1. Principles of Engineering Geology (2023) by K.V.G.K. Gokhale– B.S. Publications
2. Engineering Geology by N. Chennakesavulu, McMillan, India Ltd.2005
3. Engineering Methods by D. Venkat Reddy; VikasPublishers2015.
4. Engineering Geology by S K Duggal K Pandey McGraw Hill Education Pvt.Ltd 2014

#### **REFERENCE BOOKS:**

1. F.G. Bell, Fundamental of Engineering B.S. Publications,2005.
  2. Krynine & Judd, Principles of Engineering Geology & Geotechnics, CBS Publishers & Distribution
  3. Engineering Geology by Subinoy Gangopadhyay, Oxford university press.
- Engineering Geology for Civil Engineers– P.C. Varghese PHI

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>I Year-II Sem</b>			
Course Code: N1202B	<b>ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING (CE &amp; ME)</b>	L	T	P	C
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites:** Mathematics

## COURSE OBJECTIVES

<b>COB1:</b>	To understand the fundamental laws of electrical circuits and analyze AC/DC circuits using phasor and power concepts.
<b>COB2:</b>	To learn the components of LT switchgear, types of cables, earthing systems, and methods of energy management.
<b>COB3:</b>	To study the construction, working principles, equations, and performance of transformers, DC machines, and induction motors.
<b>COB4:</b>	To comprehend the characteristics and applications of diodes, rectifiers, and filters.
<b>COB5:</b>	To understand the construction, operation, and configurations of BJTs and FETs for amplification.

## UNIT 1:

**D.C. Circuits:** Electrical circuit elements (R, L and C), voltage and current sources, KVL and KCL, analysis of simple circuits with dc excitation.

**A.C. Circuits:** Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits, Three phase balanced circuits, voltage and current relations in star and delta connections.

## UNIT 2:

**Electrical Installations:** Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing, necessity of earthing, types. Types of Batteries, important characteristics Elementary calculations for energy consumption, power factor improvement.

## UNIT 3:

**Electrical Machines:** Construction and working principle of Single-phase transformer, equivalent circuit, e.m.f. equation, losses in transformers, efficiency, Three phase transformer connections. Construction and working principle of DC generators, EMF equation, working principle of DC motors, Torque equations and Speed control of DC motors, Construction and working principle of Three phase Induction motor.

## UNIT 4:

**P-N Junction and Zener Diode:** Principle of Operation Diode equation, Volt, Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Zener diode characteristics and applications.

**Rectifiers and Filters:** P-N junction as a rectifier, Half Wave Rectifier, Ripple Factor, Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L- section Filters,  $\pi$ - section Filters.

## UNIT 5:

**Bipolar Junction Transistor (BJT):** Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations.

**Field Effect Transistor (FET):** Construction, Principle of Operation, Comparison of BJT and FET, Biasing FET.

### TEXT BOOKS

<b>T1:</b>	Basic Electrical and electronics Engineering, M S Sukija and TK Nagasarkar, Oxford University, 1st Edition, 2012.
<b>T2:</b>	Basic Electrical and electronics Engineering, D P Kothari and I J Nagarath, McGraw Hill Education, 2nd Edition, 2020.

### REFERENCE BOOKS

<b>R1:</b>	Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, PEI and PHI, 9th Edition, 2006.
<b>R2:</b>	Millman's Electronic Devices and Circuits, J. Millman, C. C. Halkias and Satyabrata Jit, TMH, 2nd Edition, 1998.
<b>R3:</b>	Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, McGraw Hill, 6th Edition, 1971.
<b>R4:</b>	Linear circuit analysis, Raymond A. De Carlo and Pen, Min, Lin, Oxford University Press, 2 <sup>nd</sup> edition, 2004.
<b>R5:</b>	Network Theory, N. C. Jagan and C. Lakshmi Narayana, McGraw Hill, 2nd Edition, 2005.
<b>R6:</b>	Network Theory, Sudhakar and Shyam Mohan Palli, Tata McGraw Hill, 2nd Edition, 2011.
<b>R7:</b>	Fundamentals of Electrical Engineering, L. S. Bobrow, Oxford University Press, 12th edition, 2003.
<b>R8:</b>	Electrical and Electronic Technology, E. Hughes, Pearson Education, 10th Edition, 2010.
<b>R9:</b>	Electrical Engineering Fundamentals, V. D. Toro, Prentice Hall India, 2nd Edition, 1989.

### E-RESOURCES

<b>E1:</b>	<a href="https://onlinecourses.nptel.ac.in/noc24_ee125/preview">https://onlinecourses.nptel.ac.in/noc24_ee125/preview</a>
<b>E2:</b>	<a href="https://nptel.ac.in/courses/108105155">https://nptel.ac.in/courses/108105155</a>
<b>E3:</b>	<a href="https://onlinecourses.nptel.ac.in/noc25_ee160/preview">https://onlinecourses.nptel.ac.in/noc25_ee160/preview</a>
<b>E4:</b>	<a href="https://onlinecourses.nptel.ac.in/noc21_ee55/preview">https://onlinecourses.nptel.ac.in/noc21_ee55/preview</a>

### COURSE OUTCOMES

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

<b>CO1:</b>	Apply KVL, KCL, and phasor methods to analyze DC and AC circuits, and evaluate power quantities in single-phase and three-phase systems.
<b>CO2:</b>	Identify LT switchgear components, types of cables, and earthing methods, and compute energy consumption with power factor correction.
<b>CO3:</b>	Explain the construction, operation, and equations of transformers, DC machines, and induction motors, and analyze their performance.
<b>CO4:</b>	Examine the characteristics of P-N junction and Zener diodes, and analyze rectifier and filter circuits for different operating conditions.
<b>CO5:</b>	Compare BJT and FET characteristics, and demonstrate their configurations and biasing for amplification.

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: CE</b> <b>I Year – II SEM</b>			
Course Code: N1201B	<b>CIVIL ENGINEERING MATERIALS</b>	L	T	P	C
		2	0	0	2

### Course Objectives:

This course is expected to enable the student to:

- To introduce the classification and properties of traditional building materials
- To introduce the classification and properties of modern building materials
- To introduce the applications of traditional and modern building materials
- To introduce the test procedures of concrete materials used in construction of building

**Course Outcomes:** Upon completion of this course, students should be able to

- Explain how stones, bricks, tiles, and timber are classified, made, and used in building construction.
- Explain how lime, fly ash, ferrous metals and nonferrous metals are used in building construction.
- Describe different types of paints, varnishes, glass, and modern materials, and explain their uses in buildings.
- Test and understand the properties of aggregates, water, Cement and how they affect concrete quality.

### UNIT - I

**Stones, Bricks, and Tiles:** Classification and properties of building stones, Quarrying, dressing, and testing of stones, Manufacturing, classification, and properties of bricks, Tests on bricks, Types and properties of clay tiles – manufacturing process, Uses of tiles in buildings.

**Timber and Wood Products:** Classification and structure of timber, Defects in timber, seasoning, and preservation, Types of engineered wood – plywood, particle board.

### UNIT-II

**Lime:** Various ingredients of lime, constituents of limestone and classification of lime, manufacturing of lime.

**Fly ash:** properties and use in manufacturing of bricks and cement.

**Ferrous Metals and Nonferrous Metals:** Types, properties and uses and advantages of ferrous metals and non-ferrous metals.

### **UNIT - III**

**Paints, Varnishes, and Miscellaneous Materials:** Types of paints, constituents, and applications, Varnishes, distempers – composition and uses, Glass – types and uses, sealants – properties and applications

### **UNIT - IV**

**Aggregates:** Classification of fine and coarse aggregate, Properties like specific gravity, bulk density, grading, shape. Tests on aggregates like sieve analysis, impact value, crushing value.

**Water:** Requirements for mixing and curing, Effect of impurities in water on concrete

**Cement:** Types, Portland cement: chemical composition of raw material, bogue compounds, hydration of cement, role of water in hydration

### **UNIT-V**

**Steel:** Important properties and uses of Iron (Cast iron, wrought iron and steel), Important tests on steel rebar.

**Modern building materials:** GFRP, Geo synthetics, AAC blocks.

### **TEXT BOOKS:**

1. Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, “Building Construction”, Eleventh edition 2016 Laxmi Publications.
2. Concrete Technology by M. S. Shetty, S. Chand publishing & Company Pvt. Ltd.

### **REFERENCE BOOKS:**

1. Sushil Kumar “Building Materials and construction”, 20th edition, reprint 2015, Standard Publishers.
2. P C Varghese, “Building Materials”, PHI Learning Pvt. Ltd.

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: CE</b> <b>I Year – II SEM</b>			
Course Code: N1201C	<b>ENGINEERING MECHANICS FOR CIVIL ENGINEERS</b>	L	T	P	C
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Course Objectives:** This course is expected to enable the student to:

- Provide Knowledge of force systems and free body diagram to analyze rigid body equilibrium
- Comprehend the principles of Friction and solve engineering mechanics problems associated with frictional force
- Compute the centroid, first moment and second moment of an area
- Impart the concept of motion of particles and rigid bodies.
- Familiarize the concepts of work-energy method and its applications to translation, rotation and plane motion and the concept of vibrations

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

- Determine resultant of forces acting on a body and analyze equilibrium of a body subjected to a system of forces.
- Solve problem of bodies subjected to friction.
- Find the location of centroid and calculate moment of inertia of a given section.
- Understand the kinetics and kinematics of a body undergoing rectilinear, curvilinear, rotatory motion and rigid body motion.
- Interpret and implement work-energy principle and its applications.

**UNIT -1 Introduction to Engineering Mechanics–** Force Systems: Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space –Resultant-Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.

**UNIT - II Friction:** Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, Ladder friction Centroid and Centre of Gravity -Centroid of Lines, Areas and Volumes from first principle, centroid of composite sections; Centre of Gravity and its implications. –Theorem of Pappus.

**UNIT - III Area moment of inertia -** Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Product of Inertia, Parallel Axis Theorem, Perpendicular Axis Theorem. Mass Moment of Inertia: Moment of Inertia of Masses-Transfer Formula for Mass Moments of Inertia Mass moment of inertia of composite bodies.

**UNIT - IV Kinematics of Particles:** Kinematics of particles – Rectilinear motion – Curvilinear motion – Projectiles. Kinetics of Particles: Kinetics of particles– Newton’s Second Law– Differential equations of rectilinear and curvilinear motion–Dynamic equilibrium–Inertia force–D. Alembert’s Principle applied for rectilinear and curvilinear motion.

**UNIT - V Work-Energy Principle:** Equation of translation, principle of conservation of energy, work-energy principle applied to particle motion and connected systems, fixed axis rotation. Impulse– Momentum Principle: Introduction, linear impulse momentum, principle of conservation of linear momentum, elastic impact and types of impact, loss of kinetic energy, coefficient of restitution.

**TEXTBOOKS:**

1. G. Lakshmi Narasaiah (2023) Engineering Mechanics, B.S. Publications
2. Reddy Vijay Kumar K. and J. Suresh Kumar (2024), Singer’s Engineering Mechanics– Statics & Dynamics, B.S. Publications
3. Shames and Rao (2006), Engineering Mechanics, Pearson Education
4. S.S. Bhavikatti (2021) Engineering Mechanics, New age International Publishers.

**REFERENCE BOOKS:**

1. Timoshenko S. P and Young D.H, “Engineering Mechanics”, McGraw-Hill International Edition, 2017.
2. Andrew Pytel, Jaan Kiusalaas, “Engineering Mechanics”, Cengage Learning, 2014.
3. Beer F. P & Johnston E. R Jr. Vector, “Mechanics for Engineers”, TMH, 2004.
4. Hibbeler R.C & Ashok Gupta, “Engineering Mechanics”, Pearson Education, 2010.
5. Tayal D.H.,” Engineering Mechanics–Statics & Dynamics”, Umesh Publications, 2011.
6. Basudeb Bhattacharyya, “Engineering Mechanics”, Oxford University Press, 2008.
7. Meriam.J.L., “Engineering Mechanics”, Volume-II Dynamics, John Wiley & Sons, 2008.
8. P.C Duretal. “Engineering Mechanics”, University press

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>I Year-II Sem</b>			
<b>Course Code:</b> <b>N12004</b>	<b>CHEMISTRY LAB FOR ENGINEERS</b> ( CE & ME)	L	T	P	C
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Pre-Requisites:** Chemistry Knowledge at pre-university level

**Course Description:** The course includes experiments based on fundamental principles of chemistry essential for engineering students, aiming to develop practical skills and reinforce theoretical concepts.

**Course Objectives:**

1. Students will understand and perform experiments based on core chemical principles relevant to engineering applications.
2. Students will learn to estimate the hardness of water to assess its suitability for drinking purposes.
3. Students will acquire the ability to perform acid-base titrations using instrumental methods such as conductometry, potentiometry, and pH metry.
4. Students will gain hands-on experience in synthesizing polymers like Bakelite and Nylon – 6, 6 in the laboratory.

**List of Experiments:**

**I. Volumetric Analysis:**

Estimation of Hardness of water by EDTA Complexometry method.

**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  $\text{Fe}^{+2}$  ion by Potentiometry using  $\text{KMnO}_4$ .
2. Estimation of concentration of strong acid with strong base by Potentiometry using quinhydrone.

**IV. pH Metry:**

Determination of an acid concentration using pH meter.

**V. Preparations:**

1. Preparation of Bakelite.
2. Preparation Nylon – 6, 6.

**VI. Corrosion:**

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



**VII. Lubricants:**

1. Estimation of acid value of given lubricant oil.
2. Estimation of viscosity of lubricant oil using Ostwald's Viscometer.

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

**Course Outcomes:**

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

**CO1:** Develop practical skills through hands-on chemistry experiments relevant to engineering.

**CO2:** Learn to determine important parameters such as water hardness and the corrosion rate of mild steel under various conditions.

**CO3:** Apply techniques like conductometry, potentiometry, and pH metry to determine concentrations or equivalence points in acid-base reactions.

**CO4:** Gain experience in synthesizing polymers such as Bakelite and Nylon-6,6.

**CO-PO/PSO Mapping**

Course Outcomes	Program Outcomes (POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	3	-	-	-	3	2	-	-	-	-	3	-	-
<b>CO2</b>	3	3	-	-	-	3	3	-	-	-	-	3	-	-
<b>CO3</b>	3	3	-	-	-	3	3	-	-	-	-	3	-	-
<b>CO4</b>	2	-	-	-	-	3	2	-	-	-	-	2	-	-
<b>Average</b>	<b>2.75</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>2,5</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2.75</b>	<b>-</b>	<b>-</b>

**Correlation: 3-Strong; 2-Medium; 1-Weak**

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CSE</b> <b>I Year-II Sem</b>			
<b>Course Code:</b> N12053	<b>PYTHON PROGRAMMING LAB</b>	L	T	P	C
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### Course Objectives:

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

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

### List of Experiments:

1.
  - I. Use a web browser to go to the Python website <http://python.org>. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.
  - II. Start the Python interpreter and type `help()` to start the online help utility.
2. Start a Python interpreter and use it as a Calculator.
3. Write a program to calculate compound interest when principal, rate and number of periods 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 triangle using 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. The wordlist I provided, words.txt, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.
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. Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'
17. Remove the given word in all the places in a string?
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. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.
23. Use the structure of exception handling all general-purpose exceptions.
24. 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.
25. Add an attribute named color to your Rectangle objects and modify draw\_rectangle so that it uses the color attribute as the fill color.
26. 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.
27. 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.
28. Write a python code to read a phone number and email-id from the user and validate it for correctness.
29. Write a Python code to merge two given file contents into a third file.
30. Write a Python code to open a given file and construct a function to check for given words present in it and display on found.
31. Write a Python code to Read text from a text file, find the word with most number of occurrences
32. Write a function that reads a file *file1* and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters.
33. Import numpy, Plotpy and Scipy and explore their functionalities.
34. Install NumPypackage with pip and explore it.
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. Supercharged Python: Take your code to the next level, Overland
2. Learning Python, Mark Lutz, O'reilly

## REFERENCE BOOKS:

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

## COURSE OUTCOMES:

After completion of the course, the student should be able to

- Develop the application specific codes using python.
- Understand Strings, Lists, Tuples and Dictionaries in Python
- Verify programs using modular approach, file I/O, Python standard library
- Implement Digital Systems using Python

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>I Year-II Sem</b>			
Course Code: N12022	<b>ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING LAB</b> (Common to CE & ME)	L	T	P	C
Credits: <b>1</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**(ELECTRICAL ONLY)**

**Pre-Requisites: Physics**

### COURSE OBJECTIVES

The Course aims:

<b>COB1:</b>	To experimentally verify fundamental electrical laws.
<b>COB2:</b>	To familiarize students with the measurement of electrical quantities in single-phase and three-phase transformers.
<b>COB3:</b>	To study the performance characteristics of DC and AC motors through experimental methods.

### List of Experiments

#### PART- A (Electrical)

1. Verification of KVL and KCL.
2. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single Phase Transformer.
3. Verification of Relationship between Voltages and Currents (Star - Delta, Delta - Delta, Delta - Star, Star- Star) in a Three Phase Transformer.
4. Measurement of Active and Reactive Power in a balanced Three phase circuit.
5. Performance Characteristics of a DC Shunt Motor.
6. Performance Characteristics of a Three Phase Induction Motor.

### COURSE OUTCOMES

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

<b>CO1:</b>	Apply and validate KVL, and KCL in practical electrical circuits.
<b>CO2:</b>	Measure voltage, current, and power in transformer circuits and verify the phase and magnitude relationships of voltages and currents for various three-phase transformer connections.
<b>CO3:</b>	Analyse the performance of a DC shunt motor and evaluate the torque-speed characteristics of a three-phase induction motor.

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: CE</b> <b>I Year-II Sem</b>			
Course Code: N12011	<b>ENGINEERING GEOLOGY AND MATERIALS</b> <b>LABORATORY</b>	L	T	P	C
		0	0	2	1

**Pre-Requisites:** Engineering Geology Theory, Building Materials

Course Objectives: The objective of this Course is to

- Develop practical skills in identifying minerals and rocks based on physical and chemical properties.
- Classify minerals and rocks into appropriate geological groups.
- Understand crystallography and crystal systems through visual identification.
- Apply techniques for identification of igneous, sedimentary, and metamorphic rocks.
- Interpret geological maps and recognize topographical and structural features.
- Test the properties of cement and aggregate

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

- Accurately identify minerals from various mineral groups using hand specimens.
- Classify and identify igneous rocks based on texture, structure, and mineral content.
- Classify and identify sedimentary rocks and interpret their depositional environments.
- Identify and distinguish metamorphic rocks and their textures and structures.)
- Understand the testing procedures of cement and aggregate properties

### List of Experiments

1. Study of physical properties of minerals.
2. Study of different group of minerals.
3. Study of Crystal and Crystal system.
4. Identification of minerals: Silica group: Quartz, Amethyst, Opal; Feldspar group: Orthoclase, Plagioclase; Cryptocrystalline group: Jasper; Carbonate group: Calcite; Element group: Graphite; Pyroxene group: Talc; Mica group: Muscovite; Amphibole group: Asbestos, Olivine, Hornblende, Magnetite, Hematite, Corundum, Kyanite, Garnet, Galena, Gypsum.
5. Identification of rocks (Igneous Petrology): Acidic Igneous rock: Granite and its varieties, Syenite, Rhyolite, Pumice, Obsidian, Scoria, Pegmatite, Volcanic Tuff. Basic rock: Gabbro, Dolerite, Basalt and its varieties, Trachyte.
6. Identification of rocks (Sedimentary Petrology): Conglomerate, Breccia, Sandstone and its varieties, Laterite, Limestone and its varieties, Shales and its varieties.
7. Identification of rocks (Metamorphic Petrology): Marble, slate, Gneiss and its varieties, Schist and its varieties. Quartzite, Phyllite.
8. Study of topographical features from Geological maps. Identification of symbols in maps.
9. Tests on Cement: Standard Consistency Test, Initial and Final Setting Times
10. Tests on Aggregate: Impact test and Crushing Test

**LAB EXAMINATION PATTERN:**

1. Description and identification of SIX minerals
2. Description and identification of Six (including igneous, sedimentary and metamorphic rocks)  
Interpretation of a Geological map along with a geological section.
3. Identification of rocks.
4. Conducting Test Procedures on cement and Aggregate.

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>I Year-I Sem /</b> <b>II Sem</b>			
Course Code: N1200F	<b>LINGUASKILL FOR PROFESSIONALS</b> <b>(Audit Course)</b> (COMMON TO ALL)	L	T	P	C
Credits: 0		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites: NIL**

**COURSE OBJECTIVES:**

To enable students

1. Acquire an extensive range of vocabulary related to diverse topics.
2. Enhance pronunciation skills, focusing on specific sounds and intonation patterns
3. Improve the use of various grammar concepts
4. Strengthen listening, speaking, reading, and writing skills across different proficiency levels
5. Develop practical language skills for everyday communication scenarios

**Module 1 (6L)**

**UNIT-1**

**Grammar:** Subject-Object, Present Tense

**Vocabulary:** Words about friendship, communication, work and technology

**Pronunciation:** Word stress, sentence stress

**UNIT-2**

**Everyday English:** Opinions and suggestions

- **Listening:** Listening Activity 1, Listening Activity 2
- **Reading:** Reading Activity 1, Reading Activity 2
- **Speaking:** Speaking Activity 1, Speaking Activity 2

**Writing:** Guide, Email giving news

**Module 2 (6L)**

**UNIT-1**

**Grammar:** Modals, Phrases of ability, Articles, *used to* and *usually*

**Vocabulary:** Words about relationship and ability

**Pronunciation:** Linking sounds, Intonation in question tags

**UNIT -2**

**Everyday English:** Telling a story; Offering and asking for help

- **Listening:** Listening Activity 1, Listening Activity 2
- **Reading:** Reading Activity 1, Reading Activity 2
- **Speaking:** Speaking Activity 1, Speaking Activity 2

**Writing:** About someone's life, online advertisement

**Module 3 (6L)**

**UNIT-1**

**Grammar:** Future forms, zero and first conditionals, comparatives and superlatives

**Vocabulary:** Words about the natural world, environmental issues and food

**Pronunciation:** Sound and spelling 'a', /ʃ/, /tʃ/

**UNIT-2**

**Everyday English:** Giving reasons, results and examples; Asking and giving recommendations

- **Listening:** Listening Activity 1, Listening Activity 2
- **Reading:** Reading Activity 1, Reading Activity 2



- **Speaking:** Speaking Activity 1, Speaking Activity 2

**Writing:** Discussion essay, Review of a restaurant or cafe

#### Module 4 (6L)

##### UNIT-1

**Grammar:** Quantifiers, Reported speech

**Vocabulary:** Words about buildings and sharing information

**Pronunciation:** Sounds /t//d//k//g//h//w/

##### UNIT-2

**Everyday English:** Offers, request, permission; generalising and being vague

- **Listening:** Listening Activity 1, Listening Activity 2
- **Reading:** Reading Activity 1, Reading Activity 2
- **Speaking:** Speaking Activity 1, Speaking Activity 2

**Writing:** A note with useful information, an email summary of a news story

#### Module 5 (6L)

##### UNIT-1

**Grammar:** Passive, Relative clause, Second and third conditionals

**Vocabulary:** Words about music and sport; expressions with *do*, *make* and *take*

**Pronunciation:** -ed ending words, mostly confused words

##### UNIT-2

**Everyday English:** Recommending, Discussing problems and reassuring

- **Listening:** Listening Activity 1, Listening Activity 2
- **Reading:** Reading Activity 1, Reading Activity 2
- **Speaking:** Speaking Activity 1, Speaking Activity 2

**Writing:** Article, Email with advice

#### Text Books

5. Doff, Adrian, et al. *Empower Second Edition Student's Book with Digital Pack: B1+ Intermediate*. Cambridge University Press, 2022.

#### Reference Books

7. Cullen, Pauline, et al. *The Official Cambridge Guide to IELTS for Academic and General Training: Student's Book with Answers*. with DVD-ROM. Cambridge Univ. Press, 2014.

#### E-Resources

1. [Cambridge English](#)
2. [English with Cambridge - YouTube](#)
3. [BBC Learning English - Learn English with BBC Learning English - Homepage](#)
4. <https://englishonline.britishcouncil.org/>

#### Course Outcomes

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

**CO1.** Demonstrate a diverse vocabulary repertoire, facilitating better expression and comprehension.

**CO2.** Exhibit intelligible pronunciation skills, ensuring clearer oral communication.

**CO3.** Utilise various grammar concepts accurately and coherently.

**CO4.** Strengthened language skills across listening, speaking, reading, and writing.

**C05.** Apply practical language skills effectively in everyday communication scenarios.

### CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>C01</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-
<b>C02</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-
<b>C03</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-
<b>C04</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-
<b>C05</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-
<b>Average</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-

**Correlation: 3–Strong; 2–Medium; 1-Weak**

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>II Year-I Sem</b>			
Course Code: N2100B	<b>PROBABILITY AND STATISTICS</b> (COMMON TO: CE)	L	T	P	C
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites:** Mathematics courses of first year of study.

**Module 1: Random Variables and Probability Distributions:** [08L]

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.

**Module 2: Continuous Distributions and sampling:** [10L]

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.

**Module 3: Estimation:** [10L]

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.

**Module 4: Tests of Hypotheses (Large and Small Samples):** [10L]

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.

**Module 5: Applied Statistics:** [10L]

Curve fitting by the method of least squares – Fitting of straight lines – Second degree parabolas and more general curves. Correlation and Regression – Rank correlation.

**Text Books**

5. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists, 9th Ed. Pearson Publishers.
6. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications.

**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, 2014.

**E-Resources**

- [https://onlinecourses.nptel.ac.in/noc21\\_bt32/preview](https://onlinecourses.nptel.ac.in/noc21_bt32/preview)
- <https://nptel.ac.in/courses/111105041>

- [https://faculty.ksu.edu.sa/sites/default/files/chapter%204\\_3.pdf](https://faculty.ksu.edu.sa/sites/default/files/chapter%204_3.pdf)
- <https://online.stat.psu.edu/stat800/lesson/5/5.5>
- <https://nptel.ac.in/courses/110105157>

#### Course Objectives:

To learn

1. The theory of Random Variable, and probability distributions of single random variables.
2. The sampling theory and testing of hypothesis and making statistical inferences.
3. The curve fitting, correlation and regression for the given data.

#### Course Outcomes:

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

CO1: Apply the concepts of Random variable and distributions to some case studies.

CO2: apply continuous distributions, sampling distributions, and the Central Limit Theorem in practical problems.

CO3: apply classical estimation methods to estimate means, proportions, and variances for single and two-sample cases.

CO4: Understood sampling theory and apply hypothesis testing in real-world scenarios.

CO5: Fit curves using least squares and study relationships between variables using correlation and regression.

#### CO-PO/PSO Mapping

Course Outcomes	Program Outcomes (POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	2	2	2	-	-	-	-	-	-	-	1	2	1
<b>CO2</b>	3	3	2	3	-	-	-	-	-	-	-	1	2	1
<b>CO3</b>	3	3	3	3	-	-	-	-	-	-	-	1	1	1
<b>CO4</b>	3	3	2	3	-	-	-	-	-	-	-	1	1	1
<b>CO5</b>	3	3	3	3	-	-	-	-	-	-	-	1	2	1
<b>Average</b>	<b>3</b>	<b>2.8</b>	<b>2.4</b>	<b>2.8</b>	-	-	-	-	-	-	-	<b>1</b>	<b>1.6</b>	<b>1</b>

**Correlation: 3–Strong; 2–Medium; 1-Weak**

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE</b> <b>II Year-I Sem</b>			
Course Code: N2101A	<b>CONCRETE TECHNOLOGY</b>	L	T	P	C
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### Course Objectives:

This course is expected to enable the student to:

- To introduce the Various Properties of Concrete Materials
- To enable students to understand the behaviour of fresh and hardened concrete
- To introduce the mix design concepts and the quality control aspects in concrete
- To Introduce the special concrete materials used in construction
- To introduce the durability of concrete materials including life cycle cost considerations

**Course Outcomes:** Upon completion of this course, students should be able to

- Test and understand the properties of aggregates, water, and admixtures, and how they affect concrete quality.
- Understand the factors affecting the fresh and hardened concrete and their significance
- Understand the factors influencing the mix design using IS method and the acceptance criteria
- Understand the various types of special concretes and their applications in construction
- Understand the factors influencing the deterioration of concrete along with life cycle cost considerations

## UNIT - I

### Properties of Concrete Materials

Physical & chemical properties of cement; Testing of cements as per BIS specifications; Types of cements, Types of admixtures, Effects of plasticizers and superplasticizers, Types of Aggregates used in concrete.

## UNIT-II

### Fresh and Hardened Concrete

**Fresh Concrete:** Workability, factors affecting, Measurement of workability using slump cone, compaction factor, Vee-Bee test, flow table, Segregation and bleeding, setting time of concrete, Batching, mixing (hand and machine), transporting, placing, compacting, finishing, Curing methods and significance

**Hardened Concrete:** Strength gain with age, Compressive, tensile, and flexural strength, Factors affecting strength, Water–cement ratio: Abram's law, Maturity concept. Shrinkage and creep, NDT & Conventional testing of concrete

### **UNIT-3**

#### **Mix Design**

Concept of mix design – nominal mix and design mix, Factors influencing mix design, Indian Standard method (IS 10262:2019), Target strength, water-cement ratio, workability, air content, Mix design examples using IS method, Acceptance criteria for concrete (as per IS 456:2000), Quality control and quality assurance in concrete works.

### **UNIT-4**

#### **Special Concretes**

Lightweight concrete - High Density Concrete - Hot and Cold Weathering Concrete -Fibre reinforced concrete -Polymer concrete -Ferro cement - Ready Mix Concrete-High Performance Concrete -Self compacting concrete - Roller Compacted concrete- Sustainability of concrete.

### **UNIT-5**

#### **Durability of Concrete**

Mechanism of deterioration of concrete; Different modes of transport mechanism in concrete mass; Carbonation; Chloride attack; Corrosion of reinforcement in concrete; Carbon economics; Life cycle costing and energy considerations.

#### **TEXT BOOKS:**

1. Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, “Building Construction”, Eleventh edition 2016 Laxmi Publications.
2. Concrete Technology by M. S. Shetty, S. Chand publishing & Company Pvt. Ltd.

#### **REFERENCE BOOKS:**

1. Properties of Concrete by A. M. Neville – 4th edition.
3. IS 10262: 2019 code for Concrete Mix Proportioning.
4. National Building Code (NBC) of India.
5. AM Nevelli, Properties of Concrete, Prentice Hall Publishers, 2012, 5th Edition.

AY: 2025-26 Onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech CE II Year-I Sem			
Course Code: N2101B	STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3

**Pre-Requisites:** Engineering Mechanics for Civil Engineers

### Course Objectives:

The objective of this Course is to

- understand the nature of stresses developed in simple geometries such as bars, cantilevers and beams for various types of simple loads.
- calculate the elastic deformation occurring in simple members for different types of loading.
- show the plane stress transformation with a particular coordinate system for different orientation of the plane.
- know different failure theories adopted in designing of structural members.

**Course Outcome:** On completion of the course, the student will be able to:

- Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships;
- Perform calculations related to the strength of structured and mechanical components.
- Recognize various types loads applied on structural components of simple framing geometries and understand the nature of internal stresses that will develop within the components.
- To evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.
- Analyze various situations involving structural members subjected to plane stresses by application of Mohr's circle of stress.

### UNIT –I

**Simple Stresses and Strains:** Concept of stress and strain- St. Venant's Principle-Stress and Strain Diagram-Elasticity and plasticity –Types of stresses and Strains-Hooke's law–stress–strain diagram for mild steel–Working stress–Factor of safety–Lateral strain, Poisson's ratio and volumetric strain –Pure shear and Complementary Shear-Elastic moduli, Elastic constants and the relationship between them Bars of varying section–composite bars–Temperature stresses.

**Strain Energy**–Resilience–Gradual, sudden, and impact loadings–simple applications.

### UNIT - II

**Shear Force and Bending Moment:** Types of beams–Concept of shear force and bending moment S. F and B.M diagrams for cantilever, simply supported including overhanging beams subjected to point loads, uniformly distributed load, uniformly varying load, couple and combination of these loads – Point of contra flexure–Relation between S.F., B.M and rate of loading at a section of a beam.

### **UNIT - III Flexural Stresses:**

Theory of simple bending – Assumptions – Derivation of bending equation- Section Modulus Determination of flexural/bending stresses of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections–Design of simple beam sections.

**Shear Stresses:** Derivation of formula for shear stress distribution – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle and channel sections.

### **UNIT - IV**

**Deflection of Beams:** Slope, deflection and radius of curvature–Differential equation for the elastic line of a beam–Double integration and Macaulay's methods–Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L, uniformly varying load and Couple-Mohr's theorems –Moment area method –Application to simple cases.

### **UNIT - V**

**Thin Cylinders:** Thin seamless cylindrical shells–Derivation of formula for longitudinal and circumferential stresses–hoop, longitudinal and Volumetric strains–changes in diameter, and volume of thin cylinders – Thin spherical shells.

**Thick Cylinders:** Introduction-Lame's theory for thick cylinders–Derivation of Lame's formulae–distribution of hoop and radial stresses across thickness–design of thick cylinders–compound cylinders–Necessary difference of radii for shrinkage.

### **TEXT BOOKS:**

1. Strength of Materials by B. Raghu Kumar, BS Publications.
2. Strength of Materials by B.S. Basavarajaiah and P. Mahadevappa, 3rd Edition, Universities Press
3. Strength of Materials by R. K Rajput, S. Chand & Company Ltd.
4. Strength of Materials by R. Subramanian, Oxford University Press

### **REFERENCE BOOKS:**

1. Mechanics of Materials by R.C. Hibbeler, Prentice Hall publications
2. Engineering Mechanics of Solids by Egor P. Popov, Prentice Hall publications
3. Strength of Materials by T.D. Gunneswara Rao and M. Andal, Cambridge Publishers
4. Strength of Materials by R.K. Bansal, Lakshmi Publications House Pvt.Ltd.



<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE</b> <b>II Year-I Sem</b>			
Course Code:  N2101C	<b>SURVEYING AND GEOMATICS</b>	L	T	P	C
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### Course Objectives:

The objective of this Course is to

- Understand the fundamentals of surveying including its objectives, classifications, principles, and accessories used.
- Apply techniques for measurement of distances, directions, and angles using various conventional and modern instruments.
- Perform levelling and contouring to determine elevations and prepare topographical maps.
- Compute areas and volumes using different methods applicable in engineering projects like earthworks.
- Handle theodolite and tachometric surveys and perform traversing and curve setting.

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

- Classify and describe different types and phases of surveying, and explain conventional symbols and scales.
- Measure linear distances and directions using chains, tapes, compasses, and EDM methods, and apply corrections accurately.
- Perform differential levelling and contouring using various instruments and compute heights using HI and Rise & Fall methods.
- Calculate areas and volumes using MDM, DMD methods and Planimeter; compute earthwork quantities and reservoir capacities.
- Use theodolite for angle measurements, trigonometric levelling, and traverse computations including adjustments.

### UNIT - I

**Introduction and Basic Concepts:** Introduction, Objectives, classification and principles of surveying, Scales, Shrinkage of Map, Conventional symbols and Code of Signals, Surveying accessories, phases of surveying.

**Measurement of Distances and Directions** Linear distances – Approximate methods, Direct Methods- Chains-Tapes, ranging, Tape corrections, indirect methods- optical methods- E.D.M. method.

**Prismatic Compass**-Bearings, included angles, Local Attraction, Magnetic Declination and dip.

**UNIT - II Levelling and Contouring** **Leveling**- Basics definitions, types of levels and levelling staves, temporary adjustments, methods of levelling, booking and Determination of levels- HI Method-Rise and Fall method, Effect of Curvature of Earth and Refraction.

**Contouring**- Characteristics and uses of Contours, Direct& Indirect methods of contour surveying, interpolation and sketching of Contours.

## **Computation of Areas and Volumes**

**Areas** -Determination of areas consisting of irregular boundary and regular boundary (coordinates, MDM, DMD methods), Planimeter.

**Volumes** - Computation of areas for level section and two-level sections with and without transverse slopes, determination of volume of earth work in cutting and embankments, volume of borrow pits, capacity of reservoirs.

**UNIT- III Theodolite Surveying:** Types of Theodolites, Fundamental Lines, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical levelling when base is accessible and inaccessible. **Traversing:** Methods of traversing, traverse computations and adjustments, Gale's traverse table, Omitted measurements.

**UNIT-IV Tachometric Surveying:** Principles of Tachometry, stadia and tangential methods of Tachometry.

**Curves:** Types of curves and their necessity, elements of simple curve, setting out of simple Curves,

**UNIT-V Modern Surveying Methods:** Total Station and Global Positioning System: Basic principles, classifications, applications, comparison with conventional surveying. Electromagnetic wave theory – electromagnetic distance measuring system-principle of working and EDM instruments, Components of GPS–space segment, control segment and user segment, reference systems, satellite orbits, GPS observations. Applications of GPS.

## **TEXT BOOKS:**

1. Surveying with Geomatics and R First Edition (2022) by Marcelo de Carvalho Alves, Luciana Sanches.
2. Surveying and leveling by R. Subramanian, Oxford university press, New Delhi.
3. Chandra A M, "Higher Surveying", Newage International Pvt.Ltd. Publishers, New Delhi,2002.
4. Hoffman. B, H. Lichtenegga and J. Collins, Global Positioning System - Theory and Practice, Springer -Verlag Publishers, 2001.

## **REFERENCE BOOKS:**

1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw-Hill–2000.
2. Arora K R "Surveying Vol 1,2&3, Standard Book House, Delhi,2004.
3. Surveying (Vol–1,2&3), by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain-Laxmi Publications (P) Ltd., New Delhi.
4. Chandra A M, "Plane Surveying", New Age International Pvt.Ltd., NewDelhi,2002.
5. Surveying by Bhavikatti; Vikas publishing house ltd.
6. Duggal S K, "Surveying (Vol–1&2), Tata Mc Graw Hill Publishing Co. Ltd. New Delhi,2004.
7. Surveying and leveling by R. Agor Khanna Publishers 2015.

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE</b> <b>II Year-I Sem</b>			
Course Code: N2101D	<b>FLUID MECHANICS</b>	L	T	P	C
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

Course Objectives: The objectives of the course are to

- Introduce the concepts of fluid mechanics useful in Civil Engineering applications.
- Provide a first level exposure to the students to fluid statics, kinematics and dynamics.
- Learn about the application of mass, energy and momentum conservation laws for fluid flows. Train and analyses engineering problems involving fluids with a mechanistic perspective is essential for the civil engineering students
- To obtain the velocity and pressure variations in various types of simple flows.
- To prepare a student to build a good fundamental background useful in the application-intensive courses covering hydraulics, hydraulic machinery and hydrology.

**Course Outcomes:** Upon completion of this course, students should be able to:

- Understand the broad principles of fluid statics, kinematics and dynamics.
- Understand definitions of the basic terms used in fluid mechanics and characteristics of fluids and its flow.
- Understand classifications of fluid flow.
- Be able to apply the continuity, momentum and energy principles.
- Understand the applications of hydraulics, and hydrology.

### UNIT-1

**Properties of Fluid** Distinction between a fluid and a solid; Properties of fluids – Viscosity, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

**Fluid Statics** Fluid Pressure: Pressure at a point, Pascal's law, Hydrostatic law, Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micro manometers. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces.

### UNIT- II

**Fluid Kinematics** Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; One, two- and three-dimensional flows; Streamline, path line, streak line and stream tube; stream function, velocity potential function, flow net, One, two- and three-dimensional Continuity equations in Cartesian coordinates applications.

**Fluid Dynamics** Surface and Body forces -Euler's and Bernoulli's equation; Momentum equation. Correction factors. Bernoulli's equation to real fluid flows.

### **UNIT- III Flow Measurement in Pipes**

Practical applications of Bernoulli's equation: venturi meter, orifice meter and pitot tube, applications of Momentum equations; Forces exerted by fluid flow on pipe bend, sudden enlargement in pipes.

**Flow Over Notches & Weirs** Flow through rectangular; triangular and trapezoidal notches and weirs; End contractions; Velocity of approach. Broad crested weir.

### **UNIT-IV**

**Flow through Pipes** Reynolds experiment, Reynolds number, Loss of head through pipes, Darcy-Wiesbach equation, minor losses, total energy line, hydraulic grade line, Pipes in series, equivalent pipes, pipes in parallel, siphon, branching of pipes, three reservoir problem, power transmission through pipes. Analysis of pipe networks: Hardy Cross method and EPANET, water hammer in pipes and control measures.

### **UNIT-V**

#### **Laminar & Turbulent Flow**

Laminar flow through circular pipes, and fixed parallel plates.

**Boundary Layer Concepts** Prandtl contribution, Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness concepts of laminar and turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control. Drag and Lift and types of drag, magnus effect.

#### **TEXT BOOKS:**

1. Theory and Applications of Fluid Mechanics, K. Subramanian, TataMcGrawHill
2. Fluid Mechanics by Modi and Seth, Standard Book House.
3. Fluid Mechanics by Streeter
4. Fluid Mechanics by R.C. Hibbeler, Pearson India Education Services Pvt. Ltd

#### **REFERENCE BOOKS:**

1. Fluid Mechanics–Frank M. White–8th Edition–McGraw-Hill Education.
2. Introduction to Fluid Mechanics and Fluid Machines by S K Som, Gautam Biswas, Suman Chakraborty, Mc Graw Hill Education (India) Private Limited
3. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
4. Fluid Mechanics & Hydraulic Machines, Domkundwar & Domkundwar Dhanpat Rai & Co
5. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Publication Pvt. Ltd.

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>II Year-I Sem</b>			
Course Code: N21001	<b>COMPUTATIONAL MATHEMATICS LAB</b> <b>(Using Python/ Scilab software)</b> (COMMON TO: CE, ME, IT, ECM, CSE(AIML), CSE(DS), AIDS & AIML)	L	T	P	C
Credits: <b>1</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Pre-Requisites:** Matrices, Iterative methods and ordinary differential equations.

\* Visualize all solutions Graphically through programmes

**Module 1: Eigen values and Eigenvectors:** [06L]

**Programs:**

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

**Module 2: Solution of Algebraic and Transcendental Equations:** [06L]

Bisection method, Newton Raphson Method.

**Programs:**

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

**Module 3: Linear system of equations:** [06L]

Jacobi's iteration method and Gauss-Seidal iteration method.

**Programs:**

- Solution of given system of linear equations using Jacobi's method.
- Solution of given system of linear equations using Gauss-Seidal method.

**Module 4: First-Order ODEs:** [08L]

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

**Programs:**

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

**Module 5: Higher order linear differential equations with constant coefficients:** [06L]

**Programs:**

- Solving homogeneous ODEs.
- Solving non-homogeneous ODEs.

#### Text Books

1. Kenneth A. Lambert, The fundamentals of Python: First Programs, 2011, Cengage Learnings.
2. Think Python First Edition, by Allen B. Downey, Orielly publishing.
3. Gilberto E.Urroz, Ordinary Differential Equations with Scilab, 2001.

#### Reference Books

1. John C. Lusth, An Introduction to Python, The University of Alabama, 2011.
2. Dave Kuhlman, Introduction to Python, 2008.
3. Introduction to Python Programming, William Mitchell, Povel Solin, Martin Novak et al., NCLab Public Computing, 2012.
4. Introduction to Python Programming, ©Jacob Fredslund, 2007.

### E-Resources

- [https://onlinecourses.nptel.ac.in/noc24\\_ph36/preview](https://onlinecourses.nptel.ac.in/noc24_ph36/preview)
- [https://onlinecourses.nptel.ac.in/noc24\\_ma15/preview](https://onlinecourses.nptel.ac.in/noc24_ma15/preview)
- [https://help.scilab.org/docs/2025.1.0/en\\_US/ode.html](https://help.scilab.org/docs/2025.1.0/en_US/ode.html)

### Course Objectives:

To learn

1. Solve problems of Eigen values and Eigen Vectors using Python/Scilab.
2. Solution of Algebraic and Transcendental Equations using Python/Scilab.
3. Solve problems of Linear system of equations.
4. Solve problems of First-Order ODEs Higher order linear differential equations with constant coefficients.

### Course Outcomes:

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

CO1: Develop programs in Python/Scilab to compute Eigenvalues and Eigenvectors.

CO2: Implement numerical methods in Python/Scilab to solve algebraic and transcendental equations.

CO3: Apply Python/Scilab to solve linear systems of equations.

CO4: Write code to obtain numerical solutions of first-order ordinary differential equations.

CO5: Implement algorithms to solve higher-order linear differential equations with constant coefficients using Python/Scilab.

### CO-PO/PSO Mapping

Course Outcomes	Program Outcomes (POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	3	-	-	-	-	-	-	1	2	2
CO2	3	3	2	2	3	-	-	-	-	-	-	1	2	2
CO3	3	2	2	2	3	-	-	-	-	-	-	1	2	2
CO4	3	3	2	2	3	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	3	-	-	-	-	-	-	1	3	2
Average	3	2.6	2	1.8	3	-	-	-	-	-	-	1	2.4	2

Correlation: 3–Strong; 2–Medium; 1-Weak

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE</b> <b>II Year – I Sem</b>			
Course Code: N21011	<b>MATERIAL TESTING LABORATORY</b>	L	T	P	C
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Course Objectives:** The objectives of the course are to

- Know the various procedures to determine the characteristics of cement
- Understand the test procedures to evaluate the characteristics of aggregates
- Know the test procedures to find the properties of fresh concrete
- Understand the test procedures to find mechanical properties of hardened concrete

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

- Perform various tests required to assess the characteristics of cement
- Test and evaluate the properties of fine and coarse aggregates and determine its suitability for construction
- Evaluate the fresh properties of concrete
- Evaluate the hardened properties of concrete
- Design the concrete mix for required strength and test its performance characteristics

#### LIST OF EXERCISES:

##### 1. Tests on Cement:

- Soundness.
- Compressive strength.

##### 2. Tests on Aggregates:

- Specific gravity of fine aggregate.
- Specific gravity of coarse aggregate.
- Bulking of fine aggregate.
- Grading of fine aggregate

##### 1. IS method of mix design of normal concrete as per IS:10262

##### 2. Tests on Fresh Concrete:

- Slump cone test.
- Compacting factor test.
- Vee-Bee consistometer test.

##### 3. Tests on Hardened Concrete:

- Compressive & Tensile strength tests.
- Modulus of elasticity of concrete.
- Non-destructive testing of concrete.

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE</b> <b>II Year-I Sem</b>			
Course Code: N21012	<b>STRENGTH OF MATERIALS LABORATORY</b>	L	T	P	C
		0	0	2	1

**Course Objectives:** The objectives of the course are to

- Conduct the Tension test, Compression test on various materials
- Conduct the Shear test, Bending test on determinate beams
- Conduct the Compression test on spring and Hardness test using various machines
- Conduct the Torsion test, Impact test on various materials

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

- Determine the yield stress, ultimate tensile stress, percentage elongation of steel, compressive strength of brick and concrete
- Determine the ultimate shear stress, modulus of elasticity of steel
- Determine the stiffness of the close coiled helical spring
- Determine the hardness number of mild steel, brass, copper and aluminum
- Determine the modulus of rigidity and impact strength of steel

List of Experiments:

1. Tension test
2. Bending test on (Steel/Wood) Cantilever beam.
3. Bending test on simple support beam.
4. Torsion test
5. Hardness test
6. Spring test
7. Compression test on concrete.
8. Impact test
9. Shear test
10. Verification of Maxwell's Reciprocal theorem on beams.
11. Use of electrical resistance strain gauges.
12. Continuous beam-deflection test.



<b>AY: 2025 -26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE</b> <b>II Year-I Sem</b>			
Course Code: N21013	<b>SURVEYING &amp; GEOMATICS LABORATORY</b>	L	T	P	C
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

Course Objectives: The objectives of the course are to

- Learn and understand the various basic concept and principles used in surveying like Chain Surveying, Compass Surveying, Plane Table Surveying, and Levelling Surveying.
- Learn and understand about theodolite and total station in surveying.
- Learn and understand how to calculate Area of plot and Ground.
- Learn and understand about Horizontal Angle, Vertical Angle, Horizontal distance and Vertical distance to study the ground profile using total station.

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

- Prepare Map and Plan for required site with suitable scale.
- Prepare contour Map
- Estimate the Quantity of earthwork required for formation level for Road and Railway Alignment.
- Judge which type of instrument to be used for carrying out survey for a Particular Area and estimate the area.
- Judge the profile of ground by observing the available existing contour map.

### **CYCLE-I**

Theodolite surveying:

1. Measurement of horizontal angles and vertical angles.
2. Distance between two inaccessible points.
3. Measurement of area by theodolite traversing (Gales traverse table).
4. Determination of tachometer constants.
5. Distance between two inaccessible points using the principles of tachometer surveying.
6. Distance between two inaccessible points using the principles of trigonometric surveying

### **CYCLE-II**

Total Station:

7. Area Measurement
8. Stake Out
9. Remote Elevation Measurement
10. Missing Line Measurement
11. Longitudinal & Cross Section Profile
12. Contouring
13. Providing a Simple Circular Curve
14. Demonstration using DGPS (Differential Global Positioning System)

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE</b> <b>II Year-II Sem</b>			
Course Code:  N2201A	<b>STRUCTURAL MECHANICS</b>	L	T	P	C
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites:** Strength of Materials

**Course Objectives:** The objective of this Course is

- To understand the nature of stresses developed in simple geometries shafts, springs, columns & cylindrical and spherical shells for various types of simple loads.
- To calculate the stability and elastic deformation occurring in various simple geometries for different types of loading.
- To understand the unsymmetrical bending and shear center importance for equilibrium conditions in a structural member of having different axis of symmetry.

**Course Outcome:** On completion of the course, the student will be able to:

- Describe the concepts and principles, understand the theory of elasticity, and perform calculations, relative to the strength of structures and mechanical components in particular to torsion and direct compression.
- To evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.
- Analyze strength and stability of structural members subjected to Direct, and Direct and Bending stresses. Understand and evaluate the shear center and unsymmetrical bending. Principal Stresses:
- Understand the shear center.
- Evaluate the unsymmetrical bending.

### UNIT-1

**Introduction–Stresses:** Introduction - Stresses on an oblique plane of a bar under axial loading– compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses –Two perpendicular normal stresses accompanied by a state of simple shear–Principal stresses–Mohr’s circle of stresses ellipse of Stress-Analytical and graphical solutions.

**Theories of Failure:** Introduction–Various theories of Failure-Maximum Principal Stress theory, Maximum Principal Strain Theory, Maximum shear stress Theory-Strain Energy and Shear Strain Energy Theory (VonMises Theory).

### UNIT–II

**Torsion of Circular Shafts:** Theory of pure torsion– Derivation of Torsion Equation-Assumptions made in the theory of pure torsion – Polar section modulus – Power transmitted by shafts – Combined bending and torsion–Design of shafts according to theories of failure.

**Springs:** Introduction–Types of springs –deflection of close and open coiled helical springs under axial pull and axial couple–springs in series and parallel.

### UNIT- III

**Direct and Bending Stresses:** Stresses under the combined action of direct loading and bending moment, core of a section–determination of stresses in the case of retaining walls, chimneys and dams conditions for stability- Overturning and sliding–stresses due to direct loading and bending moment about both axes.

#### **UNIT- IV**

**Columns and Struts:** Introduction–Types of columns–Short, medium and long columns–Axially loaded compression members – Crushing load – Euler’s theorem for long columns- assumptions- derivation of Euler’s critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio–Euler’s critical stress–Limitations of Euler’s theory–Long columns subjected to eccentric loading – Secant formula–Empirical formulae — Rankine– Gordon formula- Straight line formula, Prof. Perry’s formula.

#### **UNIT–V**

**Unsymmetrical Bending:** Introduction – Centroidal principal axes of section –Moments of inertia referred to any set of rectangular axes – Stresses in beams subjected to unsymmetrical bending – Principal axes – Resolution of bending moment into two rectangular axes through the centroid–Location of neutral axis.  
**Shear Centre:** Introduction - Shear center for symmetrical and unsymmetrical (channel, I, T and L) sections.

#### **TEXT BOOKS:**

1. Mechanics of Materials by Dr.B.C. Punmia, Dr. Ashok Kumar Jain and Dr. Arun Kumar Jain
2. Strength of Materials by R. Subramanian, Oxford University Press.

#### **REFERENCE BOOKS:**

1. Mechanics of Materials by R.C. Hibbeler, Pearson Education
2. Engineering Mechanics of Solids by Popov E.P. Prentice-Hall Ltd
3. Strength of Materials by T.D. GunneswaraRao and M. Andal, Cambridge Publishers
4. Strength of Materials by R.K. Bansal, Lakshmi Publications House Pvt.Ltd.
5. Fundamentals of Solid Mechanics by M.L. Gambhir, PHI Learning Pvt. Ltd

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE</b> <b>II Year-II Sem</b>			
Course Code: N2201B	<b>WATER RESOURCES AND IRRIGATION ENGINEERING</b>	L	T	P	C
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Prerequisites:** Probability & Statistics, Fluid Mechanics and Hydraulic Machines

**Course Objectives:** The objective of this Course is to

- Understand the fundamentals concepts of Engineering Hydrology.
- Derive various formulae used in estimation of abstractions and runoff.
- Solve problems in hydrograph analysis and groundwater.
- Estimate the water requirement of crops and also design the dams.
- Study types of spillways and design procedures for distribution systems.

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

- Describe different concepts of engineering hydrology.
- Apply appropriate formula to estimate runoff.
- Apply fundamental principles of hydrograph analysis and estimate ground water Resources.
- Estimate water requirement for crops and design hydraulic structures.
- Apply a suitable design methodology for distribution systems.

### **UNIT I - Precipitation**

Introduction-Concepts of Hydrologic Cycle, Global Water Budget, Applications in Engineering. Precipitation-Forms of Precipitation, Measurement of Precipitation: Recording and Non-Recording Types, Mass Rainfall Curves, Characteristics Mean Rainfall on A Basin – Arithmetic, Thiessen and Isohyetal Methods, Intensity – Duration Analysis, PMP, Missing Rainfall Data – Estimation, Consistency of Rainfall Records, Double Mass Curve, Rain Gauge Network Analysis.

### **UNIT II - Abstractions from Precipitation and Runoff**

**Abstractions from Precipitation**-Evaporation Process, Evaporimeters, Analytical Methods of Evaporation Estimation, Reservoir Evaporation and Methods for Its Reduction, Evapo transpiration, Measurement of Evapo transpiration, Evapo transpiration Equations, Potential Evapo transpiration Over India, Actual Evapo transpiration, Interception, Depression Storage, Infiltration, Infiltration Capacity, Measurement of Infiltration, Modeling Infiltration Capacity, Classification of Infiltration Capacities, Infiltration Indices.

**Runoff** - Components of Runoff, Factors affecting Runoff, Basin Yield, SCS-CN Method of Estimating Runoff, Flow Duration Curves, Mass Curve of Runoff – Analysis.

### **UNIT III - Hydrographs and Groundwater Hydrology**

**Hydrographs**-Hydrograph – Components, Separation of Hydrograph into Base Flow and Effective Rainfall – Methods, Unit Hydrograph – Principles, Derivation of UH of Isolated Unit Storms.

**Groundwater Hydrology** - Occurrence, Movement and Distribution of Groundwater, Aquifers – Types, Specific Yield, Permeability, Storage Coefficient, Transmissibility, Darcy's Law. Well Hydraulics-Steady Radial Flow into Well for Confined and Unconfined Aquifers, Recuperation Tests.

#### **UNIT IV**

##### **Water Withdrawals, Dams and Reservoirs**

**Water Withdrawals-** Water Requirement of Crops -Crops and Crop Seasons in India, Cropping Pattern, Duty and Delta; Quality of Irrigation Water; Soil-Water Relationships, Root Zone Soil Water, Infiltration, Consumptive Use, Irrigation Requirement, Frequency of Irrigation; Methods of Applying Water to the Fields: Surface, Sub-Surface, Sprinkler and Trickle /Drip Irrigation.

**Dams and Reservoirs-**Classification of Dams, Gravity Dams: Forces on Gravity Dams, Causes of Failure, Stress Analysis, Elementary and Practical Profile. Arch and Buttress Dams, Economic Height of Dam, Selection of Suitable Site. Reservoirs- Types, Capacity of Reservoirs, Yield of Reservoir, Sedimentation.

#### **UNIT V - Spillways and Distribution Systems**

**Spillways-** Components of Spillways, Types of Gates for Spillway Crests.

**Distribution Systems-** Canal Systems, Alignment of Canals, Canal Losses, Estimation of Design Discharge. Design of Channels-Rigid Boundary Channels, Alluvial Channels, Kennedy's and Lacey's Theory of Regime Channels. Canal Outlets: Non-Modular, Semi-Modular and Modular Outlets. Water Logging: Causes, Effects and Remedial Measures. Lining of Canals, Types of Lining. Drainage of Irrigated Lands: Necessity, Methods.

#### **TEXT BOOKS:**

1. Hydrology, P. Jaya Rami Reddy, 3rd edition, Laxmi Publications, 2018.
2. Irrigation and Water Resources Engineering, G L Asawa, New Age Publishers, 2008.
3. Irrigation Engineering and Hydraulic structures by Santhosh kumar Garg Khanna Publishers

#### **REFERENCES:**

1. Elements of Engineering Hydrology, V.P. Singh, Tata McGraw-Hill, 2017.
2. Ground water Hydrology, David Keith Todd, John Wiley & Son, 2015.
3. Textbook of irrigation Engineering & Hydraulic Structures, R.K. Sharma, Oxford & IBH Publishing Company, 2023.

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CIVIL</b> <b>II Year-II Sem</b>			
Course Code: N2201C	<b>HYDRAULICS AND HYDRAULIC MACHINERY</b>	L	T	P	C
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:** The objective of the course is to

- Define the fundamental principles of water conveyance in open channels.
- Discuss and analyze the open channels in uniform and Non-uniform flow conditions.
- Study the characteristics of hydroelectric power plant and its components.
- Analyze and design of hydraulic machinery and its modelling.

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

- Apply their knowledge of fluid mechanics in addressing problems in open channels and hydraulic machinery.
- Understand and solve problems in uniform and gradually varied flows in open channel in steady state conditions.
- Understand and solve problems in rapidly varied flows in open channel in steady state conditions.
- Apply dimensional analysis and to differentiate the model, proto type and similitude conditions for practical problems.
- Get the knowledge on different hydraulic machinery devices and its principles that will be utilized in hydropower development and for other practical usages.

## UNIT-1

**Open Channel Flow–I:** Introduction to Open channel flow - Comparison between open channel flow and pipe flow, Classification of open channel flows, Velocity distribution. Uniform flow– Characteristics of uniform flow, Chezy's, Manning's and Bazin formulae for uniform flow – Factors affecting Manning's Roughness Coefficient. Most economical sections. Computation of Uniform flow, Normal depth.

**Critical Flow:** Specific energy – critical depth - computation of critical depth – critical, sub critical and super critical Flows-Channel transitions (Theory only).

## UNIT - II

### Open Channel Flow–II:

Non-uniform flow–Gradually Varied Flow-Dynamic equation for G.V.F; Classification of channel bottom slopes–Classification and characteristics of Surface profiles– Computation of water surface profiles by Numerical and Analytical approaches. Direct step method.

**Rapidly varied flow:** Elements and characteristics (Length and Height) of Hydraulic jump in rectangular channel– Types, applications and location of hydraulic jump, Energy dissipation and other uses.

### UNIT - III

**Dimensional Analysis and Hydraulic Similitude:** Dimensional homogeneity – Rayleigh's method and Buckingham's  $\pi$  methods–Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problems.

**Basics of Turbo Machinery:** Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, Jet striking centrally and at tip, Velocity triangles at inlet and outlet, expressions for work done and efficiency.

### UNIT - IV

**Hydraulic Turbines – I:** Elements of a typical Hydropower installation – Heads and efficiencies – Classification of turbines–Pelton wheel–Francis turbine–Kaplan turbine–working, working proportions, velocity diagram, work done and efficiency, hydraulic design. Draft tube – Classification, functions and efficiency.

**Hydraulic Turbines–II:** Governing of turbines–Surge tanks–Unit and specific turbines–Unit speed – Unit quantity – Unit power – Specific speed – Performance characteristics – Geometric similarity – Cavitation. Selection of turbines.

### UNIT - V

**Centrifugal Pumps:** Pump installation details–classification–work done–Manometric head–minimum starting speed–losses and efficiencies–specific speed. Multistage pumps –pumps in series, parallel – performance of pumps – characteristic curves – NPSH – Cavitation.

### TEXT BOOKS:

1. Fluid Mechanics by Modi and Seth, Standard Book House.
2. Fluid Mechanics and Hydraulic machines by Manish Kumar Goyal, PHI learning Private Limited, 2015
3. Fluid Mechanic & Fluid Power Engineering by D. S. Kumar (Kataria & Sons Publications Pvt. Ltd.).

### REFERENCE BOOKS:

1. Fluid Mechanics by R.C. Hibbeler, Pearson India Education Services Pvt.Ltd
2. Introduction to Fluid Mechanics and Fluid Machines by S K Som, Gautam Biswas, Suman Chakraborty, Mc Graw Hill Education (India) Private Limited
3. Hydraulic Machines by Banga & Sharma (Khanna Publishers).
4. Open channel flow by V.T. Chow (McGraw Hill Book Company).

AY: 2025-26 Onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech CE II Year-II Sem			
Course Code: N2201D	THEORY OF STRUCTURES	L	T	P	C
		3	0	0	3

**Prerequisites:** Strength of Materials.

**Course Objectives:**

- Differentiate the statically determinate and indeterminate structures.
- To understand the nature of stresses developed in perfect frames and three hinged arches for various types of simple loads
- Analyse the statically indeterminate members such as fixed bars, continuous beams and for various types of loading.
- Understand the energy methods used to derive the equations to solve engineering problems
- Evaluate the Influence on a beam for different static & moving loading positions

**Course Outcomes:** Upon completion of this course, students should be able to

- An ability to apply knowledge of mathematics, science, and engineering.
- Analyse the statically indeterminate bars and continuous beams.
- Draw strength behavior of members for static and dynamic loading.
- Calculate the stiffness parameters in beams and pin jointed trusses.
- Understand the indeterminacy aspects to consider for a total structural system.

**UNIT – I**

**Analysis of Perfect Frames:** Types of frames- Perfect, Imperfect and Redundant pin jointed plane frames - Analysis of determinate pin jointed plane frames using method of joints, method of sections and tension coefficient method for vertical loads, horizontal loads and inclined loads.

**UNIT - II**

**Energy Theorems:** Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces - Castigliano's Theorem-Unit Load Method – Deflections of simple beams and pin- jointed plane frames - Deflections of statically determinate bent frames. Three Hinged Arches – Introduction – Types of Arches – Comparison between Three hinged and Two hinged Arches - Linear Arch - Eddy's theorem - Analysis of Three hinged arches - Normal Thrust and radial shear and bending moment - Geometrical properties of parabolic and circular arches - Three hinged parabolic circular arches having supports at different levels.

**UNIT - III**

**Propped Cantilever and Fixed Beams:** Determination of static and kinematic indeterminacies for beams- Analysis of Propped cantilever and fixed beams, including the beams with different moments of inertia - subjected to uniformly distributed load - point loads - uniformly varying load, couple and combination of loads - Shear force, Bending moment diagrams and elastic curve for



Propped Cantilever and Fixed Beams-Deflection of Propped cantilever and fixed beams - effect of sinking of support, effect of rotation of a support.

**UNIT - IV Continuous Beams:** Introduction-Continuous beams - Clapeyron's theorem of three moments- Analysis of continuous beams with constant and variable moments of inertia with one or both ends fixed-continuous beams with overhang - effect of sinking of supports.

Slope Deflection Method: Derivation of slope-deflection equation, application to continuous beams with and without sinking of supports -Determination of static and kinematic indeterminacies for frames Analysis of Single Bay, Single storey Portal Frames by Slope Deflection Method including Side Sway Shear force and bending moment diagrams and Elastic curve.

#### **UNIT - V**

**Moving Loads and Influence Lines:** Introduction maximum SF and BM at a given section and absolute maximum shear force and bending moment due to single concentrated load ,uniformly distributed load longer than the span, uniformly distributed load shorter than the span, two point loads with fixed distance between them and several point loads-Equivalent uniformly distributed load-Focal length - Definition of influence line for shear force and bending moment - load position for maximum shear force and maximum bending Moment at a section - Point loads, uniformly distributed load longer than the span, uniformly distributed load shorter than the span.

#### **TEXT BOOKS:**

1. Introduction to Structural Analysis First Edition Indeterminate Structures First Edition (2026) by Meesala Chakradhara Rao, CRC Press.
2. Theory of Structures by R S Khurmi, S Chand & Company Pvt. Ltd, 2020
3. Theory of Structures Vol I & II by G.S. Pandit and S.P. Gupta, Tata McGraw Hill Education Pvt. Ltd, 2017.

#### **REFERENCE BOOKS:**

1. Structural Analysis Vol –I & II by Vazarani and Ratwani, Khanna Publishers,1999
2. Strength of Materials and mechanics of solids Vol-2 by B.C. Punmia, Laxmi Publications, New Delhi, 2015
3. Structural Analysis -I & II by S.S. Bhavikatti, Vikas Publishing House Pvt. Ltd, 2021.

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: CE</b> <b>II Year-II Sem.</b>			
Course Code: N2201E	<b>BUILDING PLANNING AND CONSTRUCTION</b>	L	T	P	C
		2	0	0	2

**Course Objectives:** This course is expected to enable the student to:

- Provide fundamental knowledge about buildings and the influence of climate, orientation, and landscaping on building planning and design.
- Impart understanding of planning principles
- Familiarize students with the National Building Code (NBC), its structure and guidelines for residential buildings,
- Develop knowledge of key building components
- Introduce various finishing works and temporary structures

**Course Outcomes:** Upon completion of this course, student should be able to

- Understand the classification of buildings, criteria for site selection, the impact of climate on building design, and the role of orientation and landscaping in planning
- Apply the principles of planning and interpret building byelaws to design functionally efficient, economical, and regulation-compliant buildings.
- Interpret and implement provisions of the National Building Code (NBC) related to residential buildings and understand basic construction techniques including foundations and masonry.
- Identify and analyze various types of floors, roofs, staircases, doors, windows, and lintels used in building construction and their suitability for different design conditions.
- Demonstrate knowledge of finishing works such as plastering, pointing, and floor finishes, and explain the types, design, and safety aspects of scaffolding, formwork, and centering.

**UNIT - I Fundamentals of Buildings:** Building, Classification of buildings, Site selection for Residential buildings, Climate and its influence on building planning; Elements of Climate, Climatic Zone of India, Climate and comfort, Earth and its motion, Directions and their characteristics, Landscaping. Orientation of buildings; orientation, Factors affecting orientation, Sun, Wind, Rain, CBRT suggestions orientation criteria for Indian conditions.

**UNIT - II Principles of planning and Bye Laws of buildings:** Aspects, prospect, Furniture Requirements, Roominess, Grouping, Circulation, Elegance, Economy, Practical consideration. Buildings bye Laws; Introduction, Objective, Principles, Applicability of building bye Laws. Introduction to National building code, Objectives, Scope, Structure of NBC. General Building Requirements, Guidelines for Residential Buildings. Building Heights, Setbacks, FAR/FSI. Open Spaces, room sizes, Lighting and Ventilation, Means of Access and service ducts. Classification of buildings for fire safety.

**UNIT - III Introduction to building construction and site preparation;** components of Building, Foundations: Functions & Requirements, Types of Shallow Foundations: isolated

footings, combined footings, strap footings, wall footings, raft foundations, Types of Deep Foundations: driven piles (timber, precast concrete, steel), bored cast-in-situ piles.

**UNIT - IV Floors, Roofs, Stairs, Doors:** Types of floors – Ground and upper floors – Brick flooring, Cement concrete flooring, Tiled flooring, Types of roofs – Flat, Pitched, Sloped, Curved roofs Components and classification of staircases – Straight flight, Dog-legged, Open well, Spiral staircases –Types of doors – Panelled, Flush, Glass, PVC, Aluminium, Steel, Sliding, Revolving, and Rolling shutter doors – Door frame materials and fittings.

**UNIT - V Finishing Works:** Plastering – Purpose, types, tools and techniques – Defects in plastering. Pointing – Types and application areas – Differences between plastering and pointing. **Scaffolding, Formwork, and Centering:** Scaffolding – Definition, purpose, components – Types: Single, Double, Cantilever, Suspended, Trestle, Steel and patented scaffolds – Safety considerations. Formwork – Functions, materials (timber, steel, aluminium, plastic), formwork for slabs, beams, columns, and walls – Centering: Definition and role in arches and domes.

#### **TEXT BOOKS:**

1. Benny Raphael (2022) Building Automation from Concepts to Implementation Routledge Publications.
2. Kumara Swamy N. and Kaneswaran Rao A., Building Planning and Drawing, Charotar Publishing House, Revised Edition, 2020.
3. B.C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain, Building Construction, Laxmi Publications, 11th Edition, 2022.
4. S.S. Bhavikatti, Building Materials and Construction, Vikas Publishing House, 4th Edition, 2020.

#### **REFERENCE BOOKS:**

1. Sushil Kumar, Building Construction, Standard Publishers Distributors, 21st Edition, 2022.
2. Bindu Balan and R. Sathish Kumar, Climatology and Building Design, McGraw Hill Education, 1st Edition, 2020.
3. Gurcharan Singh, Building Planning, Designing and Scheduling, Standard Book House, 6th Edition, 2019.
4. Rangwala S.C., Building Construction, Charotar Publishing House, 33rd Edition, 2021.
5. M. Chakraborti, Building Planning and Drawing, Chakraborti Publications, 9th Edition, 2021.
6. Bureau of Indian Standards, National Building Code of India (NBC) – 2016, SP 7, Part 1 & 2, Reprint 2021.

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: CE</b> <b>II Year-II Sem.</b>			
Course Code: <b>N220EA</b>	<b>INNOVATION AND ENTREPRENEURSHIP</b>	L	T	P	C
		<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

### **Course Objectives**

1. To highlight the relevance of creative thinking in the context of Innovation and Entrepreneurship.
2. To provide an overview of the models of creative problem solving.
3. To impart knowledge of the models and methods of developing creative intelligence.
4. To provide an overview of innovation management and theories of outsourcing new product development.
5. To provide a micro and macro perspective of innovation.

### **Course Outcomes: Students will be able to**

1. Gain an understanding of the concepts and processes of creativity and appreciate the need for improving the quality of creativity.
2. Learn the methods of creative problem solving.
3. Orient themselves on developing creative intelligence and unblock their creative energies.
4. Learn the concepts and methods of innovation and ideation and the theories of outsourcing new product development.
5. Develop a perspective of micro and macro level innovation.

**Unit – I: The Creativity Phenomenon:** Creative Cerebration, Creative Personality and Motivation, Creative Environment, Creative Technology, Creativity Training Puzzles of Creativity, Spiritual and Social Roots of Creativity, Essence, Elaborative and Expressive Creativities, Quality of Creativity, Existential, Entrepreneurial and Empowerment Creativities, Criteria for Evaluating Creativity, Credible Evaluation, Improving the Quality of our Creativity.

**Unit–II: Mastering Creative Problem Solving:** Structuring of ill-defined problems, Creative Problem Solving, Models of Creative Problem Solving, Mechanisms of Divergent Thinking, Useful Mechanisms of Convergent Thinking, Techniques of Creative Problem solving

**Unit – III: Creative Intelligence:** Creative Intelligence Abilities, A Model of Creative Intelligence, Convergent Thinking Ability, Traits Congenial to Creativity, Creative Personality and Forms of Creativity, Motivation and Creativity, Blocks to Creativity: Fears and Disabilities, Strategies for Unblocking Energy of your Creativity, Designing Creativogenic Environment.

**Unit – IV: Innovation Management:** Concept of Innovation, Levels of Innovation: Incremental Vs Radical Innovation, Inbound and Outbound Ideation, Open and Other Innovative Ideation Methods. Theories of Outsourcing New Product Development: Transaction Cost, Resource Based, Resource Dependence, Knowledge Based Theories.

**Unit – V: Micro and Macro Perspectives of Innovation:** Systems Approach to Innovation- Innovation in the context of Emerging Economies, Organizational Factors affecting Innovation at the Firm Level, Leadership and Innovations, Open Innovation, Innovation Framework, Innovations Developed by Open Technology Communities.

**Suggested Readings**

- Mike Kennard, *Innovation and Entrepreneurship*, Routledge, 2021.
- Paul Trott, *Innovation Management and New Product Development*, 4e, Pearson, 2018.
- Vinnie Jauhari, Sudanshu Bhushan, *Innovation Management*, Oxford Higher Education, 2014.
- C.S.G. Krishnamacharyulu, R. Lalitha, *Innovation Management*, Himalaya Publishing House, 2010.
- Pradip N. Khandwalla, *Lifelong Creativity, An Unending Quest*, Tata McGraw Hill, 2004.
- Brian Clegg, Paul Birch, *Creativity*, Kogan Page, 2009.
- A. Dale Timpe, *Creativity*, Jaico Publishing House, 2003.

<b>AY: 2025 - 26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE</b> <b>II Year-II Sem</b>			
Course Code: N22011	<b>DESIGN THINKING AND TINKERING LAB</b>	L	T	P	C
		0	0	2	1

**Course Objectives:** The objectives of the course are to

- introduce students to the principles and stages of design thinking, creativity, and user-centered innovation.
- develop students' ability to frame problems and create solutions using iterative and collaborative methods.
- enhance empathy-driven approaches to design and engineering challenges.
- cultivate skills in rapid prototyping, brainstorming, ideation, and effective team collaboration.
- build communication and presentation skills through real-world pitch and innovation exercises.
- promote critical reflection and systems thinking in addressing complex design problems

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

- Apply design thinking methodology (Empathize, Define, Ideate, Prototype, Test) to solve real world problems.
- Use empathy-based research techniques to understand user needs and perspectives.
- Generate innovative ideas using ideation tools like "Yes, and", "Five/Nine Whys", and "Six Thinking Hats".
- Demonstrate the ability to collaborate in multidisciplinary teams and engage in constructive feedback.
- Rapidly prototype and test design concepts within constrained timeframes (e.g., 48-hour challenges).
- Present and pitch design solutions effectively to a target audience or jury.

#### **STUDENTS' RESPONSIBILITIES:**

1. Forming diverse teams of 3–5 members each to work collaboratively throughout the semester.
2. Proactively engaging to observe the objects and interactions in their daily life and society from a design perspective.
3. Identifying general societal and social problems that may be effectively addressed using design thinking principles
4. Presenting and reporting the tasks to the concerned faculty members using their creative communication and people skills.

#### **ACTIVITIES:**

1. Introduction and briefing (15 minutes)
2. Ice-breaker activity (20 minutes)
3. Introduction to Design Thinking (20 minutes)
4. Building empathy for the user (1 hour)
5. Define a problem statement (1 hour)

6. Ideation part 1: Generate ideas and potential solutions (1 hour) Presentation (5 minutes): What is ideation? Activity—worst possible idea (10 minutes) Activity—coming up with solutions (10 minutes) Activity—sharing ideas and getting feedback (10 minutes) Activity—refining your solution (10 minutes) Reflection and discussion (5 minutes)
7. Ideation part 2: User journey mapping (1 hour) Presentation (10 minutes): What is a user journey map? Activity—define the activities and steps in the customer’s experience (15 minutes) Activity—group the steps into phases (10 minutes) Activity—adding goals and pain points (15 minutes) Sharing user journey maps, reflection and discussion (10 minutes)
8. Prototype and test ideas (1 hour) Presentation (5 minutes): Activity—create mobile screens (15 minutes) Activity—add functionality to mobile screens (15 minutes) Activity—user testing (15 minutes) Activity—decide on a winning approach (10 minutes):
9. Debrief and outline next steps (15 minutes)

#### **Exercises:**

1. The Pin-Up Exercise
2. The Systems Thinking Exercise
3. The 48-Hour Crash Course Exercise
4. The Design with Empathy Exercise
5. The Tinker Toy Exercise
6. The Wallet Exercise
7. The Pitch Competition Exercise
8. “Yes, but” vs. “Yes, and” exercise
9. “Five whys” or “Nine Whys” exercise
10. The “Six Thinking Hats” exercise

#### **TEXT BOOKS:**

1. Kumandari Ranga Chari (2024) Applied Design Thinking for Problem Solving - A Tool Kit for Business Practitioners and Managers, BS Publications
2. Tim Brown, “Change by Design”, Harper Business, 2012 (ISBN: 978-0062337382)
3. Donald A. Norman, “The Design of Everyday Things”, MIT Press, 2013 (ISBN: 978 0262525671)
4. Daniel Ling, “Complete Design Thinking Guide for Successful Professionals”, Create Space Independent Publishing, 2015 (ISBN: 978-1514202739)
5. Design Thinking: A guide to creative problem solving for everyone, Andrew Pressman, Routledge Taylor and Francis group, 2019, 1st edition.
6. Engineering Design, George E. Dieter, Linda C. Schmidt, McGraw-Hill Education, 2019, 5th edition.
7. Product design and development, Ulrich, K., Eppinger, S. and Yang, M., 2020, 7th edition.

#### **REFERENCE BOOKS:**

1. Bruno Munari, “Design as Art”, Penguin UK, 2009 (ISBN: 978-0141035819)
2. Tom Kelly, Jonathan Littman, “The Art of Innovation”, HarperCollins Business, 2002 (ISBN: 978- 0007102938)

3. Thomas Lockwood, “Design Thinking: Integrating Innovation, Customer Experience, and Brand Value”, Allworth Press, 2009 (ISBN: 978-1581156683)
4. Joost Groot Kromelink, “Responsible Innovation: Ethics, Safety and Technology”, 2nd ed., TU Delft, Faculty of Technology, Policy and Management, 2019 (e-Book ISBN: 978-9463662024)
5. Jimmy Jain, “Design Thinking for Startups: A Handbook for Readers and Workbook for Practitioners”, Notion Press, 2018 (ISBN: 978-1642495034)

Other Suggested Readings:

1. <https://www.arvindguptatoys.com/>
2. <https://honeybee.org/>
3. <https://dschool.stanford.edu/resources/getting-started-with-design-thinking>
4. <https://designthinking.ideo.com/>



<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE</b> <b>II Year-II Sem</b>			
Course Code: N22012	<b>HYDRAULICS &amp; HYDRAULIC MACHINERY LAB</b>	L	T	P	C
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Course Objectives:** The objective of this Course is to

- Identify the behaviour of analytical models introduced in lecture to the actual behaviour of real fluid flows.
- Explain the standard measurement techniques of fluid mechanics and their applications.
- Illustrate the students with the components and working principles of the Hydraulic machines- different types of Turbines, Pumps, and other miscellaneous hydraulics machines.
- Analyze the laboratory measurements and to document the results in an appropriate format.

**Course Outcomes:** Students who successfully complete this course will have demonstrated ability to:

- Describe the basic measurement techniques of fluid mechanics and its appropriate application.
- Interpret the results obtained in the laboratory for various experiments.
- Discover the practical working of Hydraulic machines-different types of Turbines, Pumps, and other miscellaneous hydraulics machines.
- Compare the results of analytical models introduced in lecture to the actual behavior of real fluid flows and draw correct and sustainable conclusions.
- Write a technical laboratory report

### List of Experiments

1. Verification of Bernoulli's equation
2. Determination of Coefficient of discharge for a small orifice by a constant head method
3. Calibration of Venturimeter/ Orifice Meter
4. Calibration of Triangular/Rectangular/ Trapezoidal Notch
5. Determination of Minor losses in pipe flow
6. Determination of Friction factor of a pipeline
7. Determination of Energy loss in Hydraulic jump
8. Determination of Manning's and Chezy's constants for Open channel flow.
9. Impact of jet on vanes
10. Performance Characteristics of Pelton wheel turbine
11. Performance Characteristics of Francis turbine
12. Performance characteristics of Kaplan Turbine
13. Performance Characteristics of a single stage/multistage Centrifugal Pump

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE</b> <b>II Year-II Sem</b>			
Course Code: N22013	<b>COMPUTER AIDED BUILDING DRAFTING LAB</b>	L	T	P	C
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Course Objectives:** The objective of this Course is to

- Plan buildings as per National Building Code (NBC).
- Understand various types of conventional signs and brick bonds.
- Draw the plan section and elevation for doors, trusses and staircases.
- Use AutoCAD tools to draw building plans, sections and elevations from a given line diagram and specifications.
- Develop working drawings of residential buildings.

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

- Plan buildings as per NBC and use different commands of selected drafting software to draw Conventional signs and brick bonds, Plan, Section and Elevation of buildings.
- Draw section and elevation of panelled doors and trusses.
- Draw and detail the different components of Staircases.
- Develop and draw single/ two storey residential building and public building as per the building by-laws.
- Draw Electrical layout, Plumbing layout for residential buildings.

**List of Experiments:**

1. Planning Aspects of Building systems as per National Building Code (NBC).
2. Brick bonds: English bond & Flemish bond– Odd and Even courses.
3. Developing plan and section of dog-legged staircase.
4. Developing plan of single storied residential building.
5. Developing section and elevation of single storied residential building.
6. Developing plan of single/ two storied Residential building as per Building by-laws.
7. Developing plan of public building as per building by-laws.
8. Developing section and elevation of public building.
9. Development of working drawing of building–Electrical Layout.
10. Development of working drawing of building–Plumbing Layout.

**TEXT BOOKS:**

1. Computer Aided Design Laboratory by M.N. Sessa Praksh & Dr.G.S. Servesh–Laxmi Publications.
2. Engineering Graphics by P.J. Sha–S. Chand&Co.
3. Civil Engineering Drawing-I by N. Sreenivasulu, S. Rama Rao–Radiant Publishing House.

**REFERENCE BOOKS:**

1. Civil Engineering Drawing-I by S. Mahaboob Basha– Falcon Publishers
2. Building drawing by M.G. Shah-Tata McGraw-Hill Education
3. Structural Engineering Drawing by S. Mahaboob Basha–Falcon Publishers

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE</b> <b>II Year-II Sem</b>			
Course Code: N22014	<b>DIGITAL SURVEYING LAB</b>	L	T	P	C
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Course Objectives:** The objective of this Course is to

- familiarize students with advanced survey instruments such as Total Station, Digital Level, and GPS.
- provide hands-on training in digital data collection and interpretation.
- enhance the capability of students in applying modern survey techniques in civil engineering practices.

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

- Handle and operate Total Station, GPS, and Digital Level effectively.
- Perform field surveys, including traversing, levelling, and contouring using digital instruments.
- Transfer and process survey data using basic CAD/GIS tools.
- Develop topographical maps based on digital survey data.
- Develop reports based on digital survey data.

**List of Experiments** (Two Hours/Week):

1. Introduction and demonstration of digital surveying instruments.
2. Setting up and calibration of the Total Station.
3. Measurement of distances, angles, and coordinates using a Total Station.
4. Traversing and plotting with Total Station.
5. Area and volume computations using digital survey data.
6. Profile and cross-section levelling using Total Station.
7. Introduction to GPS surveying – types and working principles.
8. Static and dynamic GPS survey using handheld devices.
9. Route tracking and waypoint marking with GPS.
10. Digital levelling – procedure and applications.
11. Contouring using Total Station and digital level.
12. Data extraction and plotting in AutoCAD or similar software.
13. Group mini-project: topographical survey of a given area.
14. Project data processing and map/report preparation.
15. Project presentation and viva-voce.

**SOFTWARE/TOOLS TO BE USED:**

- Total Station (Leica, Sokkia, or equivalent)
- Digital Level • GPS Devices (Handheld or DGPS)
- Surveying Software: AutoCAD / Civil 3D / GIS (optional introduction)

**RECOMMENDED BOOKS AND MANUALS:**

1. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Surveying Vol. 1 & 2, 18th Edition, 2020, Laxmi Publications Pvt. Ltd., ISBN: 9789380856596.
2. Satheesh Gopi, Advanced Surveying: Total Station, GIS and Remote Sensing, 2nd Edition, 2017, Pearson Education India, ISBN: 9789332587697.
3. R. Subramanian, Surveying and Levelling, 2nd Edition, 2014, Oxford University Press, ISBN: 9780199456154.
4. N.N. Basak, Surveying and Levelling, 3rd Edition, 2017, McGraw Hill Education (India), ISBN: 9789353161598.
5. Satheesh Gopi, GPS Surveying: Theory and Applications, 1st Edition, 2015, Pearson Education India, ISBN: 9789332541088.
6. Total Station and GPS Surveying – User Manuals, Manufacturer Guides (Leica Geosystems, Sokkia, Topcon, etc.).

<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>II Year-II Sem</b>			
Course Code: N2200C	<b>INDIAN KNOWLEDGE SYSTEM</b>	L	T	P	C
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

Bharat is considered one of the oldest civilizations of the world. Some of the archaeological evidences proved the existence of Indus Valley Civilization in 7000 B.C. Bhartiya traditions, culture, cultural activities, rituals, sacraments, painting, art of dancing, art of singing etc. is being practised till the modern times without knowing scientific approaches behind that. Eternity of Indian knowledge system proved itself that not only many rituals but also many traditions, many streams of knowledge like astrology, mathematics, physics, chemistry, biology, language studies, yoga and meditation had been following from the starting till now with some changes, in the form of traditions.

This course is for undergraduate students to inculcate Indian values. It will promote advance study and inter disciplinary research on all aspects of the Indian knowledge system

**Course Objectives:**

1. To provide a tribute of the rich culture and traditions of Indian knowledge system to students of various disciplines.
2. To introduce historical account on the education and scientific literature available in ancient Indian traditions and its connections with ancient Indian Philosophy
3. To give insights about the applications of Bharatiya Jnana Parampara
4. To introduce Indian approach towards health and wellbeing
5. To elaborate vast contribution of ancient Indian researchers, engineers, scientists and architects to the modern world.

**Module 1: Introduction to Indian Knowledge Systems:**

Meaning, Nature, Scope and Salient Aspects of Bharatiya Jnana Parampara - Introduction to Vedas, Upanishads, Vidya, Kala, Jnana, Shastra - Practices and Continuity of Tradition

**Module 2: Overview of History of Indian Education and Scientific Literature**

Gurukul System - Role of Sanskrit in Natural Language Processing - Scientific Literature - Vedic Literature - Available Scientific Treatises - Interlinkings

**Module 3: Introduction to Scientific Theories from Pure Sciences from Ancient Indian Knowledge Systems**

Overview of theories from available ancient Indian Literature about Physics, Chemistry and Mathematics - Interlinkings and applications

**Module 4: Introduction to Ancient Indian Wellness Systems**

Concept of Wellness – Yoga System - Ayurveda System - Ancient Indian Aesthetics

**Module 5: Development of Engineering, Science, Technology & Fine Arts in India**

Various Industries - Silk, Cotton and Ship Building - Evolution of Indian Fine Arts – Cave and Temple Architecture, Vastu - Vidya, Sculpture, Forts and Stepwells, Observatories and Paintings - Music and Natyakala - Cultural Traditions & Folk Arts.

**❖ Pedagogy for Teachers: Apart from Class Room Instruction, the following Methods are Suggested.**

1. Project based activities and learning.
2. Presentation and case studies.
3. Film screening and book reviews.
4. Visit to historical places, archives centre, research centre or library nearby.

Note: Activities mentioned above are only suggestive. Teacher-educators should encourage students to be innovative.

**TEXT BOOKS:**

1. B. Mahadevan, Bhat Vinayak and Nagendra Pavan R.N., (2022) 'Introduction to Indian Knowledge Systems: Concepts and Applications' PHI learning PVT, New Delhi ISBN [9789391818203]
2. Dharmapal (1971) 'Indian Science and Technology in the Eighteenth Century'. Other India Press, Goa.
3. Kapil Kapoor, Singh Avdhesh Kumar, (2005) 'Indian Knowledge Systems' D.K. Printworld (P)Ltd. ISBN 10: 8124603367 / ISBN 13: 9788124603369
4. Chakradeo, Ujwala, Temples of Bharat, Aayu Publications, New Delhi, 2024.
5. D.N. Bose, S.N. Sen and B. V. Subbarayappa, A Concise History of Science in India, Indian National Science Academy, New Delhi, 2009.
6. Datta B. and A. N. Singh, History of Hindu Mathematics: Parts I and II, Asia Publishing House, Bombay, 1962.
7. Kapoor, K. (2021), Indian Knowledge System: Nature, Philosophy, Character in Indian Knowledge System, vol. 1, Pub. Indian Institute of Advanced Studies, Shimla
8. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), Philosophical Systems, in Introduction to Indian Knowledge System, Pub. PHI Learning, New Delhi.
9. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), Knowledge: Framework and Classification, in Introduction to Indian Knowledge System, Pub. PHI Learning, New Delhi.

**Video Resources:**

1. Introductory lectures by Prof. Gauri Mahulikar
2. Introductory lectures by Prof. Kapil Kapoor

**E-Resources:**

- <https://iksin dia.org/index.php>
- Official Website of IKS- Indian Knowledge System
- <https://www.youtube.com/watch?v=uKcf-hSlcUE>
- Address by Prof Kapil Kapoor | Indian Institute of Advanced Study (FDP 2021)
- [https://www.youtube.com/watch?v=MDJTXNiH2\\_A](https://www.youtube.com/watch?v=MDJTXNiH2_A)
- Mukul Kanitkar on Bharatiya Knowledge System
- <https://www.youtube.com/watch?v=uARMhv97pjk>
- <https://www.youtube.com/watch?v=oTwgf56GbsA>
- Scientific History of India | Mukul Kanitkar Lecture in DTU
- <https://youtu.be/gNJNmPJqXJc?si=WFBbuUT65mLZzpOW>
- Ancient India's Scientific Achievements & Contribution in Mathematics, Astronomy, Science & Medicine

**Course Outcomes:**

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

- CO1:** Understand nature, scope and related fields of Indian knowledge system.
- CO2:** Demonstrate the scientific literature available in ancient Indian traditions.
- CO3:** Understanding the application of Bharatiya Jnana Parampara.
- CO4:** Understand Indian approach towards Wellbeing
- CO5:** Appreciate vast contribution of ancient Indian researchers, engineers, scientists and architects to the modern world.



<b>AY: 2025-26</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>II Year-I / II</b> <b>Sem</b>			
Course Code:	<b>LINGUASKILL FOR PROFESSIONALS-B2</b> <b>(Audit Course)</b> (COMMON TO ALL)	L	T	P	C
Credits: 0		2	0	0	0

**Pre-Requisites: A1-B1 levels (CEFR)**

**COURSE OBJECTIVES:**

To enable students

6. Acquire an extensive range of vocabulary related to diverse topics.
7. Enhance pronunciation skills, focusing on specific sounds and intonation patterns
8. Improve the use of various grammar concepts
9. Strengthen listening, speaking, reading, and writing skills across different proficiency levels
10. Develop practical language skills for everyday communication scenarios

**Module 1 (6L)**

**UNIT-1**

**Grammar:** Tenses, Clauses and Conditionals, Questions

**Vocabulary:** Character adjectives, Words connected with 'get', trying and succeeding

**Pronunciation:** Letter 'e' and 'g'; Rapid speech, Intonation in Question tags

**UNIT-2**

**Everyday English:** Breaking off a conversation; Explaining and checking understanding; Agreeing; giving compliments and responding

- **Listening:** Listening Activity 1, Listening Activity 2 (A1 Level)
- **Reading:** Reading Activity 1, Reading Activity 2 (A1 Level)
- **Speaking:** Speaking Activity 1, Speaking Activity 2 (A1 Level)

**Writing:** Articles, Guidelines

**Module 2 (6L)**

**UNIT-1**

**Grammar:** Multi-word verbs; *used to* and *would*

**Vocabulary:** Words related to ability, achievements and sports; cause and result

**Pronunciation:** Constant sounds; sound 'u'; word stress

**UNIT -2**

**Everyday English:** Making suggestions; describing photos; expressing disagreement

- **Listening:** Listening Activity 1, Listening Activity 2 (A2 Level)
- **Reading:** Reading Activity 1, Reading Activity 2 (A2 Level)
- **Speaking:** Speaking Activity 1, Speaking Activity 2 (A2 Level)

**Writing:** Job Application, For and against essay

**Module 3 (6L)**

**UNIT-1**

**Grammar:** Infinitives and -ing forms; passives

**Vocabulary:** Attitude adjectives; words related to natural world and travel

**Pronunciation:** Sound 'th'; consonant clusters; intonation

**UNIT-2**

**Everyday English:** Responding to an idea; Discussing advantages and disadvantages

- **Listening:** Listening Activity 1, Listening Activity 2 (B1 Level)
- **Reading:** Reading Activity 1, Reading Activity 2 (B1 Level)
- **Speaking:** Speaking Activity 1, Speaking Activity 2 (B1 Level)

**Writing:** Travel blog, Complaint email

## Module 4

(6L)

### UNIT-1

**Grammar:** *too, enough, so/such*

**Vocabulary:** Words related to life in cities, money and finance, crime and film

**Pronunciation:** Sound 'o', 'I'

### UNIT-2

**Everyday English:** Imagining, vague language, encouraging

- **Listening:** Listening Activity 1, Listening Activity 2 (B1+ Level)
  - **Reading:** Reading Activity 1, Reading Activity 2 (B1+ Level)
  - **Speaking:** Speaking Activity 1, Speaking Activity 2 (B1+ Level)
- Writing:** Review, Opinion essay

## Module 5

(6L)

### UNIT-1

**Grammar:** Relative clause, reported speech

**Vocabulary:** Words related to health, thought and knowledge

**Pronunciation:** Sound 'ui'; linking

### UNIT-2

**Everyday English:** Expressing uncertainty, clarifying a misunderstanding, interrupting and announcing a news

- **Listening:** Listening Activity 1, Listening Activity 2 (B2 Level)
  - **Reading:** Reading Activity 1, Reading Activity 2 (B2 Level)
  - **Speaking:** Speaking Activity 1, Speaking Activity 2 (B2 Level)
- Writing:** Story

## Text Books

6. Doff, Adrian, et al. *Empower Second Edition Student's Book with Digital Pack: B2 Upper Intermediate*. Cambridge University Press, 2022.

## Reference Books

8. Cullen, Pauline, et al. *The Official Cambridge Guide to IELTS for Academic and General Training: Student's Book with Answers*. with DVD-ROM. Cambridge Univ. Press, 2014.

## E-Resources

5. [Cambridge English](#)
6. [English with Cambridge - YouTube](#)
7. [BBC Learning English - Learn English with BBC Learning English - Homepage](#)
8. <https://englishonline.britishcouncil.org/>

## Course Outcomes

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

**CO1.** Demonstrate a diverse vocabulary repertoire, facilitating better expression and comprehension.

**CO2.** Exhibit intelligible pronunciation skills, ensuring clearer oral communication.

**CO3.** Utilise various grammar concepts accurately and coherently.

**CO4.** Strengthened language skills across listening, speaking, reading, and writing.

**CO5.** Apply practical language skills effectively in everyday communication scenarios.

**CO-PO/PSO Mapping**

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-
<b>CO2</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-
<b>CO3</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-
<b>CO4</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-
<b>CO5</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-
<b>Average</b>	-	-	-	-	-	-	-	-	2	2	-	3	-	-

**Correlation: 3–Strong; 2–Medium; 1-Weak**