

**ACADEMIC REGULATIONS**  
**COURSE STRUCTURE AND**  
**DETAILED SYLLABUS**

**MECHANICAL ENGINEERING**

**B. TECH FOUR YEAR UG COURSE**

(Applicable for the batches admitted from 2022-2023)

**REGULATION: R22**  
**(I & II Year Syllabus)**



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

(UGC AUTONOMOUS)

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

# INSTITUTE-VISION AND MISSION

## VISION:

To be a Centre of Excellence in Engineering and Management Education, Research and Application of Knowledge to benefit Society with blend of Ethical Values and Global Perception.

## MISSION:

**M1:** To provide world class engineering education, encourage research and development.

**M2:** To evolve innovative applications of technology and develop entrepreneurship.

**M3:** To mould the students into socially responsible and capable leaders.



# DEPARTMENT-VISION AND MISSION

## VISION:

To be a premier center for producing comprehensive Mechanical Engineers with a niche in Research and Innovation useful to the society.

## MISSION:

**M1:** To educate by imparting knowledge and skills in the field of Mechanical Engineering and engage in continuous learning.

**M2:** To collaborate with reputed research and development organizations, educational institutions, industry and alumni for gaining exposure to real time technological challenges.

**M3:** To facilitate entrepreneurial attitude in addressing the dynamic needs of the society, ethically and morally.



## **Program Educational Objectives (PEOs)**

### **PEO1**

Amalgamate knowledge and skills to identify, formulate and solve wide range of Mechanical Engineering systems.

### **PEO2**

Respond to challenges in the field of Mechanical Engineering and provide cost effective solutions as a researcher and entrepreneur.

### **PEO3**

Address interdisciplinary technological needs by adopting optimal unitization of diversified technological developments.

### **PEO4**

Be able to lead project management teams successfully with utmost concern to professional ethical practices associated with society and environment.

## **Program Outcomes and Program Specific Outcomes of Mechanical Engineering Department (Pos & PSOs)**

**PO1: Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

**PO2: Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

**PO3: Design / Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.

**PO4: Conduct investigations of complex problems:** using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.

**PO5: Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6: The Engineer and Society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

**PO7: Environment and Sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

**PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

**PO9: Individual and Teamwork:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

**PO10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.

**PO11: Project Management and Finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12: Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Any signatory needs to provide an overview of its learning outcomes and confirm that compliance of programs.

**PSO1**

Able to apply knowledge of design, analysis, development in implementation of the trending multidisciplinary technologies

**PSO2**

Able to convert creative ideas into cost effective and viable solutions from technological and societal perspective

# **JBIET Academic Regulations - R22**

Applicable to

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

(For the Batches admitted from the Academic Year 2022- 2023)

&

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

(For the Batches admitted from the Academic Year 2023- 2024)



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

**(UGC Autonomous)**

**JBIET Academic Regulations - R22**

Applicable to

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

(For the Batches admitted from the Academic Year 2022- 2023)

**&**

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

(For the Batches admitted from the Academic Year 2023- 2024)

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

JB Institute of Engineering and Technology (hereinafter referred to as JBIET) academic regulations **JBIET - R22** are given here under. These regulations approved by the Academic Council shall be in force and applicable from the academic year 2022-23 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 2022-23.

<b>S. No.</b>	<b>Branch Code</b>	<b>Branch Name</b>
1	<b>01</b>	Civil Engineering (CE)
2	<b>02</b>	Electrical and Electronics Engineering (EEE)
3	<b>03</b>	Mechanical Engineering (ME)
4	<b>04</b>	Electronics and Communication Engineering (ECE)
5	<b>05</b>	Computer Science and Engineering (CSE)
6	<b>12</b>	Information Technology (IT)
7	<b>19</b>	Electronics and Computer Engineering (ECM)
8	<b>25</b>	Mining Engineering (MIE)
9	<b>66</b>	Computer Science and Engineering (Artificial Intelligence and Machine Learning)-CSE(AI&ML)
10	<b>67</b>	Computer Science and Engineering (Data Science)-CSE(DS)
11	<b>72</b>	Artificial Intelligence and Data Science(AI&DS)
12	<b>73</b>	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 (EAMCET) 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 instructions for the entire Undergraduate Programme in Engineering & Technology is English only.

## 3.0 Duration of the UG Program

Each Under Graduate (**UG**) Programme is of 4 Academic Years (8 Semesters) with the Academic Year divided into two Semesters of 22 weeks ( $\geq 90$  instructional days) each. Each Semester is having "**Continuous Internal Evaluation (CIE)**" and "**Semester End Examination (SEE)**" under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC. The guidelines issued by JNTUH, AICTE and NEP-2020 are followed while designing curriculum / course structure.

**3.1 Minimum Duration:** The minimum (normal) duration of the B. Tech. Programme for the student securing admission under Regular mode is *Four Academic Years (8 Semesters)* and for the student admitted under Lateral Entry Scheme is *Three Academic Years (6 Semesters)* starting from the commencement of the First Year First Semester.

**3.2 Maximum Duration:** A student admitted under Regular mode shall complete the B. Tech Programme in a maximum period of Eight Academic Years (16 Semesters) and the student admitted under Lateral Entry Scheme shall complete the B. Tech Programme in a maximum period of Six Academic Years (12 Semesters) starting from the date of commencement of First Year First Semester.



## 4.0 B. Tech Programme Structure

The curriculum B. Tech Programme includes various curricular components like Foundation Courses (BS, HS and ES), Core Courses (PC, PW), Elective Courses (PE & OE), Audit Courses (AC), Mandatory Courses (MC) etc. The details of these courses and typical breakup of credits for each category is mentioned in the tables given below.

### 4.1 Subject/ Course Classification

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes Mathematics, Physics and Chemistry subjects
2		ES- Engg. Sciences	Includes fundamental engineering subjects
3		HS – Humanities and Social sciences	Includes subjects related to Humanities, Social sciences and Management
4	Core Courses (CoC)	PC– Professional Core	Includes core subjects related to the parent Discipline/ department/ branch of Engineering.
5		PW- Project Work	B. Tech project or UG project or UG major project or Project Stage I & II
6		Industrial training / Mini- project	Industrial training/ Summer Internship/ Industry Oriented Mini-project/Mini-project
7	Elective Courses (EIC)	PE – Professional Electives	Includes elective subjects related to the parent discipline/ department/ branch of Engineering.
8		OE – Open Electives	Elective subjects which include inter- disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering.
9	Seminar	Seminar	Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering.
10	Audit courses (AC)	-	Value Added Course / Audit Courses (Non-Credit)
11	Mandatory Courses(MC)	-	Mandatory Courses (Non-credit)

#### 4.2 Typical Breakup of Credits for each Category:

S.No	Category	Breakup of Credits
1	Humanities and Social Sciences (HS)- including Management.	10
2	Basic Sciences (BS)- Courses including Mathematics, Physics and Chemistry.	23
3	Engineering Sciences (ES)-Courses including Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Computer Engineering.	22
4	Professional Core (PC)-Courses relevant to the chosen specialization / branch.	57
5	Professional Electives (PE)-Courses relevant to the chosen specialization / branch.	18
6	Open Elective (OE) - Courses from other technical and / or emerging subject areas.	15
7	Mini-project / Project Work / Internship / Industrial training / Seminar	15
8	Mandatory Courses / Audit Courses.	Non-Credit
<b>TOTAL</b>		<b>160</b>

**5.0 Credit System:** The student has to register for all the courses offered in a Semester. The credits assigned for each course are indicated in an L: T: P/D: C (Lecture periods: Tutorial periods: Practical/Drawing periods: Credits) pattern as follows:

- Theory Courses: One Lecture Hour (L) per week in a semester: 01 Credit
- Practical Courses: One Practical Hour (P) Per week in a semester: 0.5 Credit
- Tutorial: One Tutorial Hour (T) Per week in a semester: 01 Credit
- Mandatory Courses: No CREDIT is awarded.
- Audit Courses: No CREDIT is awarded.

For Internship and Project Work credits are assigned based on the complexity of the work to be carried out.

The four-year curriculum of any B. Tech Program of study shall have a total of 160 credits. However, the curriculum for students admitted under lateral entry shall have a total of 122 credits.

**6.0 Choice Based Credit System (CBCS):** Choice Based Credit System (CBCS) is introduced in line with UGC guidelines in order to promote:

- Student centred learning
- Students to learn courses of their choice
- Interdisciplinary learning

A Student has a choice of registering for courses comprising program core, professional electives, open electives, value added, Skill oriented courses etc. Besides, choice is also offered to students for registering courses to earn Minor in Engineering / Honours degree.

## **7.0 Course Registration**

**7.1.** A faculty advisor or mentor shall be assigned to a group of 20 students, who can advise the students about the Programme, it's course structure and curriculum, choice/option for subjects/ courses, based on their competence, progress, pre-requisites and interest.

**7.2** Before the commencement of every semester, all the students shall register for the courses offered in that semester through online registration process

**7.3** A student can apply for registration, only after obtaining the 'written approval' from faculty advisor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with Head of the Department, faculty advisor and the student.

**7.4** If any student fails to register courses in a semester, he/she shall undergo the courses as per the course structure decided by the Head of the Department.

**7.5** If any student submits ambiguous choices or multiple options or erroneous entries during registration for the subject(s) / course(s) under a given / specified course group / category as listed in the course structure, the subject / courses decided by the Head of the Department will be final.

**7.6** After registering for a course, a student shall attend the classes, to satisfy the attendance requirements, earn Continuous Internal Evaluation (CIE) Marks and appear in Semester End Examinations (SEE).

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

**7.8 Open Electives:** The students have to choose requisite number of open electives (as prescribed in the course structure) from the list of open electives. However, the student cannot opt for an open elective subject offered by his own (parent) department, if it is already listed under any category of the subjects offered by parent department in any semester.

**7.9 Professional Electives:** The students have to choose requisite number of professional electives (as prescribed in the course structure) from the list of professional electives.

**7.10 Elective Courses** (Professional Electives and Open Electives) shall be offered by a Department if a minimum of 30 students register for that course.

## **8.0. Academic Requirements**

### **8.1 Attendance Requirements**

**8.1.1** A student shall be eligible to appear for the Semester End Examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects / courses (excluding attendance in Mandatory Courses and Audit Courses) for that semester. The attendance of Mandatory and Audit Non-Credit Courses should be maintained separately. Two periods of attendance for each theory subject shall be considered if the student appears for the mid-term examination of that subject.

**8.1.2** Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned by the College Academic Committee (CAC) on genuine and valid grounds, based on the student's representation with supporting evidence.

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

**8.1.4** A stipulated condonation fee as decided by the CAC is payable for condoning shortage of attendance.

**8.1.5** Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled. They will not be promoted to the next semester.

**8.1.6** Students will not be promoted to the next semester and no grade allotments or SGPA / CGPA calculations will be done for such students for the entire semester in which they have been detained.

**8.1.7** A student detained in a semester due to shortage of attendance may be readmitted in the same semester as and when offered in the forthcoming academic years for fulfilment of academic requirements. The academic regulations under which a student has been readmitted shall be applicable.

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

## **8.2 Credit Requirements**

8.2.1. A student should earn credits allotted for each of the course by securing minimum marks designated as passing standard for that course.

8.2.2. A student shall be admitted under regular scheme, register for all 160 credits offered and has to earn all the credits (A student admitted under Lateral entry scheme shall register for all 122 credits offered and all the credits). However the

student shall be eligible to avail the benefits that the JNTUH University announces such as exemption of subjects and grace marks for batches admitted during the academic years same as these students.

**8.2.3.** A student shall register for all mandatory courses mentioned in the curriculum and get minimum pass marks (i.e., 40% of total marks) to get the degree. Grade points obtained in these courses will not be considered for awarding class.

## **9.0 Break of Study from a Program (Gap Year)**

**9.1** A student is permitted to go on break of study for a maximum period of two years either as *two breaks of one year each* or a *single break of two years after completion of II year II semester*.

**9.2** In case, a student wishes to extend the gap year for one more consecutive year, he shall be permitted with the prior approval of the Principal on the recommendations of the Head of the Department prior to the beginning of the semester in which he has taken break of study.

**9.3** The student shall apply for break of study in advance, in any case, not later than the last date of the first assessment period in a semester. The gap year concept is introduced *for start-up (or) incubation of an idea, National/International Internships, and professional Volunteering*. Student taking break of study shall submit an application to the Principal through the Head of the department. A committee shall be appointed by the Principal in this regard. Based on the recommendations of the committee, Principal shall decide whether to permit the student to avail the gap year or not.

**9.4** The students permitted to rejoin the program after break of study shall be governed by the Curriculum and Regulations in force at the time of rejoining. The students rejoining in new regulations shall apply to the Principal in the prescribed format through Head of the Department, at the beginning of the readmitted semester for registering additional / equivalent courses to comply with the curriculum in-force.

**9.5** The period of break of study *shall be counted in the maximum* Period of graduation (i.e the maximum period of graduation is 8 years for Regular admitted students and 6 years for Lateral Entry admitted students availing Gap Year).

**9.6** If a student has not reported to the college after completion of the approved period of break of study he is deemed to be detained in that semester. Such students are eligible for readmission into the semester when offered next.

## 10.0. Evaluation-Distribution and Weightage of marks

**10.1** The performance of a student in all theory and Laboratory courses shall be evaluated for 100 marks each, with **40 marks** allotted for **Continuous Internal Evaluation (CIE)** and **60 marks** for **Semester End-Examination (SEE)**.The details of course-wise allotment of marks are given below.

S. No.	Course	Marks	
		CIE	SEE
1	Theory courses	40	60
2	Laboratory courses	40	60
3	Mandatory courses	100	--
4	Audit Courses	--	--
5	Internship- I	50	--
6	Internship- II	50	--
7	Mini Project	50	--
8	Project Stage - I	100	--
9	Seminar	50	--
10	<b>Project Stage - II</b>	<b>40</b>	<b>60</b>

## 10.2. Continuous Internal Evaluation (CIE)

**10.2.1 Theory Courses:** For theory courses, during the semester there shall be 2 mid-term examinations (*internal exams of 20 marks each*), 2 quizzes of 5 marks each), 4 Unit tests of 10 marks each and 2 assignments carrying 5 marks each.

S. No	Component	Frequency of Evaluation	Marks for Each test	Final Marks (Average)
1	Mid Examinations	2	20	
2	Quiz Test	2	5	
3	Unit Tests	4	10	
4	Assignments	2	5	
Total			40	40

(a) **Quiz Examinations (5 marks):**

Each quiz examination will be of 20 minutes duration consisting of objective questions for 5 marks. The objective question paper is set with 20 questions of multiple choice, fill-in the blanks and matching type of questions. The Quiz examination shall be conducted after each spell of instructions.

(b) **Mid-term Examinations (20 marks):**

Each mid-term examination will be of 1 hour 20 minutes consisting of descriptive questions (long answer) for 20 marks. The descriptive paper is four questions of 5 marks each with either / or choice. The Mid-I shall be conducted after first spell of instructions covering the syllabus of Modules I and II. The Mid-II shall be conducted after second spell of instructions covering the syllabus of Modules III, IV and V.

(c) **Unit Tests (10 Marks):**

The Unit Tests shall be conducted by the faculty member handling the subject. The duration of Unit Test shall be 1 hour. The question paper of Unit Test shall be of descriptive type with 3 questions each of 5 marks out of which student shall answer any two. Unit Test-1 and 2 shall be conducted before I Mid Term Examination covering the syllabus of Module-1, Module-2 respectively. Unit Test-3 and 4 shall be before II Mid Term Examination covering the syllabus of Module-3, Module-4 and Module-5 respectively. The average of marks obtained from Unit Test 1,2 and the



average of marks obtained Unit Test 3,4 is to be considered for CIE-I and CIE-II respectively.

(d) **Assignments (5 marks):**

There shall be two assignments for 5 marks each. Assignment-1 shall be submitted before First mid examinations covering the topics from Module-1 and Module-2, and the Assignment-2 shall be submitted before Second mid examinations covering the topics from Module-3, Module-4 and Module-5. The assignments are used to test the student in Bloom's higher order thinking skills.

- (e) If a student is absent for any Mid-Term Examinations on medical grounds / due to any emergency / unavoidable circumstances, the student may be permitted to apply for makeup examinations within a week after completion of Mid-Term Examinations. A sub-committee with the following composition will look into such cases. Student shall pay Rs.200 per subject as registration fee in which he/she is appearing for re-examination.

S. No	Faculty Member	Designation
1	Concerned Head of the Department	Chairman
2	Faculty nominated by Principal	Member
3	Senior faculty member of the concerned Department	Member
4	Class Teacher of the class/section	Member

### **10.2.2 Laboratory Courses**

Continuous Internal Evaluation (CIE): The continuous internal evaluation for laboratory courses is based on the following parameters:

There shall be Day-to-Day Evaluation for 30 marks which includes day to day Attendance (5 Marks), observation writing(5 Marks), Experimental setup/Program writing(5 Marks), Experiment conduction/Program Execution(5 Marks), Record writing(5 Marks), Viva Voce(5 Marks).

Internal laboratory examination (ILE) for 10 marks shall be conducted by the faculty member handling the laboratory. ILE shall be conducted after Second spell of instructions.

S.No	Component	Marks
1	Day-to-Day Evaluation	30
2	Internal Examination	10
	Total	40

### 10.3 Semester End Examinations (SEE)

#### 10.3.1 Theory Courses

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

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from each unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.
- The duration of Semester End Examination is 3 hours.

**10.3.2 Laboratory Courses** The performance of the student in laboratory courses shall be evaluated for **60 marks** jointly by Internal and External Examiners for 3 hours duration.

#### 10.4 Internship

The students should undergo two Internships. Internship-I shall be carried out under the guidance of professors from Science, Basic engineering subjects, with topics having some social relevance. The Internship-I is to be taken up during the summer vacation after I Year II Semester Examination and it will be evaluated in II Year I semester for 50 marks. However, the process might be initiated before the end of I Year II Semester by the concerned department. The students admitted under Lateral Entry Scheme (LES) shall carry out internship in the area of their Diploma specialization under the guidance of a faculty member of that Department immediately in the first month, after their joining of the course.

The Internship-II is to be taken up during the summer vacation after II Year II Semester examination and it will be evaluated in III Year I semester for 50 marks. However, the process might be initiated before the end of II Year II Semester by the concerned department.

For both the Internships, the student shall submit a report on the training undergone. The internships shall be evaluated by a three-member committee constituted by the Head of Department to assess the student performance on the following parameters. There shall be no Semester End Examinations for the Internships.

<b>Parameter</b>	<b>Marks</b>
Internship report	15
Quality of work	15
Presentation	15
Viva-Voce	5
Total	50

### **10.5 Industry Oriented Mini Project**

A student is required to undergo a Mini Project of his/her choice during the vacation after III Year II Semester Examination by applying theoretical concepts to develop a practical component /element/system that includes design/ testing/ analysis. The performance of a student in the Mini Project shall be evaluated in IV Year I Semester by a three-member committee constituted by the HoD as per the following parameters:

<b>Parameter</b>	<b>Marks</b>
Mini Project report	15
Quality of work	15
Presentation	15
Viva-Voce	5
Total	50

The performance of a student in Mini Project shall be evaluated based on two reviews, each carrying 50 marks. The average marks of these two reviews will be awarded. **There shall be no Semester End Examination** for the Industry Oriented Mini Project.

### **10.6 Seminar**

There is a Seminar in IV Year II Semester for 50 Marks. The student shall deliver a seminar on any emerging topic of his / her choice from the core technical domain. The student shall submit a duly-certified Seminar report. A three-member committee constituted by the HoD will evaluate the Seminar report submitted by the student. **There shall be no Semester End Examination.**

If a student is absent for seminar on medical grounds / due to any emergency / unavoidable circumstances, the student may be permitted to reappear within a month.

### **10.7 Project Work**

The student is required to undertake a Project Work by using the knowledge acquired by him / her during the course of study. The student is expected to design and build a complete system or subsystem on his / her area of interest. The Project Work consists of two parts namely, Project Stage -I (Project Survey) and Project Stage – II (Project Implementation). Project Stage – I is carried out during IV Year I Semester and the Project Stage – II during IV Year II Semester. A project work shall be taken up by a batch of students not exceeding 4 members under the guidance of a faculty supervisor.

For Project Stage – I, the Project Review Committee (PRC) consisting of Head of the Department, Project Coordinator, Project supervisor and one senior faculty member shall evaluate the Project Work for 50 marks. **There shall be no End Semester Evaluation for Project Phase-I.** The student is deemed to have failed, if he

- (i) does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule
- (ii) Secures less than 40% marks in the CIE.

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

For Project Stage – II, Project Review Committee (PRC) consisting of Head of the Department, Project supervisor, Project Coordinator and a senior faculty member **shall evaluate for 40 marks as continuous evaluation**. The External Examiner shall **evaluate the Project work for 60 marks as Semester End Examination**. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - II, or does not make a presentation of the same before the External Examiner as per schedule, or (ii) Secures less than 40% marks in the sum total of the CIE and SEE taken together. The student is deemed to have failed, if he

- (i) does not submit a report on Project Stage - II, or does not make a presentation of the same before the external examiner as per schedule.
- (ii) Secures less than 40% marks in the sum total of the CIE and SEE taken together.

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

For conducting Viva-Voce of Project Stage – II, Principal selects the External Examiner from the list of experts in the relevant branch of engineering submitted by the concerned Head of Department.

### **10.8 Mandatory Courses (MC)**

Mandatory courses carry "ZERO" credits. There shall be NO Semester-end examination. However, attendance in Mandatory courses shall be considered while calculating aggregate attendance in a semester. The Continuous Internal Evaluation (CIE) shall be conducted and evaluated for 40 marks similar to the Theory courses. In addition to this an internal Examination for 60 marks covering the syllabus from all five modules. The student shall be declared to have passed the mandatory courses only when he/she secures 40% marks in the internal evaluation carried out for 100 marks. If the student fails, a re-examination shall be conducted for such candidates in

the following semester before the supplementary examinations. The performance of the student shall be indicated in the grade sheets "PASS" (or) "FAIL" Only. The student should pass all the mandatory courses, for the award of B.Tech degree.

### **10.9 Audit Courses (AC)**

Audit courses carry **zero** credits. There shall be No mid-term and Semester end examination. However, attendance in audit courses shall be considered while calculating aggregate attendance in a semester. The student should study all the audit courses. No credits will be assigned to these courses. A separate certificate will be issued by the Head of the institution on satisfactory completion of Audit Courses.

The student may be permitted to register Mandatory courses and Audit courses as MOOCs offered by SWAYAM / NPTEL / EdX / Coursera / Udacity / Udemy /upgrad/ Khan Academy / Edureka / QEEE etc. The student shall submit weekly assessment report to the faculty coordinator as mentioned in 13.1 and the same shall be considered for internal marks and attendance.

## **11.0 Passing Standards**

**11.1** A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each subject/ course/ Laboratories/ Project Stage-II etc. which are having both CIE and SEE, only if he/she secures not less than **35% of marks (21 out of 60 marks)** in the semester end examination and a **minimum of 40% of marks (40 marks out of 100) in the sum total** of the *continuous internal evaluation (CIE) and semester end examination (SEE)* taken together.

**11.2** A student is deemed to have fulfilled the minimum academic requirements and earned the credits allotted to subjects having only internal evaluation (CIE), such as Internships / Industry Oriented Mini Project / Seminar / Project Stage - I if the student secures not less than 40% marks in each of them. However, a student who fails to secure minimum 40% marks or abstains from such subjects, he / she will be permitted to appear in the re-examination which shall be conducted before completion of Semester End Examinations. If the student fails in such re-examination he/she has

to reappear for the same in the next subsequent semester, as and when it is scheduled.

**11.3** The student shall be deemed to have failed to earn the credits allotted to subjects having only internal evaluation (CIE), if he (i) does not submit a report on Industrial Oriented Mini Project/Summer Internships, Project Stage-I or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) does not present the seminar or (iii) secures less than 40% marks in Industrial Oriented Mini Project/Summer Internship and seminar evaluations.

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

**11.5** Recounting/Revaluation/Challenging Evaluation: Students shall be permitted to apply for Recounting /Revaluation/ Challenging Evaluation of the Semester-end examination answer scripts within a stipulated period after payment of the prescribed fee. After completion of the process of Recounting /Revaluation/Challenging Evaluation, the records are updated with changes if any, and the student shall be issued a revised grade sheet. If there are no changes, the same will be shown in the student examination portal.

**11.6 Supplementary Examinations:**

The supplementary examinations Odd semester shall be conducted during even semester regular/supplementary examinations and even semester supplementary examinations during Odd semester regular supplementary examinations.

Advance supplementary examinations shall be conducted to the students failed in the IV B.Tech - II Semester Regular Examinations. A notification Advance supplementary examinations shall be released after the announcement of regular results.

## 12.0 Promotion Rules

The students shall be deemed to have promoted to higher classes i.e. from I Year to II year , II year to III Year and III year to IV Year only after earning the below mentioned credits from theory and laboratory courses registered by him/her. The tables given in 10.1, 10.2 provide the details of the credits to be earned by the student (admitted under Regular and Laterally Entry Scheme respectively) to get promoted to higher classes.

### 12.1 Promotion Rules for Regular Students

S. No.	Promotion	Conditions to be fulfilled
1	First year first semester to first year second semester	Regular course of study of first year first semester.
2	First year second semester to second year first semester	(i) Regular course of study of first year second semester.
		(ii) Must have secured at least 19 credits out of 38 credits i.e., 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3.	Second year first semester to second year second semester	Regular course of study of second year first semester.
4	Second year second semester to third year first semester	(i) Regular course of study of second year second semester.
		(ii) Must have secured at least 40 credits out of 80 credits i.e., 50% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Third year first semester to third year second semester	Regular course of study of third year first semester.
6	Third year second semester to fourth year first semester	(i) Regular course of study of third year second semester.
		(ii) Must have secured at least 61 credits out of 122 credits i.e., 50% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester.



## 12.2 Promotion Rules for Lateral Entry Students

S. No	Promotion	Conditions to be fulfilled
1	Second year first semester to second year second semester	Regular course of study of second year first semester.
2	Second year second semester to third year first semester	(i) Regular course of study of second year second semester.
		(ii) Must have secured at least 21 credits out of 42 credits i.e., 50% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester to third year second semester	Regular course of study of third year first semester.
4	Third year second semester to fourth year first semester	(i) Regular course of study of third year second semester.
		(ii) Must have secured at least 42 credits out of 84 credits i.e., 50% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester

## 13.0 Massive Open Online Courses (MOOCs)

A student shall be permitted to register BOS approved list of online / self-study course in lieu of the Professional Electives; Open Electives from Massive Open Online Courses (MOOCs) offered by SWAYAM / NPTEL / EdX / Coursera / Udacity / Udemy /upgrad/ Khan Academy / Edureka / QEEE etc. However, the syllabus of the MOOC course shall be approved by the concerned BOS. No formal lectures will be delivered for a self-study course.

**13.1** One faculty member for each course shall be nominated as coordinator by the Department to monitor the progress made by the student. The coordinator needs to carry out the conversion of grades awarded to the student in internal and external examinations by the MOOCs offering institution into corresponding grades of JBIET. If any student fails in successfully completing the MOOC course in the first attempt, he/she shall successfully complete it in the supplementary examination conducted by the college in the subsequent semesters. The question paper pattern and evaluation process for the examination of such subjects for MOOC courses will be similar to that of any other theory course offered under R22.

### **13.2 Mandatory Massive Open Online Courses (MOOCs)**

A student has to undergo one mandatory MOOC course (Professional Elective-V) of 3 credit from the online MOOC platforms listed in 13.0 during IV-I semester. The department has to finalize the electives offered on MOOC platform at the end of III-I semester and take prior approval from the BOS for the MOOC course (including syllabus) to be registered by the student.

### **14.0 Awarding Grace Marks**

A student who fails in two theory courses falling short of a few marks is eligible for 0.15% of total marks as Grace Marks.

- Grace marks addition is applicable for maximum of 2 subjects.
- Grace marks can be added only for external examinations.
- Among all the external examinations appeared by the student in a specific subject, the highest marks are considered for adding Grace Marks.
- The provision of Grace Marks is also extended for class change.

The Description of class change is given below:

- i. Class Change from 49.85 % to 50 % for Pass Class to Second Class
- ii. Class Change from 59.85 % to 60 % for Second Class to First Class
- iii. Class Change from 69.85 % to 70 % for First Class to First Class with distinction

Note: Grace marks cannot be added to internal marks.

## 15.0 Internal improvement examination

Student is permitted to appear for improvement of internal marks of all papers of the B. Tech in which the candidate has not passed due to the shortage of Internal Marks. Students who secured internal marks less than specified marks are only eligible to write the Internal Improvement Examination. The specified marks can be computed using the following formula.

➤ For B. Tech Course:  $0.4 * \text{Total-marks} - 0.35 * \text{External-marks}$

- Students who have completed all semesters of their, B. Tech course work can only avail this option.
- This internal improvement option is extended up to double the duration of the course work.
- In case of Students who secure less marks in internal improvement examination than his/her previous internal marks or if the student is has registered for Internal Improvement but has not appeared / absent, the old marks will be retained.
- A separate notification shall be released by the JBIET examination branch for conduction of this examination and the students shall register for this option at the time of this notification.

## 16.0 Award of Degree

A student is declared to have 'qualified' for the award of B. Tech. degree by JNTUH, in the chosen branch of Engineering selected at the time of admission, if he/she fulfills the following conditions.

**16.1** The student shall pursue a program of study for not less than four academic years and not more than eight academic years. In case of lateral entry students, student shall pursue a program of study for not less than three academic years and not more than six academic years.

**16.2** The student shall register for 160 credits and has to secure all 160 credits (122 credits in case of lateral entry students). Marks obtained in all 160 credits shall be considered for the award of the class based on aggregate of grades. Also, the student should appear and complete all mandatory courses prescribed.

**16.3** However, the students are eligible to avail the benefits such as exemption of credits that degree awarding University (JNTUH) announces to the students admitted during this period

#### **16.4 Award of 2-Year B.Tech. Diploma Certificate**

A student is declared to have 'qualified' for the award of **2-Year B.Tech. Diploma Certificate** by JNTUH, in the chosen branch of Engineering selected at the time of admission if he/she fulfils the following conditions.

1. When a student wants to exit from 4-Year B. Tech. program, He/she has to fulfil all the academic requirements and earn all the registered 80 credits (within 4 years from the date of admission) up to B. Tech. – II Year – II Semester to be eligible for **2-Year UG Diploma Certificate**.
2. The student once opted and awarded for 2-Year UG Diploma Certificate will not be permitted to Re-join in B. Tech. III Year – I Semester and continue for completion of remaining years of study for 4-Year B. Tech. Degree.

#### **16.5 Award of Class**

A student who qualifies for the award of the degree as is placed in the following classes.

- i. Students with final CGPA (at the end of the under graduate programme)  $\geq 7.50$  shall be placed in '**first class with distinction**'.
- ii. Students with final CGPA (at the end of the under graduate program me)  $\geq 6.50$  but  $< 7.50$ , shall be placed in '**first class**'.
- iii. Students with final CGPA (at the end of the under graduate program me)  $\geq 5.50$  but  $< 6.50$ , shall be placed in '**second class**'.
- iv. All other students who qualify for the award of the degree, with final CGPA (at the end of the undergraduate programme)  $\geq 5.00$  but  $< 5.50$ , shall be placed in '**pass class**'.

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

## **17.0 Transitory Regulations:**

The transitory guidelines are applicable to the students

**17.1** Who have been detained due to lack of attendance in any semester, shall be permitted the join the corresponding semester.

**17.2** Students detained due to shortage of credits, shall be promoted to the next semester only after acquiring the required credits as per the corresponding regulations of his / her admission

**17.3** Students who have discontinued and wish to continue the Program, are eligible for admission into the unfinished semester.

Students readmitted under conditions mentioned 16.1, 16.2 and 16.3 shall satisfy all the eligibility requirements as mentioned in 3.0

If a student readmitted to R22 Regulations, has already studied any subject with 80% of syllabus common in his / her previous regulations, that particular subject in R22 Regulations will be substituted by another subject to be suggested by the BOS concerned. If the readmitted student has not studied the pre-requisite subjects for any subject offered in R22 regulations, remedial classes shall be arranged by the concerned HoD.

## **18.0. Grading Procedure**

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

**18.2** As a measure of the performance of a student, a 10-point Absolute Grading System using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks is followed:

<b>% of Marks Secured in a Subject/Course (Class Intervals)</b>	<b>Letter Grade (UGC Guidelines)</b>	<b>Grade Points</b>
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

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

A student passes the subject/ course only when  $GP \geq 5$  ('C' grade or above).

**18.3** The Semester Grade Point Average (SGPA) is calculated by dividing the sum of Credit Points ( $\sum CP$ ) secured from all subjects/ courses registered in a semester, by the total number of Credits registered during that semester. SGPA is rounded off to two decimal places. SGPA is thus computed as given below:

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

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

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

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

(i.e., up to and inclusive of S semesters,  $S \geq 2$ ),

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

**Illustration of calculation of SGPA:**

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

$$SGPA = \frac{152}{21} = 7.24$$

### Illustration of calculation of CGPA up to 3rd semester:

Semester	Course/ Subject Title	Credits Allotted	Letter Grade Secured	Correspondin g Grade Point(GP)	Credit Points(CP)
I	Course 1	3	A	8	24
I	Course 2	3	O	10	30
I	Course 3	3	B	6	18
I	Course 4	4	A	8	32
I	Course 5	3	A+	9	27
I	Course 6	4	C	5	20
II	Course 7	4	B	6	24
II	Course 8	4	A	8	32
II	Course 9	3	C	5	15
II	Course 10	3	O	10	30
II	Course 11	3	B+	7	21
II	Course 12	4	B	6	24
II	Course 13	4	A	8	32
II	Course 14	3	O	10	30
III	Course 15	2	A	8	16
III	Course 16	1	C	5	5
III	Course 17	4	O	10	40
III	Course 18	3	B+	7	21
III	Course 19	4	B	6	24
III	Course 20	4	A	8	32
III	Course 21	3	B+	7	21
	Total Credits	69		Total Credit Points	518

$$CGPA = \frac{518}{69} = 7.51$$

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

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

**18.6** SGPA and CGPA of a semester will be mentioned in the semester Memorandum of Grades if all subjects of that semester are passed in first attempt. Otherwise the SGPA and CGPA is mentioned only on the Memorandum of Grades in which sitting he



passed his last exam in that semester. However, Mandatory Courses will not be taken into consideration.

### 19. 0 Transfer Of Students From Other Colleges / Universities

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.

## 20.0 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 or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, 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	In case of students of the college, they is expelled from examination halls and cancellation of their performance in that subject and all

	<p>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 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</p>	<p>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.</p>
<p>6.</p>	<p>Leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall.</p>	<p>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</p>

		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 student for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to police and, a police case will be registered against them.
9.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared 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 award suitable punishment.*



**ANNEXURE-I**  
**J.B.INSTITUTE OF ENGINEERING AND TECHNOLOGY**  
(UGC Autonomous)

Accredited by NBA & NAAC, Approved by AICTE & Permanently affiliated to JNTUH

Yenkapally(V), Moinabad(M), P.O. Himayat Nagar, R.R. District, Hyderabad-500075

**Academic Regulations for *B. Tech. with Honours program***

**1. Objectives**

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

- To expand the domain knowledge of the students laterally and vertically to cope up with Education 4.0.
- To enhance the employability of undergraduate students as per Industry 4.0 standards.
- To provide an opportunity to students to pursue their higher studies in wider range of specializations.

**2. Academic Regulations for B. Tech. Honours degree**

- 1) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B. Tech. program.
- 2) For B. Tech with Honours program, a student needs to earn additional 20 credits (over and above the required 160 credits for B. Tech degree). The broad guidelines for the courses of Honours program, their respective credits weightage and semester-wise break-up of the course are enclosed as Annexure. **All these 20 credits need to be completed in III year I Semester to IV year I Semester only.**
- 3) After registering for the Honours programme, **if a student is unable to pass all courses in first attempt and earn the required 20 credits, he/she shall not be awarded Honours degree.** However, if the student earns all the required 160 credits of B. Tech., he/she will be awarded only B. Tech degree in the concerned branch.
- 4) There is no transfer of credits from courses of Honours program to regular B. Tech. degree course & vice versa.

5) These 20 credits are to be earned from the additional courses offered by the host department in the college or from a closely related department in the college as well as from the MOOCS platform.

**6) Guidelines for courses selected under MOOCs platform :**

- a) Prior to registration of MOOCS courses, formal approval of the courses, by the Head of the Department is essential. Head of the Department before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.
- b) Department wise MOOCs finalized are to be consolidated and needs to be approved by BOS before commencement of the semester.
- c) Minimum credits for a MOOCS course must be equal to or more than the credits specified in the Honours course structure provided by the JBIET.
- d) Only Pass-grade/marks or above shall be considered for inclusion of grades in the Honours grade memo.
- e) Any expenses incurred for the MOOCS courses are to be met by the students only.

7) The **choice to opt/take the Honours program is purely on the choice of the students.**

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

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

10) Students can register for the Honours program only if they fulfill the **eligibility criteria.**

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

12) The record of students registered and pursuing their Honours programs branch-wise is sent to JNTUH once the enrolment process is complete.

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

### 3. Eligibility conditions of the students for the Honours degree

- a) A student can opt for B.Tech. degree with Honours, if she/he passed all subjects in first attempt in all the semesters till the results announced and **maintaining 7.5 or more CGPA.**
- b) **If a student fails in any registered course of either B. Tech. or Honours in any semester of four years program, he/she will not be eligible for obtaining Honours degree.** He will be eligible for only B. Tech. degree
- c) **Prior approval of mentor and Head of the Department for the enrolment into Honours program, before commencement of III year I Semester (V Semester), is mandatory.**
- d) If more than 30% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility is limited to 30%. The criteria to be followed for choosing 30% candidates in a branch may be the **CGPA secured by the students till II year I semester.**
- e) Successful completion of 20 credits earmarked for honours program with at least 7.5 CGPA along with successful completion of 160 credits earmarked for regular B. Tech. Program with at least 7.5 CGPA and passing all subjects in first attempt gives the eligibility for the award of B. Tech. (Honours) degree.
- f) For CGPA calculation of B. Tech. course, the 20 credits of Honours program will not be considered.

### 4. Registration for the course in Honours program

- a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.
- b) The students should choose a course from the list against each semester (from Honours course structure) other than the courses they have studied/registered for regular B.Tech programme. No course should be



identical to that of the regular B. Tech. course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

- c) The maximum No. of courses for the Honours is limited to two in a semester along with regular semester courses.
- d) The students need to register the Honours degree by paying an registration fee of Rs. 1000/- per one credit.
- e) A fee for late registration will be imposed as per the norms of JNTUH.

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### **Academic Regulations for Honours degree in B. Tech. programs**

<b>S. No.</b>	<b>Year / Semester</b>	<b>Course to be chosen from/studied</b>	<b>Mode of Learning</b>	<b>No. of Credits</b>
1	III-I	PE-1	Blended/Conventional	4
2	III-I	PE-2	Blended/Conventional	4
3	III-II	PE-3	Blended/Conventional	4
4	III-II	MOOC Platform (PE-4 or an Inter disciplinary subject)	MOOCS	2
5	IV-I	PE-5	Blended/Conventional	4
6	IV-I	MOOC Platform (PE-6 or an Inter disciplinary subject)	MOOCS	2
<b>Total Credits</b>				<b>20</b>

**Note:**

- The attendance and evaluation scheme for Honours degree courses will be same as the regular B. Tech. courses.
- If the blended course option is chosen, for the subjects in any semester, the learning should be partially in online mode and partially in offline mode. The Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) shall be carried out by JBIET.

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## ANNEXURE-II

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

(UGC Autonomous)

Accredited by NBA & NAAC, Approved by AICTE & Permanently affiliated to JNTUH

Yenkapally(V), Moinabad(M), P.O. Himayat Nagar, R.R. District, Hyderabad-500075

#### Academic Regulations for *B. Tech. with Minors program*

##### 5. Objectives

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

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

##### 6. Academic Regulations for B. Tech. Minors degree

- 14) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B. Tech. program.
- 15) For B. Tech with Minors program, a student needs to earn additional 20 credits (over and above the required 160 credits for B. Tech degree). The broad guidelines for the courses of Minors program, their respective credits weightage and semester-wise break-up of the course are enclosed as Annexure. **All these 20 credits need to be completed in III year I Semester to IV year I Semester only.**
- 16) After registering for the Minors programme, **if a student is unable to pass all courses in first attempt and earn the required 20 credits, he/she shall not be awarded Minors degree.** However, if the student earns all the required 160 credits of B. Tech., he/she will be awarded only B. Tech degree in the concerned branch.
- 17) There is no transfer of credits from courses of Minors program to regular

B. Tech. degreecourse & vice versa.

18) These 20 credits are to be earned from the additional courses offered by the host department in the college or from a closely related department in the college as well as from the MOOCS platform.

**19) Guidelines for courses selected under MOOCs platform :**

a) Prior to registration of MOOCS courses, formal approval of the courses, by the Head of the Department is essential. Head of the Department before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.

b) Department wise MOOCs finalized are to be consolidated and needs to be approved by BOS before commencement of the semester.

c) Minimum credits for a MOOCS course must be equal to or more than the credits specified in the Minors course structure provided by the JBIET.

d) Only Pass-grade/marks or above shall be considered for inclusion of grades in the Minors grade memo.

e) Any expenses incurred for the MOOCS courses are to be met by the students only.

20) The **choice to opt/take the Minors program is purely on the choice of the students.**

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

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

**23) Students can register for the Minors program only if they fulfill the eligibility criteria.**

24) A student can graduate with Minors if he/she fulfils the requirements for his/her regular B. Tech. program as well as fulfils the requirements for Minors program.

25) The record of students registered and pursuing their Minors programs

branch-wise is sent to JNTUH once the enrolment process is complete.

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

## **7. Eligibility conditions of the students for the Minors degree**

- g) A student can opt for B.Tech. degree with Minors, if she/he passed all subjects in first attempt in all the semesters till the results announced and **maintaining 7.5 or more CGPA.**
- h) **If a student fails in any registered course of either B. Tech. or Minors in any semester of four years program, he/she will not be eligible for obtaining Minors degree.** He will be eligible for only B. Tech. degree
- i) **Prior approval of mentor and Head of the Department for the enrolment into Minors program, before commencement of III year I Semester (V Semester), is mandatory.**
- j) If more than 30% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility is limited to 30%. The criteria to be followed for choosing 30% candidates in a branch may be the **CGPA secured by the students till II year I semester.**
- k) Successful completion of 20 credits earmarked for Minors program with at least 7.5 CGPA along with successful completion of 160 credits earmarked for regular B. Tech. Program with at least 7.5 CGPA and passing all subjects in first attempt gives the eligibility for the award of B. Tech. (Minors) degree.
- l) For CGPA calculation of B. Tech. course, the 20 credits of Minors program will not be considered.

## **8. Registration for the course in Minors program**

- f) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.
- g) The students should choose a course from the list against each semester (from Minors course structure) other than the courses they have

studied/registered for regular B.Tech programme. No course should be identical to that of the regular B. Tech. course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

- h) The maximum No. of courses for the Minors is limited to two in a semester along with regular semester courses.
- i) The students need to register the Minors degree by paying an registration fee of Rs. 1000/- per one credit.
- j) A fee for late registration will be imposed as per the norms of JNTUH.

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### **Academic Regulations for Minors degree in B. Tech. programs**

<b>S. No.</b>	<b>Year / Semester</b>	<b>Course to be chosen from/studied</b>	<b>Mode of Learning</b>	<b>No. of Credits</b>
1	III-I	PE-1	Blended/Conventional	4
2	III-I	PE-2	Blended/Conventional	4
3	III-II	PE-3	Blended/Conventional	4
4	III-II	MOOC Platform (PE-4 or an Inter disciplinary subject)	MOOCS	2
5	IV-I	PE-5	Blended/Conventional	4
6	IV-I	MOOC Platform (PE-6 or an Inter disciplinary subject)	MOOCS	2
<b>Total Credits</b>				<b>20</b>

**Note:**

- The attendance and evaluation scheme for Minors degree courses will be same as the regular B. Tech. courses.
- If the blended course option is chosen, for the subjects in any semester, the learning should be partially in online mode and partially in offline mode. The Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) shall be carried out by JBIET.

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<b>JBIET-R22</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech - ME</b>
<b>B. Tech Course Structure</b>		

<b>I Year I Semester</b>										
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>	<b>Credits</b>	<b>Category</b>	<b>common subject (Y/N)</b>	<b>Approving BOS</b>
1	L110A	Differential Equations and Calculus	3	1	0	0	4	BS	Y	Maths
2	L110D	Engineering Chemistry	3	0	0	0	3	BS	Y	Chemistry
3	L113A	Engineering Mechanics	3	0	0	0	3	ES	Y	MECH
4	L112B	Fundamentals of Electrical Circuits and Electronic Devices	3	0	0	0	3	ES	Y	EEE/ECE
5	L1103	Chemistry Lab	0	0	2	0	1	BS	Y	Chemistry
6	L1131	Engineering Drawing	1	0	4	0	3	ES	Y	MECH
7	L1133	Engineering Workshop and Manufacturing Practices	1	0	4	0	3	ES	Y	MECH
8	L11M1	Functional English	2	0	0	0	0	AC- I	Y	English
<b>Total</b>			<b>16</b>	<b>1</b>	<b>10</b>	<b>0</b>	<b>20</b>			

<b>I Year II Semester</b>										
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>	<b>Credits</b>	<b>Category</b>	<b>common subject (Y/N)</b>	<b>Approving BOS</b>
1	L120A	Linear Algebra and Advanced Calculus	3	1	0	0	4	BS	Y	Maths
2	L120B	English	3	0	0	0	3	HS	Y	English
3	L120E	Engineering Physics	3	0	0	0	3	BS	Y	Physics
4	L125A	Programming for Problem Solving	3	1	0	0	4	ES	Y	CSE
5	L1202	Physics Lab	0	0	2	0	1	BS	Y	Physics
6	L1201	English Language and Communication Skills Lab	0	0	2	0	1	HS	Y	English
7	L1251	Programming for Problem Solving Lab	0	0	4	0	2	ES	Y	CSE
8	L12M2	Human Values & Professional Ethics	2	0	0	0	0	AC- II	Y	
<b>Total</b>			<b>14</b>	<b>2</b>	<b>8</b>	<b>0</b>	<b>18</b>			

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<b>B. Tech Course Structure</b>		

<b>II Year I Semester</b>										
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>	<b>Credits</b>	<b>Category</b>	<b>common subject (Y/N)</b>	<b>Approving BOS</b>
1	L210A	Probability and Statistics	3	1	0	0	4	BS	Y	Maths
2	L213A	Materials Engineering	3	0	0	0	3	ES	N	MECH
3	L213B	Mechanics of Solids	3	1	0	0	4	PC	Y	MECH
4	L213C	Manufacturing Technology	3	0	0	0	3	PC	N	MECH
5	L213D	Thermodynamics	3	0	0	0	3	PC	N	MECH
6	L2131	Materials Engineering Lab	0	0	2	0	1	ES	N	MECH
7	L2132	Manufacturing Technology Lab	0	0	2	0	1	PC	N	MECH
8	L2133	Internship - I	0	0	2	0	1	PW	N	MECH
9	L21M1	Gender Sensitization	2	0	0	0	0	MC	Y	
<b>Total</b>			<b>17</b>	<b>2</b>	<b>6</b>	<b>0</b>	<b>20</b>			

<b>II Year II Semester</b>										
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>	<b>Credits</b>	<b>Category</b>	<b>common subject (Y/N)</b>	<b>Approving BOS</b>
1	L22EA	Business Economics and Financial Analysis	3	1	0	0	4	HS	Y	MBA
2	L223A	Kinematics of Machines	3	1	0	0	4	PC	N	MECH
3	L223B	Thermal Engineering – I	3	0	0	0	3	PC	N	MECH
4	L223C	Mechanics of Fluids and Hydraulic Machines	3	0	0	0	3	PC	N	MECH
5	L223D	Metal Cutting and Machine Tools	3	0	0	0	3	PC	N	MECH
6	L2231	Machine Drawing Practice	1	0	4	0	3	PC	Y	MECH
7	L2232	Mechanics of Fluids and Hydraulic Machines Lab	0	0	2	0	1	PC	N	MECH
8	L2233	Machine Tools Lab	0	0	2	0	1	PC	N	MECH
9	L22M2	Environmental Science	2	0	0	0	0	AC	Y	
<b>Total</b>			<b>18</b>	<b>2</b>	<b>8</b>	<b>0</b>	<b>22</b>			

<b>JBIET-R22</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech - ME</b>
<b>B. Tech Course Structure</b>		

<b>III Year I Semester</b>										
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>	<b>Credits</b>	<b>Category</b>	<b>common subject (Y/N)</b>	<b>Approving BOS</b>
1	L313A	Dynamics of Machinery	3	1	0	0	4	PC	N	MECH
2	L313B	Design of Machine Members - I	3	1	0	0	4	PC	N	MECH
3	L313C	Thermal Engineering - II	3	0	0	0	3	PC	N	MECH
4	BTMEE1	Professional Elective - I	3	0	0	0	3	PE	N	MECH
5	BTMEO1	Open Elective - I	3	0	0	0	3	OE	Y	
6	L3131	Dynamics of Machinery lab	0	0	2	0	1	PC	N	MECH
7	L3132	Thermal Engineering Lab	0	0	2	0	1	PC	N	MECH
8	L3133	Internship - II	0	0	2	0	1	PW	N	MECH
9	L31M1	Artificial intelligence	2	0	0	0	0	MC- III	Y	
10	L31T1	Employability skills	2	0	0	0	0	AC- III	Y	
<b>Total</b>			<b>19</b>	<b>2</b>	<b>6</b>	<b>0</b>	<b>20</b>			

<b>III Year II Semester</b>										
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>	<b>Credits</b>	<b>Category</b>	<b>common subject (Y/N)</b>	<b>Approving BOS</b>
1	L323A	Design of Machine Members - II	3	0	0	0	3	PC	N	MECH
2	L323B	Heat Transfer	3	1	0	0	4	PC	N	MECH
3	BTMEE2	Professional Elective - II	3	0	0	0	3	PE	N	MECH
4	BTMEE3	Professional Elective - III	3	0	0	0	3	PE	N	MECH
5	BTMEO2	Open Elective - II	3	0	0	0	3	OE	Y	
6	BTMEO3	Open Elective - III	3	0	0	0	3	OE	Y	
7	L3231	Heat Transfer Lab	0	0	2	0	1	PC	N	MECH
8	L3232	Life Skills and Professional Skills	0	0	4	0	2	HS	Y	
9	L32M2	Cyber security	2	0	0	0	0	MC- IV	Y	
10	L32T2	Foundation of Entrepreneurship	2	0	0	0	0	AC- IV	Y	
<b>Total</b>			<b>22</b>	<b>1</b>	<b>6</b>	<b>0</b>	<b>22</b>			



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<b>B. Tech Course Structure</b>		

<b>IV Year I Semester</b>										
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>	<b>Credits</b>	<b>Category</b>	<b>common subject (Y/N)</b>	<b>Approving BOS</b>
1	L413A	Non - Destructive Testing Methods	3	1	0	0	4	BS	N	MECH
2	L413B	Instrumentation and Control Systems	3	0	0	0	3	PC	N	MECH
3	L413C	CAD/CAM	3	0	0	0	3	PC	N	MECH
4	BTMEE4	Professional Elective - IV	3	0	0	0	3	PE	N	MECH
5	BTMEE5	Professional Elective - V Mandatory MOOC (online)	3	0	0	0	3	PE	Y	
6	L4131	Instrumentation and Control Systems lab	0	0	2	0	1	PC	N	MECH
7	L4132	CAE and PDP Lab	0	0	4	0	2	PC	N	MECH
8	L4133	Mini Project	0	0	4	0	2	PW	N	MECH
9	L4134	Project Phase - I	0	0	4	0	2	PW	N	MECH
10	L41M4	3D Printing and Design	2	0	0	0	0	MC- V	N	MECH
<b>Total</b>			<b>17</b>	<b>1</b>	<b>14</b>	<b>0</b>	<b>23</b>			

<b>IV Year II Semester</b>										
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>	<b>Credits</b>	<b>Category</b>	<b>common subject (Y/N)</b>	<b>Approving BOS</b>
1	L423A	Renewable Energy Sources	3	0	0	0	3	PC	N	MECH
2	BTMEE6	Professional Elective - VI	3	0	0	0	3	PE	N	MECH
3	L4231	Seminar	0	0	2	0	1	PW	N	MECH
4	L4232	Project Phase - II	0	0	16	0	8	PW	N	MECH
<b>Total</b>			<b>6</b>	<b>0</b>	<b>18</b>	<b>0</b>	<b>15</b>			

**Note:** All End Examinations (Theory and Practical) are of three-hour duration.

L - Lecture, T - Tutorial, P - Practical, D - Drawing, C - Credits.

<b>JBIEET-R22</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech - ME</b>
<b>B. Tech Course Structure</b>		

<b>Professional Elective-I</b>										
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>	<b>Credits</b>	<b>Category</b>	<b>common subject (Y/N)</b>	<b>Approving BOS</b>
1	L313E	Unconventional Machining Processes	3	0	0	0	3	PE	N	MECH
2	L313F	Theory of Metal Cutting	3	0	0	0	3	PE	N	MECH
3	L313G	Machine Tool Design	3	0	0	0	3	PE	N	MECH

<b>Professional Elective-II</b>										
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>	<b>Credits</b>	<b>Category</b>	<b>common subject (Y/N)</b>	<b>Approving BOS</b>
1	L323E	Refrigeration and Air Conditioning	3	0	0	0	3	PE	N	MECH
2	L323F	Automobile Engineering	3	0	0	0	3	PE	N	MECH
3	L323G	Power Plant Engineering	3	0	0	0	3	PE	N	MECH

<b>Professional Elective-III</b>										
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>	<b>Credits</b>	<b>Category</b>	<b>common subject (Y/N)</b>	<b>Approving BOS</b>
1	L323H	Finite Element Methods	3	0	0	0	3	PE	N	MECH
2	L323I	Robotics	3	0	0	0	3	PE	N	MECH
3	L323J	Product Development	3	0	0	0	3	PE	N	MECH

<b>Professional Elective-IV</b>										
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>	<b>Credits</b>	<b>Category</b>	<b>common subject (Y/N)</b>	<b>Approving BOS</b>
1	L413E	Operations Research	3	0	0	0	3	PE	N	MECH
2	L413F	Quality Engineering in Manufacturing	3	0	0	0	3	PE	N	MECH
3	L413G	CNC Technology	3	0	0	0	3	PE	N	MECH

<b>JBIET-R22</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech - ME</b>
<b>B. Tech Course Structure</b>		

<b>Professional Elective-V (Mandatory MOOC)</b>										
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>	<b>Credits</b>	<b>Category</b>	<b>common subject (Y/N)</b>	<b>Approving BOS</b>
1	L413H	Energy conservation and waste heat recovery	3	0	0	0	3	PE	N	MECH
2	L413I	Introduction to Mechanical Micro Machining	3	0	0	0	3	PE	N	MECH
3	L413J	Product Design and Manufacturing	3	0	0	0	3	PE	N	MECH

<b>Professional Elective-VI</b>										
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>	<b>Credits</b>	<b>Category</b>	<b>common subject (Y/N)</b>	<b>Approving BOS</b>
1	L423A	Additive Manufacturing	3	0	0	0	3	PEC	N	MECH
2	L423B	Automation in Manufacturing	3	0	0	0	3	PEC	N	MECH
3	L423C	Production Planning and Control	3	0	0	0	3	PEC	N	MECH

<b>JBIET-R22</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech - ME</b>
<b>B. Tech Course Structure</b>		

<b>Open Elective-I</b>					
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>Credits</b>	<b>Approving BOS</b>
1	L310A	Elements of CIVIL Engineering	3	3	CE
2	L310B	Introduction to Computer Networks	3	3	CSE
3	L310C	Introduction to Machine Learning	3	3	AI&ML
4	L310D	Fundamentals Of Data Science	3	3	AI&DS
5	L310E	Principles of Communications	3	3	ECE
6	L310F	Fundamentals of Digital Logic Design	3	3	ECM
7	L310G	Energy Engineering	3	3	EEE
8	L310H	Open Source Software's	3	3	IT
9	L310I	Automotive Technology	3	3	MECH
10	L310J	Introduction to Mining Technology	3	3	MINING
11	L310K	Entrepreneurship for Micro, Small and Medium Enterprises	3	3	MBA
12	L310L	Numerical Solution of Ordinary Differential Equations	3	3	Maths
13	L310M	Nano materials	3	3	Physics
14	L310N	Chemistry of Engineering materials	3	3	Chemistry
15	L310O	Technical writing skills	3	3	English
16	L310P	Indian Constitution	3	3	English

<b>JBIET-R22</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech - ME</b>
<b>B. Tech Course Structure</b>		

<b>Open Elective-II</b>					
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>Credits</b>	<b>Approving BOS</b>
1	L320A	Construction Management, Contracts and valuation	<b>3</b>	<b>3</b>	CE
2	L320B	Principles of Operating Systems	<b>3</b>	<b>3</b>	CSE
3	L320C	Introduction to Predictive Analytics	<b>3</b>	<b>3</b>	AI & ML
4	L320D	Business Data Analytics	<b>3</b>	<b>3</b>	AI & DS
5	L320E	Basics of IC Technology	<b>3</b>	<b>3</b>	ECE
6	L320F	Introduction to Micro Processor and Micro Controllers	<b>3</b>	<b>3</b>	ECM
7	L320G	Hybrid Electric Vehicles	<b>3</b>	<b>3</b>	EEE
8	L320H	Distributed Systems	<b>3</b>	<b>3</b>	IT
9	L320I	Fundamentals of Operations Research	<b>3</b>	<b>3</b>	MECH
10	L320J	Introduction to Surface Mining	<b>3</b>	<b>3</b>	MINING
11	L320K	Intellectual Property Rights	<b>3</b>	<b>3</b>	MBA
12	L320L	Numerical Solution of Partial Differential Equations	<b>3</b>	<b>3</b>	Maths
13	L320M	Advanced physics for Engineers	<b>3</b>	<b>3</b>	Physics
14	L320N	Nano Chemistry	<b>3</b>	<b>3</b>	Chemistry
15	L320O	Teamwork and Team Building	<b>3</b>	<b>3</b>	English
16	L320P	Essence of Indian Traditional Knowledge	<b>3</b>	<b>3</b>	English

<b>JBIET-R22</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech - ME</b>
<b>B. Tech Course Structure</b>		

<b>Open Elective-III</b>					
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>Credits</b>	<b>Approving BOS</b>
1	L32OQ	Road Safety Engineering	3	3	CE
2	L32OR	Introduction to Java Programming	3	3	CSE
3	L32OS	Introduction to Neural Networks	3	3	AI&ML
4	L32OT	Health Care Data Analytics	3	3	AI&DS
5	L32OU	MATLAB Programming Language	3	3	ECE
6	L32OV	Introduction to Sensors and Its Applications	3	3	ECM
7	L32OX	Non-Conventional Energy Sources	3	3	EEE
8	L32OY	Soft Computing	3	3	IT
9	L32OZ	Basics of Robotics	3	3	MECH
10	L32O1	Basic Mining Geology	3	3	MINING
11	L32O2	Digital Marketing	3	3	MBA
12	L32O3	Number Theory and Cryptography	3	3	Maths
13	L32O4	NDT and Vacuum Technology	3	3	Physics
14	L32O5	Chemistry for Engineers	3	3	Chemistry
15	L32O6	Technical communication skills	3	3	English

<b>JBIET-R22</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech - ME</b>
<b>B. Tech Course Structure</b>		

<b>Open Elective-IV</b>					
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>Credits</b>	<b>Approving BOS</b>
1	L410A	Environmental Impact Assessment	3	3	CE
2	L410B	Introduction to Python Programming	3	3	CSE
3	L410C	Introduction to Deep Learning	3	3	AI&ML
4	L410D	Fundamentals of Big Data	3	3	AI&DS
5	L410E	Consumer Electronics	3	3	ECE
6	L410F	Introduction to Embedded Systems	3	3	ECM
7	L410G	Special Electrical Machines	3	3	EEE
8	L410H	Object Oriented Analysis and Design	3	3	IT
9	L410I	Basics of MINE Environment	3	3	MINING
10	L410J	Rural Marketing	3	3	MBA

<b>JBIET-R22</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech - ME</b>
<b>B. Tech Course Structure</b>		

<b>Open Elective-V</b>					
<b>S. No</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>Credits</b>	<b>Approving BOS</b>
1	L420A	Energy Audit & Green buildings	<b>3</b>	<b>3</b>	CE
2	L420B	Introduction to Big Data Analytics	<b>3</b>	<b>3</b>	CSE
3	L420C	Introduction to Generative Adversarial Networks	<b>3</b>	<b>3</b>	AI&ML
4	L420D	Cloud Computing	<b>3</b>	<b>3</b>	AI&DS
5	L420E	Principles of Sensors and their Application	<b>3</b>	<b>3</b>	ECE
6	L420F	Introduction to Electronic Instrumentation	<b>3</b>	<b>3</b>	ECM
7	L420G	Instrumentation	<b>3</b>	<b>3</b>	EEE
8	L420H	Cyber Laws & Ethics	<b>3</b>	<b>3</b>	IT
9	L420I	Fundamentals to Rock Mechanics	<b>3</b>	<b>3</b>	MINING
10	L420J	Customer Relationship management	<b>3</b>	<b>3</b>	MBA



<b>JBLET-R22</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech-ALL</b>
<b>B. Tech – ALL BRANCHES</b>		

<b>Open Elective-I</b>					
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>Credits</b>	<b>Approving BOS</b>
1	L310A	Elements of CIVIL Engineering	3	3	CE
2	L310B	Introduction to Computer Networks	3	3	CSE
3	L310C	Introduction to Machine Learning	3	3	AI&ML
4	L310D	Fundamentals Of Data Science	3	3	AI&DS
5	L310E	Principles of Communications	3	3	ECE
6	L310F	Fundamentals of Digital Logic Design	3	3	ECM
7	L310G	Energy Engineering	3	3	EEE
8	L310H	Open Source Software's	3	3	IT
9	L310I	Automotive Technology	3	3	MECH
10	L310J	Introduction to Mining Technology	3	3	MINING
11	L310K	Entrepreneurship for Micro, Small and Medium Enterprises	3	3	MBA
12	L310L	Numerical Solution of Ordinary Differential Equations	3	3	Maths
13	L310M	Nano materials	3	3	Physics
14	L310N	Chemistry of Engineering materials	3	3	Chemistry
15	L310O	Technical writing skills	3	3	English
16	L310P	Indian Constitution	3	3	English

<b>JBIET-R22</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech-ALL</b>
<b>B. Tech – ALL BRANCHES</b>		

<b>Open Elective-II</b>					
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>Credits</b>	<b>Approving BOS</b>
1	L32OA	Construction Management, Contracts and valuation	<b>3</b>	<b>3</b>	CE
2	L32OB	Principles of Operating Systems	<b>3</b>	<b>3</b>	CSE
3	L32OC	Introduction to Predictive Analytics	<b>3</b>	<b>3</b>	AI & ML
4	L32OD	Business Data Analytics	<b>3</b>	<b>3</b>	AI & DS
5	L32OE	Basics of IC Technology	<b>3</b>	<b>3</b>	ECE
6	L32OF	Introduction to Micro Processor and Micro Controllers	<b>3</b>	<b>3</b>	ECM
7	L32OG	Hybrid Electric Vehicles	<b>3</b>	<b>3</b>	EEE
8	L32OH	Distributed Systems	<b>3</b>	<b>3</b>	IT
9	L32OI	Fundamentals of Operations Research	<b>3</b>	<b>3</b>	MECH
10	L32OJ	Introduction to Surface Mining	<b>3</b>	<b>3</b>	MINING
11	L32OK	Intellectual Property Rights	<b>3</b>	<b>3</b>	MBA
12	L32OL	Numerical Solution of Partial Differential Equations	<b>3</b>	<b>3</b>	Maths
13	L32OM	Advanced physics for Engineers	<b>3</b>	<b>3</b>	Physics
14	L32ON	Nano Chemistry	<b>3</b>	<b>3</b>	Chemistry
15	L32OO	Teamwork and Team Building	<b>3</b>	<b>3</b>	English
16	L32OP	Essence of Indian Traditional Knowledge	<b>3</b>	<b>3</b>	English

<b>JBIET-R22</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech-ALL</b>
<b>B. Tech – ALL BRANCHES</b>		

<b>Open Elective-III</b>					
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>Credits</b>	<b>Approving BOS</b>
1	L32OQ	Road Safety Engineering	3	3	CE
2	L32OR	Introduction to Java Programming	3	3	CSE
3	L32OS	Introduction to Neural Networks	3	3	AI&ML
4	L32OT	Health Care Data Analytics	3	3	AI&DS
5	L32OU	MATLAB Programming Language	3	3	ECE
6	L32OV	Introduction to Sensors and Its Applications	3	3	ECM
7	L32OX	Non-Conventional Energy Sources	3	3	EEE
8	L32OY	Soft Computing	3	3	IT
9	L32OZ	Basics of Robotics	3	3	MECH
10	L32O1	Basic Mining Geology	3	3	MINING
11	L32O2	Digital Marketing	3	3	MBA
12	L32O3	Number Theory and Cryptography	3	3	Maths
13	L32O4	NDT and Vacuum Technology	3	3	Physics
14	L32O5	Chemistry for Engineers	3	3	Chemistry
15	L32O6	Technical communication skills	3	3	English

<b>JBIET-R22</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech-ALL</b>
<b>B. Tech – ALL BRANCHES</b>		

<b>Open Elective-IV</b>					
<b>S. No.</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>Credits</b>	<b>Approving BOS</b>
1	L410A	Environmental Impact Assessment	3	3	CE
2	L410B	Introduction to Python Programming	3	3	CSE
3	L410C	Introduction to Deep Learning	3	3	AI&ML
4	L410D	Fundamentals of Big Data	3	3	AI&DS
5	L410E	Consumer Electronics	3	3	ECE
6	L410F	Introduction to Embedded Systems	3	3	ECM
7	L410G	Special Electrical Machines	3	3	EEE
8	L410H	Object Oriented Analysis and Design	3	3	IT
9	L410I	Basics of MINE Environment	3	3	MINING
10	L410J	Rural Marketing	3	3	MBA

<b>JBIET-R22</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech-ALL</b>
<b>B. Tech – ALL BRANCHES</b>		

<b>Open Elective-V</b>					
<b>S. No</b>	<b>Code</b>	<b>Course Title</b>	<b>L</b>	<b>Credits</b>	<b>Approving BOS</b>
1	L42OA	Energy Audit & Green buildings	<b>3</b>	<b>3</b>	CE
2	L42OB	Introduction to Big Data Analytics	<b>3</b>	<b>3</b>	CSE
3	L42OC	Introduction to Generative Adversarial Networks	<b>3</b>	<b>3</b>	AI&ML
4	L42OD	Cloud Computing	<b>3</b>	<b>3</b>	AI&DS
5	L42OE	Principles of Sensors and their Application	<b>3</b>	<b>3</b>	ECE
6	L42OF	Introduction to Electronic Instrumentation	<b>3</b>	<b>3</b>	ECM
7	L42OG	Instrumentation	<b>3</b>	<b>3</b>	EEE
8	L42OH	Cyber Laws & Ethics	<b>3</b>	<b>3</b>	IT
9	L42OI	Fundamentals to Rock Mechanics	<b>3</b>	<b>3</b>	MINING
10	L42OJ	Customer Relationship management	<b>3</b>	<b>3</b>	MBA

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year-I Sem</b>			
Course Code: <b>L110A</b>	<b>DIFFERENTIAL EQUATIONS AND CALCULUS</b> (Common to all Branches)	L	T	P	D
Credits: <b>4</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>

**Pre-Requisites: NIL**

### **Module 1: First Order, First Degree ODE and its Applications [9L]**

Differential equations of first order and first degree ,Exact differential equation, Linear and Bernoulli differential equation.

Applications of differential equations of first order and first degree, Newton's law of cooling, Law of natural growth and decay, Orthogonal trajectories.

### **Module 2: Second and higher order ODE with constant coefficients [10L]**

Second order linear differential equations with constant coefficients, Solution of Homogenous, non homogeneous differential equations, non-homogeneous terms of the type  $e^{ax}$ ,  $\sin(ax)$ ,  $\cos(ax)$ , polynomials in  $x$ ,  $e^{ax} \cdot V(x)$ ,  $xV(x)$ . Method of variation of parameters, Equations reducible to linear ODE with constant Coefficients, Euler- Cauchy equation, Legendre's equation.

### **Module 3: Sequences and Fourier series [10L]**

Definition of a Sequence, limit, Convergent, Divergent and Oscillatory sequences. Series, Convergent, Divergent and Oscillatory Series, Series of positive terms, P-test, Comparison test, Alternating series, Leibnitz test, Absolute and Conditionally Convergence. Determination of Fourier coefficients, Fourier series of even and odd functions, Fourier series in an arbitrary interval, even and odd periodic continuation, Half-range Fourier sine and cosine expansions.

### **Module 4: Calculus and Improper integrals [9L]**

Mean value theorems: Rolle's Theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's mean value Theorem, Taylor's Series. Definition of Improper Integrals, Beta functions, Properties of beta functions, Gamma functions, Properties of Gamma functions, Relation between the Gamma and Beta functions, evaluation of improper integrals using Beta and Gamma functions.

### **Module 5: Functions of Multivariable's [10L]**

Limits, Continuity, Partial differentiation, partial derivatives of first and second order, homogeneous function, Euler's theorem, total derivative, Chain rule, Jacobian, Taylor's theorem of two variables (without proof). Maxima and Minima of two variables, Lagrange's method of undetermined multipliers.

### **Text Books**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2015
2. Erwin kreyszig, Advanced Engineering Mathematics, 9<sup>th</sup> Edition, John Wiley & Sons,2006.
3. R.K.Jain & S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5<sup>th</sup> Edition, 2015.

## Reference Books

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11<sup>th</sup> Reprint, 2010.

## E-Resources

1. <https://nptel.ac.in/courses/111106100>
2. <https://www.math.ust.hk/~machas/differential-equations.pdf>
3. [https://en.wikipedia.org/wiki/Fourier\\_series](https://en.wikipedia.org/wiki/Fourier_series)
4. <https://www.khanacademy.org/math/ap-calculus-bc/bc-integration-new/bc-6-13/a/improper-integrals-review>
5. [https://onlinecourses.nptel.ac.in/noc20\\_ma15/preview](https://onlinecourses.nptel.ac.in/noc20_ma15/preview)

## Course Outcomes

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

- CO1.** Formulate and solve the First order linear differential equations.
- CO2.** Apply the concepts of higher order linear differential equations with constant coefficients solving physical problems arising in engineering.
- CO3.** Obtain Fourier series expansion of a given function.
- CO4.** Analyse the improper integrals.
- CO5.** Find the maxima and minima of multi variable functions.

## 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	2	3	-	-	-	-	-	-	-	3	-	-
<b>CO2</b>	3	3	2	3	-	-	-	-	-	-	-	3	-	-
<b>CO3</b>	2	2	1	1	-	-	-	-	-	-	-	2	-	-
<b>CO4</b>	3	3	2	1	-	-	-	-	-	-	-	2	-	-
<b>CO5</b>	3	3	2	2	-	-	-	-	-	-	-	2	-	-
<b>Average</b>	3	3	1.9	1.6	-	-	-	-	-	-	-	2.4	-	-

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year-I Sem</b>			
Course Code: <b>L110D</b>	<b>ENGINEERING CHEMISTRY</b> (COMMON TO: AIML, CE, ME, ECE, EEE and MIE)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Nil

### Module 1: Molecular Structure and Theories of Bonding [9L]

Atomic and Molecular orbitals- Molecular orbital theory- LCAO – bonding in homo and hetero nuclear di atomic molecules, molecular orbital energy level diagrams of homo nuclear diatomic molecules (N<sub>2</sub>, O<sub>2</sub> and F<sub>2</sub>), hetero nuclear di atomic molecules (CO and NO). Crystal Field Theory (CFT), Salient Features of CFT – Crystal Field Splitting of transition metal ion d- orbitals in Tetrahedral, Octahedral complexes. Magnetic and colour properties of complexes. Band theory of solids – band diagrams for conductors, semiconductors and insulators, effect of doping on conductance.

### Module 2: Water and Its Treatment [10L]

Introduction – hardness of water – Causes of hardness - Types of hardness- temporary and permanent – units of hardness-numerical problems – Estimation of hardness of water by complexometric method. Potable water and its specifications. Steps involved in potable water treatment – Disinfection of water by chlorination and ozonization- Break-point chlorination. Boiler feed water- scale and sludge formation--internal treatment of boiler feed water– Calgon conditioning, Phosphate conditioning and Colloidal conditioning. External treatment of water – Ion exchange process. Desalination of brackish water – Reverse osmosis.

### Module 3: Electrochemistry and Corrosion [12L]

#### Unit 1: Electrochemistry [7L]

Introduction-electrode potential, standard electrode potential, Electrochemical cell-Galvanic cell – Nernst equation derivation-applications, Numerical problems. Types of electrodes – calomel, Quinhydrone and glass electrode. determination of pH of a solution by using quinhydrone and glass electrode. Electro chemical series and its applications. Batteries – Primary (Li-MnO<sub>2</sub> cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery).

#### Unit 2: Corrosion [5L]

Causes and effects of corrosion – chemical and electrochemical corrosion – mechanism of electrochemical corrosion, types of corrosion-galvanic, pitting and waterline corrosion-factors influencing rate of corrosion-Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current cathodic methods-Surface coatings-Hot dipping(Galvanizing and Tinning).

### Module 4: Chemical Fuels [8L]

#### Unit 1: Fuels [3L]

Definition, classification, characteristics of a good fuel, Calorific value(CV)-HCV and LCV. Calculation of CV using Dulong’s formula, numericals.

#### Unit 2: Solid Fuels [2L]

Coal-proximate & ultimate analysis-significance.

#### Unit 3: Liquid Fuels [2L]



Composition and CV of gasoline, cracking: Fixed bed catalytic cracking method. Knocking and its significance, octane number, cetane number.

## Module 5: Polymers and Nanomaterials [12L]

### Unit 1: Polymers [8L]

Definition – Types of polymerization – addition and condensation polymerization with examples. Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, compounding and fabrication of plastics (compression and injection moulding). Preparation, Properties and engineering applications of PVC, Nylon-6, 6 and Bakelite. Conducting Polymers-conduction in polyacetylene.

### Unit 2: Nanomaterials [4L]

Introduction, Synthesis: Top down and bottom up approaches. Sol-gel and Chemical Vapour Deposition(CVD) methods. Properties and applications of fullerenes, carbon nanotubes. Medical applications of nanomaterials.

## Text Books

1. Engineering Chemistry: P. C. Jain & M. Jain, Dhanpat Rai Publications, New Delhi.
2. Engineering Chemistry: Shashi Chawla, Dhanapathrai Publications (2019), New Delhi.

## Reference Books

1. Engineering Chemistry, M. Thirumalachary and Laxminarayana, Scitech Publications.
2. Text Book of Engineering Chemistry, Cengage Learning, B. Rama Devi, Ch. Venkata Ramana Reddy and Prasanth Rath.
3. Engineering Chemistry (NPTEL Web-book)by B.L. Tembe, Kamaluddin and M.S.Krishnan

## E-Resources

1. <https://www.imnh.isu.edu/digitalatlas/hydr/basics/main/chmtxt>.
2. [https://chem.libretexts.org/Core/.../Electrochemistry/Basics\\_of\\_Electrochemistry](https://chem.libretexts.org/Core/.../Electrochemistry/Basics_of_Electrochemistry)
3. <https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/polymers.htm>
4. <https://www.youtube.com/watch?v=W0-CvvAGtEM>
5. <https://sengerandu.wordpress.com/tutorials/physical-metallurgy/engineering-materials>

## Course Outcomes

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

- CO1.** Understand and analyse microscopic chemistry in terms of atomic orbitals, molecular orbitals.
- CO2.** Recognize and select the domestic and industrial problems caused by hard water and also learn about the municipal water treatment using various methods.
- CO3.** Understand and interpret the important fundamental concepts of electrochemical procedures related to corrosion and its control.
- CO4.** Rate the fuels and suggest methods for enhancement of the quality of fuels for the required output.
- CO5.** Identify & recognize the role of polymers and Nanomaterials in everyday life.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year - I Sem</b>			
Course Code: <b>L113A</b>	<b>ENGINEERING MECHANICS</b> (COMMON TO: ME, CE)	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics.

### **Module 1: Resultant Force system and Equilibrium of Force System [12L]**

#### **Unit-I: [6L]**

Concepts of force, System of forces, components of forces in a plane and in space systems. Resultant of force systems. Moment of forces and its applications. Couples and its applications

#### **Unit-II: [6L]**

Free body diagram, equation of equilibrium of coplanar and spatial force systems.

### **Module 2: Friction, Analysis of Trusses and Virtual Work [9L]**

#### **Unit-I: [3L]**

Laws of friction, application of friction to a single body & connecting systems, wedge friction

#### **Unit-II: [3L]**

Analysis of perfect trusses using method of joints and method of sections.

#### **Unit-III: [3L]**

Virtual displacements, Principle of virtual work for particle and ideal system of rigid bodies- problems on determinate beams only.

### **Module 3: Centroid & Centre of Gravity and Area & Mass moment of Inertia [9L]**

#### **Unit-I: [4L]**

Centroid of simple planes (from first principles), Centroid of Composite sections, Centre of gravity and its implications, Pappu's theorems.

#### **Unit-II: [5L]**

Definition of Area moment of Inertia, Moment of inertia of plane section from first principles, Theorems of moment of inertia, moment of inertia of standard sections and composite sections, Mass moment of inertia of rectangular and circular plates, cylinder, cone & sphere.

### **Module 4: Kinematics and Kinetics [10L]**

#### **Unit-I: [5L]**

Rectilinear and Curvilinear motion, Velocity and Acceleration, Types of Rigid body motion, Kinematics of fixed axis rotation and Plane Motion.

#### **Unit-II: [5L]**

Kinetics of Particle and Rigid Body in Translation, Fixed Axis Rotation, Equations of Plane Motion, Rolling Bodies.

### **Module 5: Work Energy Method and Mechanical Vibrations [10L]**

#### **Unit-I: [5L]**

Work Energy Principle and its application to Translation, Fixed axis rotation and plane motion.

#### **Unit-II: [5L]**

Introduction to vibration, free and forced vibrations, simple harmonic motion, simple pendulum and compound pendulum.

### Text Books

1. Vijaykumar K. and J. Suresh Kumar, "Engineering Mechanics Statics and Dynamics", B. S. Publications. 2011.
2. Timoshenko & Young, "Engineering Mechanics", SI Publications, 2010.

### Reference Books

1. Basudev Bhattacharya, "Engineering Mechanics", Oxford University Press, 2<sup>nd</sup> Edt, 2014
2. S.S. Bhavikatti & J.G. Rajasekharappa, "Engineering Mechanics", 2010.
3. Irving. H. Shames, "Engineering Mechanics", Prentice–Hall, 2012.

### E-Resources

1. <https://rb.gy/6nbwyl>
2. <https://rb.gy/s5qltu>
3. <https://nptel.ac.in/courses/122/104/122104015/>

### Course Outcomes

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

- CO1.** Solve problems dealing with forces in plane and space force system, draw free body diagrams to analyze various problems in equilibrium.
- CO2.** Analyze for smooth and frictional surface, simple trusses for forces and virtual work.
- CO3.** Determine the Centroid, centre of gravity and moment of inertia for elementary.
- CO4.** Solve problem in kinematics and kinetics of particles and rigid bodies.
- CO5.** Analyze body motion using work energy principles and able to apply the concept of simple harmonic motion and free vibrations in dynamics.

### 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	-	-	-	-	-	-	-	3	1	-
<b>CO2</b>	3	2	2	2	-	-	-	-	-	-	-	3	2	-
<b>CO3</b>	3	2	2	2	-	-	-	-	-	-	-	3	2	-
<b>CO4</b>	3	2	1	3	-	-	-	-	-	-	-	3	2	-
<b>CO5</b>	3	2	1	3	-	-	-	-	-	-	-	3	2	-
<b>Average</b>	3	2	1.6	2.4	-	-	-	-	-	-	-	3	1.8	-

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year-I Sem</b>			
Course Code: <b>L112B</b>	<b>FUNDAMENTALS OF ELECTRICAL CIRCUITS AND ELECTRONIC DEVICES</b> (Common to CE, ME & MIE)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:**

**Module 1: DC Circuits [10L]**

**Unit-I: [6L]**

Electrical quantities – Electrical circuit elements - resistors - inductors - capacitors - voltage and current sources - Source transformations - Ohm's Law - Kirchhoff's Laws - simple problems.

**Unit-II: [4L]**

Network reduction techniques - series and parallel circuits - analysis of DC circuits - mesh, nodal - simple problems.

**Module 2: AC Circuits [9L]**

**Unit-I: [5L]**

Sinusoidal functions - phasor representation - RMS and Average values - form and peak factors.

**Unit-II: [4L]**

Analysis of single phase AC circuits consisting of R, L, C, RL, RC and RLC series combinations - power and power factor-concept of three phase system.

**Module 3: DIODES AND APPLICATIONS [12L]**

**Unit-I:**

P-N junction diode Principle of operation and characteristics of a P-N junction diode static and dynamic resistance of a diode, ideal diode, Zener Diode, Avalanche and Zener Breakdown mechanisms, V-I characteristics of Zener Diode

**Unit-II:**

Rectifiers & Filters Diode as a Rectifier Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, zener diode as a voltage regulator

**Module 4: Bi-Polar Junction Transistor (BJT) [7L]**

**Unit-I:**

Principle of operation of Bi-Polar Junction Transistor (BJT), current components in a junction Transistor, V-I characteristics in CB, CE, CC configurations.

**Unit-II:**

Determination of " $\alpha$ " and " $\beta$ " of a transistor from the V-I characteristics, relation between " $\alpha$ " and " $\beta$ " of a transistor.

**Module 5: FIELD EFFECT TRANSISTER [12L]**

**Unit-I:**

Comparison of BJT & JFET, Construction & Operation of JFET, V-I Characteristics of JFET, Determination of FET Parameters from the V-I characteristics.

**Unit-II:**

MOSFET Construction & Operation in Enhancement and Depletion modes, V-I Characteristics of MOSFET.

**Text Books**

1. V.K. Mehta, "Principles of Electrical Engineering and Electronics", S. Chand & Company Ltd,

2012

2. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
3. A. K. Sawhney, "A course in Electrical and Electronics Measurements and Instrumentation", Dhanapath Rai and Sons., 10<sup>th</sup> Edition, 2007.
4. Electronic Devices & Circuits : Millman & Halkias Mcgraw Hill
5. Integrated Electronics : Millman & Halkias Mcgraw Hill

### Reference Books

1. Dr. Ramana Pilla, Dr. M. Suryakalavathi, "Basic Electrical Engineering", S. Chand, 2018.
2. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

### E-Resources

1. [https://onlinecourses.swayam2.ac.in/nou21\\_ee02/preview](https://onlinecourses.swayam2.ac.in/nou21_ee02/preview)
2. <https://nptel.ac.in/courses/108/108/108108076/>
3. <https://www.electrical4u.com>

### Course Outcomes

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

- CO 1.** Analyze DC electrical circuits using network laws.
- CO 2.** Analyze single phase AC and three phase AC circuits.
- CO 3.** Understand PN junction diode operation, characteristics and applications.
- CO 4.** Gain Knowledge on characteristics of BJT in CB., CE, CC Configuration
- CO 5.** Gain Knowledge on characteristics of FET in various modes of operation

### 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	1	1	1	-	-	-	-	-	-	1	1	1
<b>CO2</b>	3	2	1	1	-	-	-	-	-	-	-	1	1	1
<b>CO3</b>	3	3	3	2	2	-	-	-	-	-	-	2	2	2
<b>CO4</b>	3	3	3	2	2	-	-	-	-	-	-	2	2	2
<b>CO5</b>	3	3	3	2	2	-	-	-	-	-	-	2	2	2
<b>Average</b>	3	2.8	2.2	1.6	1.75	-	-	-	-	-	-	1.6	1.6	1.6

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year-I Sem</b>			
Course Code: <b>L1103</b>	<b>CHEMISTRY LAB</b> (COMMON TO: AIML, CE, ME, ECE, EEE and MIE)	L	T	P	D
Credits: <b>1</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**Pre-Requisites:** Nil

### List of experiments ( Any 10-12 experiments)

#### Volumetric Analysis:

1. Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Determination of total hardness of water by complexometric method using EDTA.
3. Determination of chloride content of water by Argentometry.
4. Estimation of Fe<sup>2+</sup> in Mohr's salt using permanganometry.
5. Estimation of ferrous iron by dichrometry.

#### Instrumental methods of Analysis:

6. Estimation of an HCl by Conductometric titrations using NaOH.
7. Estimation of Acetic acid by Conductometric titrations using NaOH.
8. Estimation of HCl by Potentiometric titrations using NaOH.
9. Estimation of Fe<sup>2+</sup> by Potentiometry using KMnO<sub>4</sub>.

#### Determination of Physico-Chemical Properties:

10. Determination of viscosity of a given liquid by using Ostwald's viscometer.
11. Determination of surface tension of a given liquid using stalagmometer.
12. Determination of partition coefficient of acetic acid between n-butanol and water.

#### Synthesis of Nanomaterials, Polymers and drug molecules:

13. Synthesis of drug molecule Aspirin.
14. Synthesis of Polymer-Bakelite.
15. Synthesis of Iron nanoparticles.

#### Text Books

1. Senior practical physical chemistry, B.D. Khosla, A. Gulati and V. Garg, (R.Chand & Co.)
2. An introduction to practical chemistry, K.K. Sharma & D.S. Sharma, (Vikas publishing)

#### Course Outcomes

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

1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
2. Calculate the concentration and amount of various substances using instrumental techniques.
3. Synthesize the engineering materials like nanomaterials, polymers and drug molecules.
4. Determine the physico-chemical properties like partition co-efficient, surface tension and viscosity.
5. Determine the partition coefficient of organic compound in two immiscible liquids.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year - I Sem</b>			
Course Code: <b>L1131</b>	<b>ENGINEERING DRAWING</b> (COMMON TO CE,EEE,ME,ECE,MIE, AIML)	L	T	P	D
Credits: 3		<b>1</b>	<b>0</b>	<b>4</b>	<b>0</b>

**Pre-Requisites:** Engineering Mathematics.

### **Module 1: Principles of Engineering Drawing, Conic Sections, Curves, Scales [12L]**

#### **Unit-I: [2L]**

Introduction to Engineering Drawings, Significance, Introduction to AutoCAD.

#### **Unit-II: [4L]**

Ellipse – Eccentric Method, Arcs Method, Concentric, Circle Method, Rectangular Method;  
Parabola – Eccentric Method, Rectangular Method.

#### **Unit-III: [3L]**

Cycloid – Epicycloid, Hypocycloid, Involute of Circles.

#### **Unit-IV: [3L]**

Construction of Plane, Diagonal Scales.

### **Module 2: Principles of Orthographic Projections, Projections of Points, Line, Planes [9L]**

#### **Unit-I: [3L]**

Introduction to Orthographic Projections, Conventions.

#### **Unit-II: [3L]**

Projections of Points in four Quadrants, Projection of Lines in first quadrant, Inclined to both Principle Planes.

#### **Unit-III: [3L]**

Projections of Planes in first quadrant and inclined to both Principle Planes for Regular Geometrical Figures – Circle, Square, Rectangle, Triangle, Pentagon, Hexagon.

### **Module 3: Projections of Solids [8L]**

#### **Unit-I: [5L]**

Projections of Right Regular Solids – Prisms and Pyramids of Square, Pentagon, Hexagon;

#### **Unit-II: [3L]**

Projections of Generated Solids – Cone, Cylinder.

### **Module 4: Sections of Solids, Development of Surfaces of Solids [12L]**

#### **Unit-I: [6L]**

Sectional and Auxiliary Views of Right Regular Solids – Prisms and Pyramids of Pentagon, Hexagon; Generated solids – Cylinder and Cone.

#### **Unit-II: [6L]**

Surfaces of Right Regular solids – Prism, cylinder pyramid and cone

### **Module 5: Isometric Projections, Orthographic Views [9L]**

#### **Unit-I: [5L]**

Principles of Isometric Projections, Isometric Scale, Isometric Views of Simple and Compound Solids; Conversion of Orthographic Views of simple objects to Isometric Views.

## Unit-II: [4L]

Conversion of Isometric Views to Orthographic Views.

### Text Books

1. Bhatt N.D., Panchal V.M. & Ingle P.R., "Engineering Drawing", Charotar Publishing House, 2014.
2. K. Venugopal & V. Prabhu Raja, "Engineering Drawing + Auto CAD", New Age International Publishers. Fifth Edition, 2011.

### Reference Books

1. Narayana, K.L. & P Kannaiah, "Text book on Engineering Drawing", Scitech Publish, 2008
2. Agrawal B. & Agrawal C. M., "Engineering Graphics", TMH Publ, 2012.

### E-Resources

1. <https://nptel.ac.in/courses/112/103/112103019/>
2. <https://urlzs.com/fLJ3T>
3. <https://urlzs.com/zky46>

### Course Outcomes

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

- CO1.** Equipped with the basic knowledge of using the drawing instruments and dimension practice.
- CO2.** Represent any three-dimensional object with two-dimensional drawings and exposed to the visual aspects of lines and planes.
- CO3.** Visualize of solids inclined to both the planes.
- CO4.** Visualization of sections of solids and their developments.
- CO5.** Representation of 3D objects through isometric and orthographic views

### 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	2	1	2	-	-	-	-	-	-	3	1	1
<b>CO2</b>	3	3	2	1	2	-	-	-	-	-	-	3	2	1
<b>CO3</b>	3	3	2	1	2	-	-	-	-	-	-	3	2	1
<b>CO4</b>	3	3	3	1	2	-	-	-	-	-	-	3	2	2
<b>CO5</b>	3	3	3	1	2	-	-	-	-	-	-	3	2	3
<b>Average</b>	3	3	2.4	1	2	-	-	-	-	-	-	3	1.8	1.6

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



<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year-I Sem</b>			
Course Code: <b>L1133</b>	<b>ENGINEERING WORKSHOP AND MANUFACTURING PRACTICES</b> (COMMON TO CE,EEE,ME,ECE,MIE, AIML)	L	T	P	D
Credits: 3		<b>1</b>	<b>0</b>	<b>4</b>	<b>0</b>

**Pre-Requisites:** Basic knowledge about tools and different trades

### List of Experiments

#### Experiments for Practice

1. To make a Half Lap joint from the given two reapers.
2. To make a Dovetail joint from the given two reapers.
3. To make a Straight fitting from the given two MS pieces.
4. To make a V- fitting from the given two MS pieces.
5. To make a Rectangular Scoop using the given Sheet metal.
6. To make a Hooper using the given Sheet metal.
7. To perform Parallel and Series wiring connection
8. To perform stair case wiring connection
9. To prepare a sand mould for the given single piece pattern.
10. To prepare a sand mould for the given Split-piece pattern.

#### Demonstration

11. To make a Square rod and S- hook from a given round rod
12. To make a Lap and Butt joint using the given two M.S pieces by arc welding
13. To perform Plain and Step turning operation on lathe machine.
14. To perform Taper turning and Thread cutting operation on lathe machine.
15. To perform a simple Milling operation on given workpiece.

#### Text Books

1. P.N.Rao, "Manufacturing Technology", TataMcGrawHill, 4th Edition, 2013.
2. K. C. John, "Mechanical Workshop Practice", PHI Publishers, 2nd Edition, 2010.

#### Course Outcomes

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

- CO1.** know the importance of general safety precautions on different shop floors.
- CO2.** identify the basic tools and equipments used in fitting, carpentry, sheet metal, machine shop, welding and smithy.
- CO3.** understand the basics of removal of material from workpiece surface to attain specific shape.
- CO4.** familiarize with the production of simple models in fitting, carpentry, sheet metal, machine, welding and smithy trades.
- CO5.** Gain different skills of manufacturing and importance of dimensional accuracies and dimensional tolerances in assembling of various components.

**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	2	3	3	3
<b>CO2</b>	-	-	-	-	-	-	-	-	2	2	2	3	3	1
<b>CO3</b>	-	-	-	-	-	-	-	-	2	2	2	3	3	3
<b>CO4</b>	-	-	-	-	-	-	-	-	2	2	2	3	3	3
<b>CO5</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: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year-I Sem</b>			
Course Code: <b>L11M1</b>	<b>FUNCTIONAL ENGLISH</b> (Audit Course-I)	L	T	P	D
Credits: 0		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites: NIL**

### **Module 1: FUNCTIONAL ENGLISH [6L]**

Introduction - Functional Spoken English; Listening – Speaking: Do’s and Don’ts; Expressing: Ability/ Admiration/ Agreement/ Anger/ Annoyance/ Appreciation/ Pleasure/ Sarcasm/ Satisfaction/ Surprise/ Approval/ Capability/ Certainty/ Condolences/ Doubt/ Fear/ Gratitude/ Possibility/ Worry; Asking for: Advice/ Clarification/ Direction/ Information/ Permission/ Predictions/ Recommendation.

### **Module 2: VOCABULARY BUILDING [6L]**

Vocabulary for Day-to-day Conversations; Introduction: Vegetables/ Groceries/ Fruits/ Weather; Parts of Human body/ Dresses/ Furniture/ Relations; Birds/ Cries of Animals; Food/ Hospitality/ Houses/ Rooms/ Tools; Airport/ News Paper/ Books/ Gems; Corporate Vocabulary/ Jobs/ Occupations; Diseases; Slang Words and Technical Jargon.

### **Module 3: FUNCTIONAL GRAMMAR - I [6L]**

Introduction: Parts of Speech; Verb Forms; Phrases and Clauses; Tenses; Speeches; Voices; Degrees of Comparison; Simple, Complex and Compound Sentences.

### **Module 4: FUNCTIONAL GRAMMAR - II [6L]**

Sentence Making for Effective Communication; Sentence Structure – ‘Wh’ Questions - How to Frame Questions and Give Answers; Question Tags; Spotting Errors.

### **Module 5: COMMUNICATION SKILLS [6L]**

Polite, Courteous and Diplomatic Terms; Useful Daily Expressions; Courtesy, Good Manners and Etiquettes; Conversation Techniques; Story Telling.

### **Text Books**

1. L. Adinarayana and V. Prakasam, *Spoken English*, Neelkamal Publications Pvt. Ltd., New Delhi, 2008.
2. Ram Bhasker Raju, *The Complete Book on Spoken English*, Goutham Buddha Publications, Hyderabad, 2002.

### **Reference Books**

1. Sabina Pillai, *Spoken English for My World*, Oxford University Press, New Delhi, 2016.
2. K. R. Lakshminarayanan, *Speak in English*, Scitech Publications, Chennai, 2009.

### **E-Resources**

1. <https://www.britishcouncil.in/programmes/english-partnerships/state/skills-projects/AP-English-Skills>.
2. <https://www.fluentu.com/blog/english/websites-to-learn-english/>

## Course Outcomes

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

- CO1.** Demonstrate knowledge of grammar and vocabulary in writing effective formal letters and e-mails.
- CO2.** Communicate effectively by applying appropriate speaking and writing techniques by examining and applying functional English.
- CO3.** Learn the transformation of sentences and use them effectively.
- CO4.** Understand making small sentences and use them in daily colloquial situation.
- CO5.** Learn the useful communication expression and use them in day-to-day life.

## 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: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year-II Sem</b>			
Course Code: <b>L120A</b>	<b>LINEAR ALGEBRA AND ADVANCED CALCULUS</b> (Common to all Branches)	L	T	P	D
Credits: 4		<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>

**Pre-Requisites: NIL**

### **Module 1: Matrices and system of equations [10L]**

Types of Matrices, Symmetric, Skew-symmetric, Hermitian, Skew-Hermitian, orthogonal matrices, Unitary Matrices, rank of a matrix by Echelon form and Normal form, Gauss elimination, Inverse of non-singular matrices by Gauss-Jordan method.  
System of linear equations, solving system of Homogeneous and Non-Homogeneous equations.

### **Module 2: Eigen values, Eigen Vectors and Quadratic Forms [12L]**

Eigen values, Eigen vectors and their properties, Diagonalization, Cayley - Hamilton theorem (without proof), Inverse and powers of a matrix using Cayley - Hamilton theorem.  
Definitions of Linear Transformation and Orthogonal Transformation, Quadratic forms, rank and nature of the quadratic forms, index and signature, reduction of quadratic forms into canonical form using Linear Transformation and Orthogonal Transformations.

### **Module 3: Multiple Integrals [10L]**

Evaluation of double integrals, change of order of integration, change of variables, evaluation of triple integrals, change of variables.  
Applications: Finding areas and volumes, centre of gravity.

### **Module 4: vector differential calculus [8L]**

Scalar and vector fields, vector differentiation, level surfaces, gradient of a scalar field, directional derivative, divergence and curl of a vector field, Scalar potential energy, Tangent plane and normal line. Vector Identities (without proofs).

### **Module 5: Vector integral calculus [8L]**

Line, surface and volume integrals.  
Green's theorem in a plane, Gauss-Divergence theorem and Stokes theorem (without proofs).

### **Text Books**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2015
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9<sup>th</sup> Edition, John Wiley & Sons, 2006.
3. R.K.Jain & S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5<sup>th</sup> Edition, 2015.

### **Reference Books**

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2008.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill, 11<sup>th</sup> Reprint, 2010.

### **E-Resources**

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

### **Course Outcomes**

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

- CO1.** Solve the consistent system of linear equations.
- CO2.** Apply orthogonal congruent Transformations to a quadratic form.
- CO3.** Evaluate multiple integrals in various coordinate system.
- CO4.** Apply the concept of gradient, divergence and curl to formulate engineering problems.
- CO5.** Convert line integrals to surface integrals and surface integrals to volume integrals.

#### 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	1	3	-	-	-	-	-	-	-	2	-	-
<b>CO2</b>	3	3	2	3	-	-	-	-	-	-	-	3	-	-
<b>CO3</b>	3	3	2	3	-	-	-	-	-	-	-	3	-	-
<b>CO4</b>	3	3	1	3	-	-	-	-	-	-	-	2	-	-
<b>CO5</b>	3	3	2	3	-	-	-	-	-	-	-	3	-	-
<b>Average</b>	3	3	1.6	3	-	-	-	-	-	-	-	2	-	-

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year-II Sem</b>			
Course Code: <b>L120B</b>	<b>ENGLISH</b>  (Common to CE,EEE,ME,ECE,MIE & AIML)	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites: NIL**

#### **Module 1: [8L]**

**The Model Millionaire-Oscar Wilde** from the prescribed textbook 'Forging Ahead' published by Orient Black Swan.

**Listening:** The Listening Process-Hearing and Listening; Types of Listening.

**Speaking:** Narrating Personal Experiences, Expressing Opinions.

**Reading:** Reading for Summarizing and Paraphrasing, Facts versus Opinions.

**Writing Skills:** Note-making, Summarizing; Writing Formal Letters.

**Vocabulary and Grammar:** Subject-Verb Agreement, Noun-Pronoun Agreement; Collocations.

#### **Module 2: [8L]**

**The Lotos-Eaters (extract)-Alfred Tennyson** from the prescribed textbook 'Forging Ahead' published by Orient Black Swan.

**Listening:** Listening for Style-Communicative Purpose, Degree of Formality, Choice of Vocabulary Pronunciation and Syntax; Listening for Structure-Introduction, Body and Conclusion.

**Speaking:** Making Presentation-Preparing a Presentation, Structuring Content, Delivering the Presentation.

**Reading:** Reading for Meaning; Reading for Pleasure; Making Inferences; Reading Between the Lines.

**Writing Skills:** Writing an Appreciation of a Poem; Paraphrasing; Note-Taking.

**Vocabulary And Grammar:** Word Roots and Affixes; Tenses; Correcting Errors in Punctuation.

#### **Module 3: [8L]**

**Continuous Transformation-Azim Premji** from the prescribed textbook 'Forging Ahead' published by Orient Black Swan.

**Listening:** Listening with a Purpose-Barriers to Listening.

**Speaking:** Agreeing and Disagreeing with, and Defending Opinions.

**Reading:** Reading Methods-SQ3R Reading Technique.

**Writing Skills:** Writing Argumentative Essays.

**Vocabulary and Grammar:** Active and Passive Voice, Academic Vocabulary.

#### **Module 4: [8L]**

**Steve Jobs-Sтивен Paul Jobs** from the prescribed textbook 'Forging Ahead' published by Orient Black Swan.

**Listening:** Effective Listening Strategies-Ten Thumb Rules for Good Listening.

**Speaking:** What is a Group Discussion? GD Strategies-Type of GDs-Dos and Don'ts.

**Reading:** Reading Strategies-Scanning and Skimming Skills.

**Writing Skills:** Writing Job Application Letters and CVs.

**Vocabulary and Grammar:** Phrasal Verbs, Phrasal Prepositions; Technical Vocabulary.

#### **Module 5: [8L]**

**How I Became a Public Speaker (extract) - George Bernard Shaw** from the prescribed textbook 'Forging Ahead' published by Orient Black Swan.

**Listening:** Listening for Explicit and Implicit Information.

**Speaking:** Making Presentations as a Team.

**Reading:** Reading Strategies-Extensive and Intensive Reading Skills.

**Writing Skills:** Report Writing-Formats of Reports, Types of Reports.

**Vocabulary and Grammar:** Improving Vocabulary-Avoiding Cliches, Redundancies; Correcting Common Errors.

## Text Books

1. Chitra. V.B. G.M. Sundaravalli, D.S. Kesava Rao. Ed. *Forging Ahead A Course Book for B. Tech Students*: Orient Black Swan: Hyderabad, 2022.
2. Ashraf Rizvi. M. *Effective Technical Communication*. McGraw-Hill: New Delhi, 2010.

## Reference Books

1. Swan, M. (2016). *Practical English Usage*. Oxford University Press.
2. Kumar, S and Lata, P. (2018). *Communication Skills*. Oxford University Press.
3. Wood, F.T. (2007). *Remedial English Grammar*. Macmillan.
4. Zinsser, William. (2001). *On Writing Well*. Harper Resource Book.
5. Hamp-Lyons, L. (2006). *Study Writing*. Cambridge University Press.
6. *Exercises in Spoken English. Parts I –III*. CIEFL, Hyderabad. Oxford University Press.

## E-Resources

1. <https://poemanalysis.com/alfred-tennyson/the-lotos-eaters/>
2. <https://degmateng.wordpress.com/2019/11/27/ls-6-the-model-millionaire-oscar-wilde-summary/>
3. <https://www.britannica.com/biography/Steve-Jobs>
4. <http://kjtenglishnotes.blogspot.com/2015/10/how-i-became-public-speaker.html>
5. <https://www.learngrammar.net/english-grammar>

## Course Outcomes

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

- CO1.** Use English Language effectively in spoken and written forms.
- CO2.** Comprehend the given texts and respond appropriately.
- CO3.** Use the proper vocabulary and grammatically correct sentences.
- CO4.** Communicate confidently in various contexts and different cultures.
- CO5.** Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

## CO-PO/PSO Mapping

Course Outcomes	Program Outcomes (POs)/Program Specific Outcomes (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO 2
<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: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year- II Sem</b>			
Course Code: <b>L120E</b>	<b>ENGINEERING PHYSICS</b> (COMMON TO CE, ME & MIE)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Fundamentals of Physics.

### Module-1: Wave Optics [9L]

**Unit 1: Interference:** Principle of Superposition, coherence and methods to produce coherent sources, interference in thin film by reflected light, Newton's Rings.

**Unit 2: Diffraction** – Distinction between Fraunhofer and Fresnel Diffraction, Farunhofer diffraction due to single slit, Plane Diffraction Grating, resolving power of Grating.

**UNIT 3: Polarization:** Introduction, Polarization by reflection, Polarization by double refraction.

### Module -2: Waves and Oscillations [9L]

Simple harmonic Oscillator, damped harmonic oscillator, types of damping – heavy, critical and light damping, energy decay in a damped harmonic oscillator, relaxation time, quality factor, Forced harmonic Oscillator, electrical and mechanical analogy for a simple oscillator. Torsional Pendulum and Compound Pendulum.

### Module-3: Crystal Structures, Crystal Planes and X-Ray Diffraction [9L]

**Crystal Structures, Crystal Planes:** Space lattice, Unit cell, Lattice parameters, Crystal systems, Bravais lattices, Coordination number, Atomic packing fraction, Structures and Packing fractions of Simple Cubic, Body Centered Cubic, Face Centered Cubic crystals. Crystal planes and Directions, Miller Indices for Crystal planes, Inter planar spacing of orthogonal crystal systems.

**X-Ray Diffraction:** Diffraction of X-rays by crystal planes: Bragg's law, Powder method, Applications of X-ray diffraction.

### Module-4: Lasers & Fiber Optics [9L]

**Lasers:** Introduction, absorption, spontaneous emission, Stimulated emission, calculation of Einstein co-efficient of A & B, Population inversion, Pumping, Lasing action, Types of Lasers: Ruby laser, He-Ne laser, Semiconductor laser, Applications of laser.

**Fiber Optics:** Principle and construction of an optical fiber, Acceptance angle, Numerical aperture, Types of optical fibers (Single mode, multimode, step index, graded index), Losses in optical fibers, Optical fiber communication system with block diagram and Applications of optical fibers.

### Module-5: Dielectric and Magnetic Properties [ 9L]

**Dielectric Properties:** Electric dipole, dipole moment, dielectric constant, polarizability, electric susceptibility, displacement vector, electronic, ionic and orientation polarizations (quantitative treatment), Internal fields in a solid, Clausius-Mossotti equation, Ferro-electricity and Piezo electricity.

**Magnetic Properties:** Basic definitions, origin of magnetic moment, Bohr magneton, classification of Dia , Para and Ferro magnetic materials on the basis of magnetic moment, domain theory of Ferro magnetism on the basis of hysteresis curve.

### Text Books

1. Engineering Mechanics, 2nd ed.- MK Harbola, Cengage Learning.
2. Engineering Physics, Gaur and Gupta, McGraw Hills.
3. " Optics" , Ajoy Ghatak, McGraw Hill Education, 2012A textbook of Engineering Physics.

### Reference Books

1. "The physics of vibrations and waves", H. J. Pain, Wiley, 2006.
2. "Principles of Lasers", O.Svelto.
3. "Introduction to Mechanics", M.K.Verma, Universities Press.
4. P.K.Palanisamy, "Engineering Physics", SciTech Publications, Fourth edition.

### E-Resources

1. [http://www.gistrayagada.ac.in/gist\\_diploma/PHYSICS-StudyMaterial.pdf](http://www.gistrayagada.ac.in/gist_diploma/PHYSICS-StudyMaterial.pdf)
2. <http://www.faadooengineers.com/threads/3300-Applied-Physics-Ebooks-pdf-freedownload?s=1b6cb6b1de4e7152298bd9d60156cd11>
3. <http://aip.scitation.org/journal/jap>

### Course Outcomes

On completion of the course, the students will be able to:

1. Interpret the intensity variation of light due to interference and diffraction
2. Distinguish free, damped and forced vibrations.
3. Analyze the bonding scheme and its physical properties of a given material
4. Analyze working principle of lasers and to summarize its applications.
5. Explain the principles of physics in dielectrics, magnetic materials useful to engineering Applications.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year- II Sem</b>			
Course Code: <b>L125A</b>	<b>PROGRAMMING FOR PROBLEM SOLVING</b>	L	T	P	D
Credits: 4		<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>

**Pre - Requisites:** Mathematical Knowledge, Analytical Skills.

#### **Module-1: INTRODUCTION TO PROGRAMMING: [11L]**

**Unit 1: Introduction to components of a computer system:** disks, primary and secondary memory, processor, operating system, compilers, creating, compiling and executing a program etc., Number systems.

**Unit 2: Introduction to Algorithms:** steps to solve logical and numerical problems. Representation of Algorithm, Flowchart/Pseudo code with examples, Program design and structured programming.

**Unit 3: Introduction to C Programming Language:** variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code, Operators, expressions and precedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion, The main method and command line arguments

**Unit 4: Bitwise operations:** Bitwise AND, OR, XOR and NOT operators Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do- while loops. I/O: Simple input and output with scanf and printf, formatted I/O, Introduction to stdin, stdout and stderr.

#### **Module-2: ARRAYS, STRINGS, STRUCTURES AND PREPROCESSOR [9L]**

**Unit 1: Arrays:** one and two dimensional arrays, creating, accessing and manipulating elements of arrays.

**Unit 2: Strings:** Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strstr etc.), arrays of strings

**Unit 3: Structures:** Defining structures, initializing structures, unions, Array of structures.

**Unit 4: Preprocessor:** Commonly used Preprocessor commands like include, define, undef, If, ifdef, ifndef.

#### **Module-3: POINTERS AND FILE HANDLING IN C [10L]**

**Unit 1: Pointers:** Idea of pointers, defining pointers, Pointers to Arrays and Structures, Use of Pointers in self-referential structures, usage of self-referential structures in linked list (no implementation) Enumeration data type.

**Unit 2: Files:** Text and Binary files, Creating and Reading and writing text and binary files, appending data to existing files, Writing and reading structures using binary files, Random access using fseek, ftell and rewind functions.

#### **Module-4: FUNCTION AND DYNAMIC MEMORY ALLOCATION [10L]**

**Unit 1: Functions:** Designing structured programs, declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, passing arrays to functions, passing pointers to functions, idea of call by reference, Some C standard functions and libraries.

**Unit 2: Recursion:** Simple programs, such as Finding Factorial, Fibonacci series etc., Limitations of Recursive functions.

Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of different data types.

## Module-5: INTRODUCTION TO ALGORITHMS [10L]

Basic searching algorithms (linear and binary search techniques), Basic sorting algorithms (Bubble, Insertion, Quick, Merge and Selection sort algorithms) Basic concept of order of complexity through the example programs

### Text Books

1. Ream Thareja, Programming in C, Oxford university press.
2. B.A. Forouzan and R.F. Gilberg, C Programming and Data Structures, Cengage Learning, (3rdEdition).

### Reference Books

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. R.G. Dromey, How to solve it by Computer, Pearson (16thImpression)
3. Stephen G. Kochan, Programming in C, Fourth Edition, PearsonEducation.
4. Herbert Schildt, C: The Complete Reference, McGraw Hill, 4thEdition
5. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

### E-Resources

1. <https://fresh2refresh.com/c-programming/>
2. <https://www.studytonight.com/c/>
3. <https://beginnersbook.com/2014/01/c-tutorial-for-beginners-with-examples/>
4. <https://www.programiz.com/c-programming>
5. [http://www.gtucampus.com/uploads/studymaterials/Degree%20EngineeringSandipFundamentals\\_of\\_C.pdf](http://www.gtucampus.com/uploads/studymaterials/Degree%20EngineeringSandipFundamentals_of_C.pdf)
6. [http://cs.indstate.edu/~cbasavaraj/cs559/the\\_c\\_programming\\_language\\_2.pdf](http://cs.indstate.edu/~cbasavaraj/cs559/the_c_programming_language_2.pdf)

### Course Outcomes

On completion of the course, the students will be able to:

1. Design the algorithms/flowcharts of C-programs.
2. Write the Code and test a given logic in C programming language.
3. Decompose a problem into functions and to develop modular reusable code.
4. Make Use of arrays, pointers, strings and structures to write C Programs.
5. Apply searching and sorting algorithms.

### 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	2	2
<b>CO2</b>	2	2	3	2	2	-	-	-	-	-	-	-	2	-
<b>CO3</b>	3	2	2	-	-	-	-	-	-	-	-	1	-	3
<b>CO4</b>	3	2	2	2	-	-	-	-	-	-	-	1	-	3
<b>CO5</b>	3	2	2	-	-	-	-	-	-	-	-	1	2	3
<b>Avg</b>	<b>2.8</b>	<b>2.0</b>	<b>2.3</b>	<b>2.0</b>	<b>2.0</b>	-	-	-	-	-	-	<b>1.0</b>	<b>2.0</b>	<b>2.8</b>

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year- II Sem</b>			
Course Code: <b>L1202</b>	<b>PHYSICS LAB</b> (COMMON TO: All branches)	L	T	P	D
Credits: <b>1</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**Pre-Requisites:** Intermediate basic concepts.

**List of Experiments:**

**1. Energy gap of P-N junction diode :**

To determine the energy gap of a semiconductor diode.

**2. Solar Cell:**

To study the V-I Characteristics of solar cell.

**3. Light emitting diode and Laser Diode:**

Plot V-I characteristics of light emitting diode and Laser diode.

**4. Optical fiber:**

Determination of Numerical Aperture of an optical fibre.

**5. Hall effect:**

To determine Hall co-efficient of a given semiconductor.

**6. Photoelectric effect**

To determine work function of a given material.

**7. LASER**

To study the Wave length of LASER Source.

**8. Dielectric Constant**

To determine the Dielectric constant of the given material.

**9. LCR Circuit**

To determine the Quality factor of LCR Circuit ( Series & Parallel).

**10. R-C Circuit**

To determine the time constant of R-C circuit (Growth and Decay).

**11. Melde's Experiment**

To determine the frequency of a vibrating bar or tuning fork using Melde's arrangement.

**12. Torsional Pendulum**

To determine the rigidity modulus of the material of the given wire using torsional pendulum.

**13. Newton's Rings**

To determine the radius of curvature of the lens by forming Newton's rings.

**14. Diffraction Grating**

To determine the number of lines per inch of the grating.

**15. Sonometer**

To determine the frequency of AC Supply sonometer.

**Note: Any 10 experiments are to be performed.**

## **Text Books**

1. Dr. Narendra, L. Mathakari, "Experiments in Applied Physics" ( Physics Lab Manual 4<sup>th</sup>edition) ,
2. " Engineering Physics Lab Resources" By Department of Physics JBIET.

## **Course Outcomes**

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

1. Learn the experimental concepts on in LED, Electric and Electronics materials.
2. Get the knowledge of fundamentals of Semiconductor physics.
3. Design, characterization and study of properties of material help the students to prepare new materials for various engineering applications.
4. Be exposed to the phenomena of waves, oscillations and optics.
5. Lasers and fiber optics enable the students to apply to various systems like communications, solar cell, photo cells and so on.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year-II Sem</b>			
Course Code: <b>L1201</b>	<b>ENGLISH LANGUAGE COMMUNICATION SKILLS</b> <b>LAB</b>	L	T	P	D
Credits: 1	(Common to CE,EEE,ME,ECE,MIE & AIML)	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**Pre-Requisites: NIL**

**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:**

Introduction to Phonetics – Speech Sounds – Vowels and Consonants, Minimal Pairs, Pronunciation Patterns.

**ICS Lab:**

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

#### **Module 2: [9L]**

**CALL Lab:**

The Phoneme: The Syllable

**ICS Lab:**

Features of Good Conversation – Non-verbal Communication- Telephone Etiquette.

#### **Module 3: [9L]**

**CALL Lab:**

Stress-Word and Sentence Stress-Stress Shift-Strong and Weak Forms.

**ICS Lab:**

Presentations Skills-Formal Presentations.

#### **Module 4: [9L]**

**CALL Lab:**

Intonation-Errors in Pronunciation-the Influence of Mother Tongue (MTI)-Common Indian Variants in Pronunciation – Differences in British and American Pronunciation.

**ICS Lab:**

Group Discussion skills-mock GDs

#### **Module 5: [9L]**

**CALL Lab:**

Listening for Specific Details-Listening Comprehension Tests.

**ICS Lab:**

Interview Skills-Mock Interviews.

#### **Text Books**

1. ELCS Lab Manual: A Workbook for CALL & ICS Lab Activities; Prepared for JNTUH; Orient Black Swan.

#### **Reference Books**

1. Balasubramanian. T (2009), A Textbook of English Phonetics for Indian Students. Macmillan.
2. Bansal. R.K, Harrison J.B. (2008). Spoken English. Orient Black Swan.

3. Ashraf Rizvi M (2010). Effective Technical Communication. McGraw-Hill

### E-Resources

1. <https://bbamantra.com/listening/>
2. <https://en.wikipedia.org/wiki/Phonetics#:~:text=Phonetics%20is%20a%20branch%20of,the%20physical%20properties%20of%20speech.>
3. <https://www.innovativeteachingideas.com/blog/10-great-activities-to-break-the-ice-with-your-students>
4. <http://kjtenglishnotes.blogspot.com/2015/10/how-i-became-public-speaker.html>
5. <https://www.learngrammar.net/english-grammar>

### Course Outcomes

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

- CO1.** Use English Language effectively in spoken and written forms.
- CO2.** Comprehend the given texts and respond appropriately.
- CO3.** Use the proper vocabulary and grammatically correct sentences.
- CO4.** Communicate confidently in various contexts and different cultures.
- CO5.** Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

### CO-PO/PSO Mapping

Course Outcomes	Program Outcomes (POs)/Program Specific Outcomes (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO 2
<b>CO1</b>	-	-	-	-	-	-	-	-	3	3	-	2	-	-
<b>CO2</b>	-	-	-	-	-	-	-	-	3	3	-	2	-	-
<b>CO3</b>	-	-	-	-	-	-	-	-	3	3	-	2	-	-
<b>CO4</b>	-	-	-	-	-	-	-	-	3	3	-	2	-	-
<b>CO5</b>	-	-	-	-	-	-	-	-	3	3	-	2	-	-
<b>Average</b>	-	-	-	-	-	-	-	-	<b>3</b>	<b>3</b>	-	<b>2</b>	-	-

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



<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year-II Sem</b>			
Course Code: <b>L1251</b>	<b>PROGRAMMING FOR PROBLEM SOLVING LAB</b>	L	T	P	D
Credits: 2		<b>0</b>	<b>0</b>	<b>4</b>	<b>0</b>

**Pre - Requisites:** Mathematical Knowledge, Analytical Skills.

**List of Experiments:**

1. a) Write a program for find the max and min from the three numbers.
- c) Write a program to read marks from keyboard and your program should display equivalent grade according to following table(if else ladder)

<b>Marks</b>	<b>Grade</b>
100 - 80	Distinction
79 - 60	First Class
59 - 40	Second Class
< 40	Fail

2. 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)
3. Write a program that finds if a given number is a prime number
4. Write a C program to generate the first n terms of the sequence
5. Write a C program to find the minimum, maximum and average in an array of integers.
6. Write a C program to find Addition of Two Matrices
7. Write a C program to count the number of times a character occurs in a text file. The file name and the character are supplied as command line arguments.
8. Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)
9. a) Write a C program to implement binary search algorithm.  
b) Write a C program to implement linear search algorithm.
10. a) Write a C program that implements the Bubble sort method.  
b) Write a C program that implements the Insertion sort method.
11. Write a C program that implements the Quick sort method.
12. Write a C program that implements the Merge sort method.

**Case Studies:**

1. Implement Hotel Management system in C with the following requirements.  
Requirements:
  - Provide the information on reserving rooms, book an event, check the features
  - Give the login for both admin and user for proper login validation
  - Add/View/Edit/Delete user records
  - Calculate the bill after checkout of customers
2. Implement Library management system in C with the following requirements.  
Requirements:
  - To add Book Information
  - Display Book Information
  - List all the books of the given author
  - List the title of the specified Book
  - List the count of books in the library

### Course Outcomes:

The student will be able to:

1. Formulate the algorithms for simple problems
2. Examine syntax errors as reported by the compilers
3. Define and manipulate data with arrays, strings, and structures
4. Make use of pointers with different function types
5. Create, read, and write to and from simple text and binary files

### 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	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
<b>CO1</b>	3	2	-	-	-	-	-	-	2	-	-	-	-	2
<b>CO2</b>	3	2	-	-	-	-	-	-	2	-	-	-	-	2
<b>CO3</b>	3	2	-	-	-	-	-	-	2	-	-	-	-	2
<b>CO4</b>	3	2	-	-	-	-	-	-	2	-	-	-	-	2
<b>CO5</b>	3	2	-	-	-	-	-	-	2	-	-	-	-	2
<b>Average</b>	<b>3.0</b>	<b>2.0</b>	-	-	-	-	-	-	<b>2.0</b>	-	-	-	-	<b>2.0</b>

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>I Year-II Sem</b>			
Course Code: <b>L12M2</b>	<b>HUMAN VALUES &amp; PROFESSIONAL ETHICS</b> (AUDIT COURSE - II)	L	T	P	D
Credits: <b>0</b>		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Nil

#### Module 1:

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Understanding the need, basic guidelines, content and process for Value Education. Self Exploration-what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

#### Module 2:

Understanding Harmony in the Human Being - Harmony in Myself! : Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvridha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

#### Module 3:

**Understanding Harmony in the Family and Society-** Harmony in Human - Human Relationship : Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship.

**Understanding the meaning of Vishwas;** Difference between intention and competence. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha )- from family to world family.

#### Module 4:

Understanding Harmony in the Nature and Existence - Whole existence as Co- existence : Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self- regulation in nature. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

#### Module 5:

### Implications of the above Holistic Understanding of Harmony on Professional Ethics :

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics:

Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco- friendly production systems, Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers At the level of society: as mutually enriching institutions and organizations.

### Text Books

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Prof. KV Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.

### Reference Books

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
4. Susan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

### E-Resources

1. Value Education website, <http://www.uptu.ac.in> Story of Stuff, <http://www.storyofstuff.com>
2. Al Gore, An Inconvenient Truth, Paramount Classics, USA Charlie Chaplin, Modern Times, United Artists, USA
3. IIT Delhi, Modern Technology – the Untold Story

### 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	3	1	3	1	-	-	-	-	-	-	-	-	-
<b>CO2</b>	3	3	2	3	2	-	-	-	-	-	-	-	2	-
<b>CO3</b>	1	2	1	2	1	-	-	-	-	-	-	-	-	-
<b>CO4</b>	1	2	1	2	1	-	-	-	-	-	-	-	-	1
<b>CO5</b>	3	1	1	1	1	-	-	-	-	-	-	-	1	1
<b>Average</b>	2	2.2	1.2	2.2	1.2	-	-	-	-	-	-	-	1.5	1

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year-I Sem</b>			
Course Code: <b>L210A</b>	<b>PROBABILITY AND STATISTICS</b> (Common to CE,ME,CSE, IT, ECM, MIE,AI&ML & AI&DS)	L	T	P	D
Credits: <b>4</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering mathematics

### Module 1: Single Random variables [10L]

Introduction to probability, Random Variables, Discrete and Continuous. Probability distributions, mass function/ density function of a probability distribution, mathematical expectation, moments about origin, central moments. Moment generating function of probability distribution.

### Module 2: Probability Distributions [12L]

Binomial, Poisson, Normal, exponential distributions and their Properties. moment generating functions of the above distributions and hence finds the mean and variance.

### Module 3: Correlation & Regression Sampling Distributions [10L]

**Correlation:** Types of correlation, coefficient of correlation, the rank correlation, Covariance of two random variables. Regression- Regression coefficient, the lines of regression.

**Sampling:** Definitions of population, sampling, statistic, and parameter. Types of sampling, Expected values of Sample mean and variance, sampling distribution, Standard error, Sampling distribution of means, sampling distribution of variance and sampling distribution of proportions, Parameter estimation- Point estimation and interval estimation.

### Module 4: Testing of Hypothesis-I [8L]

**Testing of hypothesis:** Null hypothesis, Alternate hypothesis, Type I & Type II errors – critical region, confidence interval, and Level of significance. One sided test, two sided test.

#### Large sample tests:

- (i) Test of Equality of means of two samples, equality of sample mean and population mean (cases of known variance & unknown variance, equal and unequal variances)
- (ii) Tests of significance of difference between sample S.D and population S.D.
- (iii) Tests of significance difference between sample proportion and population proportion, difference between two sample proportions.

### Module 5: Testing of Hypothesis-II [8L]

Student t-distribution, its properties and applications, test of significance sample mean and population mean, difference between means of two small samples. Snedecor's F- distribution and its properties. Test of equality of two population variances. Chi-square distribution, its properties, Chi-square test of goodness of fit, Chi-square test for independence & applications of attributes.

### Text Books

1. S.C.Gupta and V.K.Kapoor : Fundamentals of Mathematical Statistics, 2006
2. Kantisarup, P.K.Gupta and Manmohan Singh : Operations Research, S.Chand & Co, 2010

### Reference Books

1. R. A. Johnson: Miller and Freund's Probability and Statistics for Engineers, Pearson Publishers, 9th Edition, 2017
2. Freund: Modern elementary statistics, PHI, 2006
3. Probability and Statistics for Engineers by Richard Arnold Johnson, Irwin Miller and John E. Freund, New Delhi, Prentice Hall

## E-Resources

1. <https://nptel.ac.in/courses/111/108/111108098/>
2. [https://en.wikipedia.org/wiki/Probability\\_distribution](https://en.wikipedia.org/wiki/Probability_distribution)
3. <http://www.randomservices.org/random/sample/Covariance.html>
4. [https://www.nptel.ac.in/content/storage2/courses/103106120/Lecture Notes/Lec3\\_1.pdf](https://www.nptel.ac.in/content/storage2/courses/103106120/Lecture_Notes/Lec3_1.pdf)
5. <https://www.smartbugmedia.com/blog/hypotheses-worth-testing-on-your-website>

## Course Outcomes

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

- CO1.** Understand the concept of probability and statistics
- CO2.** Find the mean and variance of a given probability distribution
- CO3.** Find the coefficient of correlation and lines of regression.
- CO4.** Test the hypothesis for large samples.
- CO5.** Test the hypothesis for small samples

## 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	1	2	2	-	-	-	-	-	-	-	1	-	-
<b>CO2</b>	3	1	2	2	-	-	-	-	-	-	-	1	-	-
<b>CO3</b>	3	1	2	2	-	-	-	-	-	-	-	1	-	-
<b>CO4</b>	3	1	2	2	-	-	-	-	-	-	-	1	-	-
<b>CO5</b>	3	1	2	2	-	-	-	-	-	-	-	1	-	-
<b>Average</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>2</b>	-	-	-	-	-	-	-	<b>1</b>	-	-

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year - I Sem</b>			
Course Code: <b>L213A</b>	<b>MATERIALS ENGINEERING</b>	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Chemistry, Engineering Physics.

### **Module 1: Structure of Metals, Constitution of Alloys [10L]**

#### **Unit-I: [5L]**

Grains and Grain Boundaries. Effect of grain size on the properties. Determination of grain size by different methods.

#### **Unit-II: [4L]**

Necessity of alloying, Types of solid solutions, Hume - Rothery rules, Intermediate alloy phases.

### **Module 2: Phase Diagrams, Engineering Materials – I [9L]**

#### **Unit-I: [5L]**

Construction and interpretation of phase diagrams, Phase rule. Lever rule. Binary phase Diagrams, Isomorphous, Eutectic and Eutectoid transformations with examples.

#### **Unit-II: [4L]**

STEELS: Iron-Carbon Phase Diagram and Heat Treatment: Study of Fe-Fe<sub>3</sub>C phase diagram. Construction of TTT diagrams. Annealing, Normalizing, Hardening and Tempering of steels.

### **Module 3: Engineering Materials – II, III [8L]**

#### **Unit-I: [5L]**

CAST IRONS: Structure and properties of White Cast iron, Malleable Cast iron, Grey cast iron.

#### **Unit-II: [3L]**

Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

### **Module 4: Engineering Materials –IV [12L]**

#### **Unit-I: [4L]**

Cermets: Structure, properties and applications.

#### **Unit-II: [4L]**

Composites: Classification, properties and applications.

#### **Unit-III: [4L]**

Polymers: Classification, Properties and applications.

### **Module 5: Smart Materials, Shape Memory Alloys [10L]**

#### **Unit-I: [5L]**

Introduction to Smart Materials, Principles of Piezoelectricity, Principles of Magnetostriction, Rare earth Magnetostrictive materials, Giant Magnetostriction and Magneto-resistance Effect, Shape Memory Effect.

#### **Unit-II: [5L]**

Shape Memory Polymers, Electro-rheological Fluids, Magneto Rheological Fluids.

### **Text Books**

1. Sidney H. Avner, "Introduction to Physical Metallurgy", S. Chand Publications, 2<sup>nd</sup> Edition, 1997.
2. Kodgire, "Material Science and Metallurgy for Engineers", Everest Publications, 14<sup>th</sup> Edition, 2003.
3. Donald R. Askeland, Wendelin J. Wright, "Fundamentals of Smart Materials", Cengage Learning, 3<sup>rd</sup> Edition, 2013.

### Reference Books

1. William and Callister, "Materials Science and Engineering".
2. Er. Amandeep Singh Wadhwa, "Engineering Material and Metallurgy"

### E-Resources

1. [shorturl.at/lry34](http://shorturl.at/lry34)
2. [shorturl.at/ghUV8](http://shorturl.at/ghUV8)

### Course Outcomes

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

- CO1.** Determine and correlating the grain size with the properties of different metals.
- CO2.** Draw interpretation of phase diagrams and determine the phases of metals at different temperatures.
- CO3.** Identify the properties and structure of ferrous and non-ferrous steel material.
- CO4.** Classify ceramics, polymers and composites with their properties and applications.
- CO5.** Recognize and differentiate the smart material, shape memory alloys

### 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	1	3	2	-	-	-	-	-	-	-	-	-
<b>CO2</b>	3	3	2	2	3	-	-	-	-	-	-	-	2	-
<b>CO3</b>	3	2	1	1	1	-	-	-	-	-	-	-	-	-
<b>CO4</b>	3	2	1	1	1	-	-	-	-	-	-	-	-	1
<b>CO5</b>	3	1	1	1	3	-	-	-	-	-	-	-	1	1
<b>Average</b>	3	2.2	1.2	1.6	2	-	-	-	-	-	-	-	1.5	1

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



<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year - I Sem</b>			
Course Code: <b>L213B</b>	<b>MECHANICS OF SOLIDS</b> (COMMON TO: ME, MIE)	L	T	P	D
Credits: 4		<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics, Engineering Mechanics

### Module 1: Stresses & Strains [10L]

Definitions, types of stresses and strains, elasticity and plasticity. Hooke's law, stress-strain diagrams for engineering materials, modulus of elasticity. Poisson's ratio, relationship between elastic constants, linear and volumetric strains, bars of uniform strength, temperature stresses, and composite bars.

### Module 2: Shear Force and Bending Moment diagrams [9L]

Definition of bending moment and shear force; relationship between intensity of loading, shear force and bending moment; bending moment and shear force diagrams for cantilever, simply supported and overhanging beams; simple theory of bending, moment of resistance, modulus of section.

### Module 3: Flexural stresses, Shear Stresses [8L]

#### Unit-I: [4L]

Theory of simple bending –Assumptions–Derivation of bending equation, Determination bending stresses –Section modulus of rectangular and circular (Solid and Hollow) sections..

#### Unit-II: [4L]

Distribution of shear stresses in rectangular, I-section, T- section, solid and hollow circular sections.

### Module 4: Deflection of Beams, Torsion [10L]

#### Unit-I: [5L]

Deflections of cantilever and simply supported beams including overhanging for point loads, U.D.L by double integration and Macaulay's method. Strain energy in bars due to gradually applied loads, impact loads and shock loads.

#### Unit-II: [5L]

Theory of pure torsion – Derivation of Torsion equations – Assumptions made in the theory of pure torsion – Torsional moment of resistance, Polar section modulus, Power transmitted by shafts – Combined bending and torsion and end thrust.

### Module 5: Principal Stresses and Strains, Thin and Thick Cylinders [10L]

#### Unit-I: [5L]

Introduction –Stresses on an inclined section 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 – Mohr's circle of stresses, Principal stresses and strains – theories of failures.

#### Unit-II: [5L]

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- Lami's equations, Compound cylinders.

## Text Books

1. R.S. Kurmi and Gupta, "Strength of materials".
2. Popov, "Solid Mechanics".
3. W.A. Nash, "Strength of Materials", Tata McGraw Hill Publishers

## Reference Books

1. Jindal, "Strength of Materials", Umesh Publications.
2. H. J. Shah and S. B. Junnarkar, "Mechanics of Structures", Charotar Publishing House Pvt. Ltd. Vol – I.
3. S. S. Rattan, "Strength of Materials", Tata McGraw Hill.

## E-Resources

1. <https://rb.gy/j4ja0h>
2. <https://rb.gy/ydbalp>
3. <https://nptel.ac.in/courses/112/102/112102284/>

## Course Outcomes

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

- CO1.** Predict mechanical behavior of the member by determining the stresses, strains and deflections produced by the various loads.
- CO2.** Draw shear force and bending moment diagrams for statically determinate beam due to various types of loads and evaluate slope and deflection of statically determinate beams by the various loads
- CO3.** Apply the concept of theory of bending and solve numerical problems across various beam sections like rectangular, circular, triangular etc.
- CO4.** Apply the concepts of different types of stresses and strains in the design of simple beam sections, shafts,
- CO5.** Solve numerical problems to determine the torsional moments in shaft and to design shafts according to various theories of failure, and apply the concept of thick and thin cylinders

## 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	2	1	-	-	-	-	-	-	-	2	1	1
<b>CO2</b>	3	3	2	1	-	-	-	-	-	-	-	2	2	1
<b>CO3</b>	3	3	2	1	-	-	-	-	-	-	-	2	2	1
<b>CO4</b>	3	3	2	2	-	-	-	-	-	-	-	2	2	2
<b>CO5</b>	3	3	2	2	-	-	-	-	-	-	-	2	2	1
<b>Average</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>1.4</b>	-	-	-	-	-	-	-	<b>2</b>	<b>1.8</b>	<b>1.2</b>

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year - I Sem</b>			
Course Code: <b>L213C</b>	<b>MANUFACTURING TECHNOLOGY</b>	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics, Engineering Materials.

### **Module 1: Casting, Methods of Melting [10L]**

#### **Unit I:[7]**

Steps involved in making a casting – Advantage of casting and its applications – Patterns and Pattern making – Types of patterns – Materials used for patterns – pattern allowances and their construction – Principles of Gating – Gating ratio and design of Gating systems. Risers – Types function and design; casting design considerations – special casting processes – Centrifugal casting, Die casting, Investment casting; Solidification of pure metals and alloys.

#### **Unit II:[3]**

Crucible melting and cupola operation.

### **Module 2: Welding, Cutting of Metals [9L]**

#### **Unit I: [6]**

Classification of welding processes, types of welds and welded joints – their characteristics, Gas welding, Arc welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding. Inert Gas welding – TIG and MIG welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering and Brazing; Heat affected zones in welding – welding defects – causes and remedies; destructive and non-destructive testing of welds.

#### **Unit II: [3]**

Oxy Acetylene Gas cutting, water plasma cutting; Cutting of ferrous, non-ferrous metals.

### **Module 3: Hot and cold working, Extrusion of Metals [8L]**

#### **Unit I: [4]**

Hot working – cold working – strain hardening – Comparison of properties of Cold and Hot worked parts. Rolling fundamentals – theory of rolling – types of Rolling mills and products – Forces in rolling and power requirements.

#### **Unit II: [4]**

Basic extrusion process and its characteristics – Hot and cold extrusion, Forward and backward extrusion, Impact extrusion, Hydrostatic extrusion.

### **Module 4: Forging processes, Stamping, forming and cold working processes [10L]**

#### **Unit I: [4]**

Forging processes: Principles of forging – Tools and dies – Types of Forging – Smith forging, Drop Forging, Rotary forging, Roll forging – Forging hammers – forging defects.

#### **Unit II: [6]**

Stamping, forming and other cold working processes: Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing, coining, Hot and cold spinning – Types of presses and press tools. Forces and power requirement in the above operations

## Module 5: Polymers, Processing of Plastics [10L]

### Unit-I: [4L]

Introduction – Processing techniques of Polymers

### Unit-II: [6L]

Types of Plastics – Properties – applications and their Processing methods and Equipment – blow & injection moulding.

### Text Books

1. P.N. Rao, "Manufacturing Technology", Tata McGraw Hill, 2nd Edition, 2000.
2. Kalpak jian and Steven R Schmid, "Manufacturing Processes for Engineering Materials", Pearson Publishers.

### Reference Books

1. Marsha P C, "Production Technology", S. Chand Publications, 6th Edition, 2006.
2. R.K. Jain, "Production Technology", Khanna Publications, 2005.

### E-Resources

1. <https://rb.gy/ltwuxf>
2. <https://rb.gy/60ohwo>

### Course Outcomes

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

- CO1.** Make the pattern, mould and casting.
- CO2.** Prepare metal joints by welding and use different methods for cutting metals.
- CO3.** Well-versed with the principles of Hot / Cold working and Rolling.
- CO4.** Well-versed with the principles of Forging, Stamping, forming and other cold working processes.
- CO5.** Apply the knowledge of polymer processing techniques in the industry.

### 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	1	2	-	-	-	-	-	-	2	2	-
<b>CO2</b>	2	3	2	1	2	-	-	-	-	-	-	2	2	-
<b>CO3</b>	2	1	2	1	1	-	-	-	-	-	-	2	1	-
<b>CO4</b>	2	3	2	1	1	-	-	-	-	-	-	2	1	-
<b>CO5</b>	2	2	2	1	1	-	-	-	-	-	-	2	-	-
<b>Average</b>	2.2	2.4	2.2	1	1.4	-	-	-	-	-	-	2	1.5	-

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year - I Sem</b>			
Course Code: <b>L213D</b>	<b>THERMODYNAMICS</b>	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics, Engineering Materials.

### Module 1: Basic Concepts [8L]

System – Control Volume – Surrounding – Boundaries and Universe – Types of Systems – Macroscopic and Microscopic viewpoints – Concept of Continuum – Thermodynamic Equilibrium – State – Property – Process – Exact & Inexact Differentials – Cycle – Reversibility – Quasi static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition – Types – Displacement Work and other forms of work – Heat, Point and Path functions. Various Non -flow processes – Heat and Work Transfer – Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Constant Volume gas Thermometer – Scales of Temperature – Ideal Gas Scale – Joule’s Experiments.

### Module 2: THERMODYNAMIC LAWS [10L]

First law of Thermodynamics – Corollaries – First law applied to a Process and flow system – Steady Flow Energy Equation. Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump , Parameters of performance. Second Law of Thermodynamics – Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries – PMM – I & II. Carnot’s principle, Carnot cycle and its specialties. Clausius Inequality – Entropy, Principle of Entropy Increase. Energy Equation – Availability and Irreversibility – Thermodynamic Potentials – Gibbs and Helmholtz Functions – Maxwell Relations

### Module 3: GAS LAWS AND MOLLIER CHARTS [8L]

Perfect Gas Laws – Equation of State – Specific and Universal Gas constants. Changes in Internal Energy. Throttling and Free Expansion Processes, Flow processes. Deviations from perfect Gas Model – Vander Waal’s Equation of State – Compressibility charts – variable specific Heats – Gas Tables- Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation. Third Law of Thermodynamics. Property tables. Mollier charts – Steam Calorimetry.

### Module 4: PSYCHROMETRIC PROPERTIES [10L]

Mixtures of perfect Gases – Mole Fraction, Mass fraction Gravimetric and volumetric Analysis – Dalton’s Law of partial pressure, Avogadro’s Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas constant and Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air – Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier’s Equation – Psychrometric chart.

### Module 5: THERMODYNAMIC CYCLES [10L]

Power cycles – Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P–V and T– S diagram – Thermal Efficiency, Mean Effective Pressures on Air standard basis. Comparison of Cycles. Refrigeration Cycles – Bell Coleman cycle, Vapour compression cycle – Performance Evaluation.

### Text Books

1. PK Nag, "Engineering Thermodynamics", Tata McGraw Hill, 2013.
2. Ethirajan Ratha Krishnan, "Engineering Thermodynamics", PHI, 2006.

### Reference Books

1. DP Mishra, Cengage Learning, "Engineering Thermodynamics", 2<sup>nd</sup> Impression, 2012.
2. Yunus A. Cengel, Michael A. Boles, "Thermodynamics An Engineering Approach", Tata McGraw Hill, 8th Edition, 2015.
3. J.P.Holman, "Thermodynamics", Tata McGraw Hill, 4th Edition.

### E-Resources

1. [shorturl.at/jzGMP](http://shorturl.at/jzGMP)
2. [shorturl.at/motvX](http://shorturl.at/motvX)
3. <https://nptel.ac.in/courses/112/105/112105123/>

### Course Outcomes

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

- CO1.** Understand the basic concepts of thermodynamic such as temperature, pressure, system, properties and types of processes, state, cycles and equilibrium.
- CO2.** Apply the concepts of first law, second law of thermodynamics and solve problems related to entropy.
- CO3.** Identify the properties of substances on property diagrams and obtain the data from property tables.
- CO4.** Differentiate gravimetric and volumetric analysis, compute problems on psychrometry
- CO5.** Calculate thermal efficiency and mean effective pressure for power cycles.

### 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	1	-	-	-	-	-	-	-	-	-	2	1	-
<b>CO2</b>	3	2	2	2	2	-	-	-	-	-	-	2	2	-
<b>CO3</b>	2	3	2	2	2	-	-	-	-	-	-	3	2	1
<b>CO4</b>	3	3	2	3	2	-	-	-	-	-	-	3	2	2
<b>CO5</b>	3	2	3	2	2	-	-	-	-	-	-	3	1	2
<b>Average</b>	2.8	2.2	2.3	2.8	2	-	-	-	-	-	-	2.6	1.6	1.7

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year - I Sem</b>			
Course Code: <b>L2131</b>	<b>MATERIALS ENGINEERING LAB</b>	L	T	P	D
Credits: 1		<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**Pre-Requisites:** Engineering Materials, Mechanics of Solids

### List of Experiments

1. Preparation and study of the micro-Structure of pure metals such as Fe, Cu and Al.
2. Preparation and study of the micro-structure of Mild steel, Low carbon Steel and High carbon Steel
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Copper Alloys.
5. Study of the Micro Structures of Aluminum Alloys.
6. Tensile test on UTM.
7. Impact test.
8. Hardness test.
9. Torsion test.
10. Deflection test on beams

### E-Resources

1. [https://books.google.co.in/books?id=kBM8BAAQBAJ&printsec=frontcover&source=gbs\\_ge\\_summary\\_r&cad=0#v=onepage&q&f=false](https://books.google.co.in/books?id=kBM8BAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false)

### Course Outcomes

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

- CO1.** Find the micro-structures of pure metals such as Fe, Cu and Al.
- CO2.** Find the micro-structures of Carbon steels and alloy steels.
- CO3.** Find out the various mechanical properties.
- CO4.** Find out the young's modulus using beams.
- CO5.** Find out the torsion moment using torsion test.

### 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	1	1
<b>CO2</b>	-	-	-	-	-	-	-	-	3	2	-	2	1	1
<b>CO3</b>	-	-	-	-	-	-	-	-	3	2	-	2	1	1
<b>CO4</b>	-	-	-	-	-	-	-	-	3	2	-	1	1	1
<b>CO5</b>	-	-	-	-	-	-	-	-	3	2	-	1	1	1
<b>Average</b>	-	-	-	-	-	-	-	-	<b>3</b>	<b>2</b>	-	<b>1.6</b>	<b>1</b>	<b>1</b>

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year - I Sem</b>			
Course Code: <b>L2132</b>	<b>MANUFACTURING TECHNOLOGY LAB</b>	L	T	P	D
Credits: 1		<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics, Engineering Materials.

### List of Experiments

1. To prepare a pattern using Wood Turning Lathe machine.
2. To prepare a mould cavity and casting.
3. To prepare a Journal bearing by Casting Process.
4. To prepare a Lap and Square butt joint joint using Arc welding
5. To prepare a Butt joint using Gas welding.
6. To prepare a Lap joint using Spot Welding.
7. To prepare a butt joint using TIG Welding.
8. To join two sheets by Brazing process.
9. To cut MS plates using Plasma Welding/ Cutting Machine.
10. Study of Simple Die, Compound die and progressive dies.
11. To make a cup using hydraulic press.
12. To prepare a plastic product using injection moulding machine.

### E-Resources

1. <https://rb.gy/ohqifk>

### Course Outcomes

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

- CO1.** Prepare wooden patterns on lathe machine  
**CO2.** Prepare mould cavities using different types of patterns, get the training for melting and pouring the molten metal into mould cavity.  
**CO3.** Understand the welding symbols, types of joints, defects in weld joints and the applications of arc welding, spot welding, TIG welding, brazing and plasma welding.  
**CO4.** Identify sheet metal cutting operations.  
**CO5.** Classify the processed plastics by injection, blow moulding and describe the process of manufacturing.

### 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	-	-	-	-	-	2	-	-	2	2	-
<b>CO2</b>	1	1	2	-	-	-	-	-	2	-	-	1	2	1
<b>CO3</b>	1	1	-	-	-	-	-	-	1	-	-	-	2	-
<b>CO4</b>	1	1	-	-	-	-	-	-	2	-	-	1	2	-
<b>CO5</b>	1.5	1.2	0.7	-	-	-	-	-	1.7	-	-	1	2	1
<b>Average</b>	-	-	-	-	-	-	-	-	<b>3</b>	<b>2</b>	-	<b>1.6</b>	<b>1</b>	<b>1</b>

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



<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year - I Sem</b>			
Course Code: <b>L2133</b>	<b>INTERNSHIP - I</b>	L	T	P	D
Credits: 1		<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**Guidelines:**

The students should undergo two Internships. Internship-I shall be carried out under the guidance of professors from Science, Basic engineering subjects, with topics having some social relevance. The Internship-I is to be taken up during the summer vacation after I Year II Semester Examination and it will be evaluated in II Year I semester for 50 marks. However, the process might be initiated before the end of I Year II Semester by the concerned department. The students admitted under Lateral Entry Scheme (LES) shall carry out internship in the area of their Diploma specialization under the guidance of a faculty member of that Department immediately in the first month, after their joining of the course.

For the Internship, the student shall submit a report on the training undergone. The internship shall be evaluated by a three-member committee constituted by the Head of Department to assess the student performance on the following parameters. There shall be no Semester End Examinations for the Internships.

Parameter	Marks
Internship report	15
Quality of work	15
Presentation	15
Viva-Voce	5
Total	50

**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	-	-	-	-	3	2	2	2	3	-	2	-	1
<b>CO2</b>	-	-	-	-	-	2	2	2	1	2	-	1	-	-
<b>CO3</b>	-	-	-	-	-	2	2	3	2	1	-	2	-	1
<b>CO4</b>	-	-	-	-	-	2	1	3	1	3	-	3	2	2
<b>Average</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2.25</b>	<b>1.75</b>	<b>2.5</b>	<b>1.5</b>	<b>2.25</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>1.3</b>

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year-I Sem</b>			
Course Code: <b>L21M1</b>	<b>GENDER SENSITIZATION</b> (Mandatory Course) COMMON TO: ALL	L	T	P	D
Credits: 0		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites: NIL**

### Module 1: UNDERSTANDING GENDER [6L]

**Gender: Why Should We Study It? (Towards a World of Equals: Unit -1)**

**Socialization: Making Women, Making Men (Towards a World of Equals: Unit -2)**

Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

### Module 2: GENDER AND BIOLOGY [6L]

**Missing Women: Sex Selection and Its Consequences (Towards a World of Equals: Unit -4)**

Declining Sex Ratio. Demographic Consequences.

**Gender Spectrum: Beyond the Binary (Towards a World of Equals: Unit -10)**

Two or Many? Struggles with Discrimination.

### Module 3: GENDER AND LABOUR [6L]

**Housework: The Invisible Labour (Towards a World of Equals: Unit -3)**

"My Mother doesn't Work." "Share the Load."

**Women's Work: Its Politics and Economics (Towards a World of Equals: Unit -7)**

Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

### Module 4: ISSUES OF VIOLENCE-I [6L]

**Sexual Harassment: Say No! (Towards a World of Equals: Unit -6)**

Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu".

**Domestic Violence: Speaking Out (Towards a World of Equals: Unit -8)**

Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.

### Module 5 ISSUES OF VIOLENCE-II [6L]

**Thinking about Sexual Violence (Towards a World of Equals: Unit -11)**

Blaming the Victim- "I Fought for my Life...."

Additional Reading: The Caste Face of Violence.

### Text Books

1. "**Towards a World of Equals: A Bilingual Textbook on Gender**" written by A.Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu.

### Reference Books

1. Raj Paul Singh, Anupama Singh. Gender Sensitization: Issues and Challenges: Raj Publications: 2019.

## E-Resources

1. <https://www.medicalnewstoday.com/articles/232363>
2. <https://web.stanford.edu/~eckert/PDF/Chap1.pdf>
3. <https://open.lib.umn.edu/sociology/chapter/11-1-understanding-sex-and-gender/>

## Course Outcomes

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

- CO1.** develop a better understanding of important issues related to gender in contemporary India.
- CO2.** sensitize to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- CO3.** attain a finer grasp of how gender discrimination works in our society and how to counter it.
- CO4.** acquire insight into the gendered division of labour and its relation to politics and economics.
- CO5.** be better equipped to work and live together as equals.

## 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>	-	-	-	-	-	-	-	-	<b>2</b>	<b>2</b>	-	<b>3</b>	-	-

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

<b>AY: 2022 -23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year- II Sem</b>			
<b>Course Code:</b> <b>L22EA</b>	<b>BUSINESS ECONOMICS AND</b> <b>FINANCIAL ANALYSIS</b>	L	T	P	D
<b>Credits: 4</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>

### Course objectives:

The Student will:

1. Understand the market dynamics namely Business, economics, trends in market.
2. Understand the demand elasticity of demand and supply in different market conditions.
3. Learn how organisations make important investment and financing decisions respective to production, cost, and pricing in different markets.
4. Analyze a company's financial statements and come to a reasoned conclusion about the financial situations of the company.
5. Acquire the basics of how to analyze and interpret the financial statements through ratio analysis.

### Module 1:

#### Introduction to Business and Economics:

**Unit – 1: Business:** Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

**Unit – 2: Economics:** Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

### Module 2:

#### Demand and Supply Analysis:

**Unit – 1: Elasticity of Demand:** Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

**Unit – 2: Supply Analysis:** Determinants of Supply, Supply Function & Law of Supply.

### Module 3:

#### Production, Cost, Market Structures & Pricing:

**Unit – 1: Production Analysis:** Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

**Unit – 2: Cost analysis:** Types of Costs, Short run and Long run Cost Functions.

**Unit – 3: Market Structures:** Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition.

**Unit – 4: Pricing:** Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

#### **Module 4:**

**Unit – 1: Financial Accounting:** Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

#### **Module 5:**

**Unit – 1: Financial Analysis through Ratios:** Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems).

**Unit – 2:** Introduction to Fund Flow and Cash Flow Analysis (simple problems).

#### **Text Books:**

1. D.D.Chaturvedi,S.L.Gupta,BusinessEconomics-TheoryandApplications,International Book House Pvt. Ltd. 2013.
2. DhaneshKKhatri,FinancialAccounting,TataMcGrawHill,2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGraw Hill Education Pvt. Ltd. 2012.

#### **Reference Books:**

1. Paresh Shah, Financial Accounting for Management 2e, OxfordPress,2015.
2. S.N.Maheshwari,SunilKMaheshwari, Sharad KMaheshwari, Financial Accounting, 5e,Vikas Publications, 2013.

#### **Web Resources:**

1. <https://nptel.ac.in/courses/110/101/110101005/>
2. <https://sites.google.com/site/economicsbasics/>

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year - II Sem</b>			
Course Code: <b>L223A</b>	<b>KINEMATICS OF MACHINES</b>	L	T	P	D
Credits: 4		<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Mathematics, Engineering Mechanics.

### **Module 1: Mechanisms and Machines [10L]**

#### **Unit I: [5L]**

Elements or Links – Classification – Rigid Link, flexible link, fluid link. Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs. Constrained motion – completely constrained, partially or successfully constrained and incompletely constrained.

#### **Unit II: [5L]**

Mechanism and machines–kinematic chain–Degrees of freedom, Kutzbach’s criteria and Grubler’s criterion. Inversions of kinematic chain–inversions of quadric cycle chain, single slider crank chain and double slider crank chain. Mechanical advantage.

### **Module 2: Kinematics, Plane motion of body, Analysis of Mechanisms [10L]**

#### **Unit I: [4L]**

Velocity and acceleration–Motion of link in machine– Determination of Velocity and acceleration– Graphical method – Application of relative velocity method for simple mechanisms, Acceleration diagram for a given mechanism, Kleins construction, Coriolis acceleration, determination of Coriolis component of acceleration.

#### **Unit II: [3L]**

Instantaneous center of rotation, centrode and axodes – relative motion between two bodies – Three centers in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

#### **Unit III: [3L]**

Analysis of slider crank chain for displacement, velocity and acceleration of slider

### **Module 3: Steering Mechanisms, Hooke’s Joint, Straight Line Motion Mechanisms [8L]**

#### **Unit I: [3L]**

Conditions for correct steering – Davis Steering gear mechanism, Ackerman’s steering gear mechanism

#### **Unit II: [2L]**

Single and double Hooke’s joint – velocity ratio – Universal coupling – application – problems.

#### **Unit III: [3L]**

Exact type – Peaucellier, Hart, Scott- Russel mechanism. Approximate type–Grasshopper, Watt T. Chebicheff, Robert Mechanisms. Generated Types–Pantograph.

### **Module 4: Cams [10L]**

Definitions of cam and followers, their uses. Types of cams, Types of followers, Terminology, Types of follower Motion - Simple Harmonic Motion, Uniform Velocity, Uniform Acceleration and Retardation - Determination of Maximum velocity and maximum acceleration during outward and return strokes in the above three cases. Drawing of cam profiles with knife edge follower, roller follower and flat faced follower.

## Module 5: Gears, Gear Trains [10L]

### Unit I: [6L]

Higher pairs, friction wheels and toothed gears – types of toothed gears. Law of gearing-condition for constant velocity ratio for transmission of motion. Form of teeth - cycloidal and involute profiles. Velocity of sliding. Phenomena of interferences – Methods of interference, condition for minimum number of teeth to avoid interference. Expressions for arc of contact and path of contact.

### Unit II: [4L]

Introduction – Train value – Types – Simple, compound, reverted and epicyclic gear train. Methods of finding velocity ratio.

### Text Books

1. Thomas Bevan, "Theory of Machines", Pearson Publications, 3rd Edition, 2011.
2. R.K Bansal, "Theory of Machines", S Chand Publications, 5th Edition, 2010

### Reference Books

1. R.S Khurmi & J.K Gupta, "Theory of Machines", S Chand Publications, 14th Edition, 2013.
2. P.L. Ballaney, "Theory of Machines", Khanna publishers.
3. JS Rao and RV Dukupati, "Mechanism and Machine Theory", New Age Publishers.

### E-Resources

1. <https://rb.gy/lwrqrg>
2. <https://rb.gy/uqcvmt>

### Course Outcomes

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

- CO1.** Describe the concepts of machines, mechanisms and related terminologies.
- CO2.** Analyse planar mechanism for displacement, velocity and acceleration graphically.
- CO3.** Analyse different types of steering gear mechanisms to satisfy the condition for correct steering and straight-line motion mechanisms to generate exact and approximate straight-line motions.
- CO4.** Analyse various types of motion of the followers in cams
- CO5.** Apply the knowledge of the different types of gears and gear trains.

### 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	2	1	-	-	-	-	-	-	-	2	1	-
<b>CO2</b>	3	3	2	1	-	-	-	-	-	-	-	2	2	2
<b>CO3</b>	3	3	2	3	-	-	-	-	-	-	-	2	1	2
<b>CO4</b>	3	3	2	3	-	-	-	-	-	-	-	2	1	2
<b>CO5</b>	3	3	2	3	-	-	-	-	-	-	-	2	2	2
<b>Average</b>	3	3	2	2.2	-	-	-	-	-	-	-	2	1.4	2

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year - II Sem</b>
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Course Code: <b>L223B</b>	<b>THERMAL ENGINEERING – I</b>	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics, Thermodynamics

### **Module 1: Actual Cycles and their Analysis, I.C. Engines [10L]**

#### **Unit I: [5L]**

Introduction – Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down, Loss due to Gas exchange Process, Volumetric Efficiency, Loss due to Rubbing Friction. Actual and Fuel Air Cycles of CI Engines.

#### **Unit II: [5L]**

Classification - Working principles, Valve and Port Timing Diagrams, Air standard, Air fuel and Actual cycles. Engine systems – Fuel, Carburetor, Fuel injection System, Ignition, Cooling and Lubrication.

### **Module 2: Combustion in S.I. Engines, Combustion in C.I. Engines [10L]**

#### **Unit I: [6L]**

Normal Combustion and abnormal combustion, Importance of flame speed and effect of engine variables. Type of Abnormal combustion – pre-ignition and knocking. Fuel requirements and fuel rating, anti-knock additives. Combustion chamber requirements and types.

#### **Unit II: [4L]**

Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence. Open and divided combustion chambers and nozzles used. Fuel requirements and fuel rating.

### **Module 3: Testing and Performance of I.C. Engines [8L]**

Parameters of performance – measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, brake power, determination of frictional losses and indicated power. Performance test – Heat balance sheet and chart.

### **Module 4: Compressors, Reciprocating Compressors [10L]**

#### **Unit I: [4L]**

Classification–positive displacement and rotodynamic machinery. Power producing and power absorbing machines – fan, blower and compressor. Positive displacement and dynamic types – reciprocating and rotary types.

#### **Unit II: [6L]**

Principle of operation, work required, Isothermal efficiency, volumetric efficiency and effect of clearance. Stage compression, under cooling, saving of work, minimum work condition for stage compression.

### **Module 5: Rotary Compressors, Dynamic Compressors, Axial Flow Compressors [10L]**

#### **Unit I: [3L]**

Roots Blower, vane sealed compressor, Lysholm compressor–mechanical details and principle of working. Efficiency considerations.

#### **Unit II: [4L]**



Centrifugal compressors – Mechanical details and principle of operation, velocity and pressure variation. Energy transfer-impeller blade, shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient. Velocity diagrams – power.

**Unit III: [3L]**

Mechanical details and principle of operation– velocity triangles, energy transfer per stage, degree of reaction, work done factor, isentropic efficiency, pressure rise calculations and polytropic efficiency.

**Text Books**

1. V. Ganesan, "I.C. Engines" , Tata McGraw Hill, 4th Edition, 2012.
2. K.K. Ramalingam, "I.C. Engines", SciTech Publishers, 2nd Edition, 2011.

**Reference Books**

1. R.P. Sharma, "I.C. Engines", DhanpathRai Publications, 8th Edition, 2010.
2. R.K. Rajput, "Thermal Engineering", Lakshmi Publications, 9th Edtn, 2018.

**E-Resources**

1. <https://nptel.ac.in/courses/112/103/112103262/>
2. <https://freevideolectures.com/course/3110/turbomachinery-aerodynamics/33>

**Course Outcomes**

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

- CO1.** Analyse the working of IC engines on actual cycles and its application in industry and automobiles.
- CO2.** Differentiate the combustion process in both SI and CI engines, identify the various effects of abnormal combustion.
- CO3.** Evaluate the performance of IC Engines using several tests.
- CO4.** Analyse the working principles of various types of compressors and selection for industrial applications.
- CO5.** Evaluate the performance of rotary, dynamic and axial flow compressors

**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	1	2	-	-	-	-	-	-	-	2	2	2
<b>CO2</b>	3	2	2	2	-	-	-	-	-	-	-	3	2	2
<b>CO3</b>	3	3	2	3	2	-	-	-	-	-	-	3	3	3
<b>CO4</b>	3	3	2	3	1	-	-	-	-	-	-	3	1	1
<b>CO5</b>	3	3	3	2	1	-	-	-	-	-	-	2	2	1
<b>Average</b>	3	2.8	2	2.4	1.3	-	-	-	-	-	-	2.6	2	1.8

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year - II Sem</b>			
Course Code: <b>L223C</b>	<b>MECHANICS OF FLUIDS AND HYDRAULIC MACHINES</b>	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics, Engineering Mathematics, Engineering Mechanics

### **Module 1: Fluid Statics, Pressure Measurement [8L]**

#### **Unit I: [4L]**

Dimensions and units – physical properties of fluids – specific gravity – viscosity and surface tension – Vapour pressure and their influence on fluid motion – buoyancy.

#### **Unit II:[4L]**

Atmospheric, gauge and vacuum pressures – measurement of pressure – Piezometer, U-tube and differential manometers.

### **Module 2: Fluid Kinematics, Fluid Dynamics [10L]**

#### **Unit I: [5L]**

Stream line, path line and streak lines and stream tube – classification of flows – steady and unsteady, uniform and non-uniform, laminar and turbulent, rotational and irrotational flows – equation of continuity for one dimensional flow and three-dimensional flows.

#### **Unit II:[5L]**

Surface and body forces –Euler’s and Bernoulli’s equations for flow along a stream line – momentum equation and its application on pipe bend.

### **Module 3: Closed conduit flow, Boundary Layer Concepts [8L]**

#### **Unit I: [4L]**

Reynold’s experiment – Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel – total energy line – hydraulic gradient line. Measurement of flow: pitot tube, venturi meter, and orifice meter, Flow nozzle.

#### **Unit II: [4L]**

Definition – thicknesses – characteristics along thin plate – laminar and turbulent boundary layers (No derivation), boundary layer in transition -separation of boundary layer – submerged objects – drag and lift.

### **Module 4: Basics of turbo machinery,Hydraulic Turbines [10L]**

#### **Unit I: [3L]**

Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes – jet striking centrally and at tip – velocity diagrams, work done and efficiency – flow over radial vanes.

#### **Unit II: [3L]**

Classification of turbines – Heads and efficiencies – impulse and reaction turbines – Pelton wheel – Francis turbine and Kaplan turbine – working proportions – work done, efficiencies – hydraulic design –draft tube theory, functions and efficiency.

#### **Unit III: [4L]**

Geometric similarity, Unit and specific quantities – characteristic curves – governing of turbines – selection of type of turbine cavitation – surge tank –water hammer.

## Module 5: Centrifugal pumps, Reciprocating pumps [9L]

### Unit I: [5L]

Centrifugal pumps: Classification – working –work done – barometric head losses and efficiencies – specific speed – performance characteristic curves – NPSH.

### Unit II: [4L]

Reciprocating pumps: Working – Discharge – slip indicator diagrams.

### Text Books

1. Dr. P.N. Modi, Dr. S.M. Seth, "Hydraulics and Fluid Mechanics including Hydraulics Machines", Standard Book House, 20th Edition, 2015.
2. Er. R.K. Rajput, "Fluid Mechanics and Hydraulic Machines", S. Chand, 6<sup>th</sup> Edition.

### Reference Books

1. Dr. D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", KATSON Publications,
2. D. Rama Durgaiyah, "Fluid Mechanics and Machinery", New Age International (P) Ltd, Publishers, Reprint 2004.

### E-Resources

1. <https://nptel.ac.in/courses/112/105/112105183/>
2. <https://rb.gy/7unc79>

### Course Outcomes

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

- CO1.** Understand the basics of Fluid Properties and evaluate numerical problems on the measurement of pressure.
- CO2.** Apply the various equations such as the Continuity equation, Euler's and Bernoulli's equations, Momentum equation, etc., to analyse the Kinematics and Dynamics of fluids and solve concern numerical problems
- CO3.** Apply the concepts of laminar and turbulent boundary layers in closed conduit flow and solve concern numerical problems.
- CO4.** Analyse the working of Hydraulic Turbines, solve the numerical problems concerning the hydraulic Turbine.
- CO5.** Analyse the working of Centrifugal pumps, Reciprocating pumps and Solve numerical problems concerning the pumps.

### 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	-	-	-	-	-	-	-	2	1	-
<b>CO2</b>	3	3	2	2	1	-	-	-	-	-	-	2	1	1
<b>CO3</b>	3	3	2	2	2	-	-	-	-	-	-	3	2	1
<b>CO4</b>	3	3	3	3	1	-	-	-	-	-	-	3	2	2
<b>CO5</b>	3	3	3	2	1	-	-	-	-	-	-	3	2	1
<b>Average</b>	3	2.8	2.5	2	1.2	-	-	-	-	-	-	2.6	1.6	1.2

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year - II Sem</b>			
Course Code: <b>L223D</b>	<b>METAL CUTTING AND MACHINE TOOLS</b>	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics, Engineering Materials.

### **Module 1: Metal cutting [6L]**

Elementary treatment of metal cutting theory – Basics of cutting process – Geometry of single point tool – angles chip formation and types of chips, chip breakers. Mechanics of orthogonal cutting – Merchant’s diagram, cutting forces – cutting speeds, feed, depth of cut.

### **Module 2: Thermal Aspects of Metal Cutting, Tool Wear and Tool Life, Economics [10L]**

#### **Unit I: [3L]**

Sources of heat and heat distribution. Various methods of measurement of temperature – cutting fluids and applications

#### **Unit II: [4L]**

Criteria for tool wear, flank and crater wear theories – criteria for tool life in roughing and finishing – Measurement of tool wear, Taylor’s tool life equation, factors effecting tool life – Machinability.

#### **Unit III: [3L]**

Economics of machining: Tool life for maximum production – minimum cost.

### **Module 3: Engine lathe, Drilling Machine, Boring Machine [10L]**

#### **Unit I: [3L]**

Principle of working– types of lathe – specifications. Taper turning – Lathe attachments. Capstan and Turret lathe – Single spindle and multi- spindle automatic lathes – tool layouts.

#### **Unit II: [3L]**

Principles of working– specifications– types– operations performed; geometry of twist drill.

#### **Unit III: [4L]**

Types of Boring machines and applications. Shaping– slotting and planning machines – Principles of working – machining time calculations.

### **Module 4: Milling Machines, Grinding Machines [10L]**

#### **Unit I:[5L]**

Principles of working – Types of milling machines – Geometry of milling cutters – Methods of indexing

#### **Unit II: [5L]**

Theory of grinding – classification of grinding machines. Types of abrasives, bonds. Selection of grinding wheel. Lapping– honing and broaching machines.

### **Module 5: Jigs and Fixtures, Unconventional Machining [9L]**

#### **Unit I: [3L]**

Classification– Design principles for location and clamping.

## Unit II: [6L]

Principles of working and applications of USM, AJM, EDM, ECM, LBM and EBM (Mechanisms, MRR and Process parameters in each case)

### Text Books

1. P. N. Rao, "Manufacturing Technology: Metal cutting and Machine Tools", Tata McGraw-Hill Publications, 3<sup>rd</sup> Edition, Volume 2, 2013.
2. HMT Bangalore, "Production Technology", Tata McGraw-Hill Publishing Company Limited, 28<sup>th</sup> Edition, 2008

### Reference Books

1. Yoram and Koren, "Computer Control of Manufacturing Systems", Tata McGraw-Hill International Book Company, 2nd Edition, 2006.
2. V.K Jain, "Advanced Machining Processes", Allied publishers, 5th Edition. 2010.

### E-Resources

1. <https://nptel.ac.in/courses/112/105/112105233/>
2. <https://nptel.ac.in/courses/112/105/112105126/>

### Course Outcomes

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

- CO1.** Gain thorough knowledge about Metal Cutting process, the parameters involved– Geometry of single point tools and Cutting tool material.
- CO2.** Select the cutting tool materials, tool geometry, and appropriate machining processes for different combinations of tool and work materials and evaluating the effect of thermal characteristics on tool & job.
- CO3.** Fabricate various components by using Lathe, Drilling, Boring and shaping machines
- CO4.** Fabricate various components by Milling, and grinding machines.
- CO5.** Understand of Non-Traditional machining, Jigs and Fixtures

### 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	1	-	-	2	-	-	-	-	-	-	-	2	-
<b>CO2</b>	2	2	-	2	2	-	-	-	-	1	-	-	2	-
<b>CO3</b>	2	1	1	-	2	-	-	-	-	1	-	-	2	-
<b>CO4</b>	2	1	1	-	2	-	-	-	-	1	-	-	2	-
<b>CO5</b>	3	2	2	1	2	-	-	-	-	1	-	-	3	-
<b>Average</b>	2.4	1.4	1.3	1.5	2	-	-	-	-	1	-	-	2.2	-

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year - II Sem</b>			
Course Code: <b>L2231</b>	<b>MACHINE DRAWING PRACTICE</b> (Common to ME, MIE)	L	T	P	D
Credits: 3		<b>1</b>	<b>0</b>	<b>4</b>	<b>0</b>

**Pre-Requisites:** Engineering Drawing.

### Module 1: Machine Drawing Conventions [5L]

Need for Machine Drawings – Introduction to SI Conventions – Introduction to types of Drawings and working Drawings for Machine Parts.

- Conventional representation of Materials, Common Machine Elements and Parts such as Screws, Nuts, Bolts, Keys, Gears, Bearings, Springs, etc.
- Types of Sections – Selection of sectional planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
- Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centre lines, curved and tapered features.
- Title boxes - size, location and details - common abbreviations in general usage

### Module 2: Drawing of Machine Elements and Simple Parts [20L]

Selection of Views, additional views for the following machine elements and parts with easy drawing proportions.

- Screw Threads and Fasteners** - Popular forms of Screw Threads, Bolts, Nuts, Stud Bolts, Tap Bolts, Set Screws.
- Keys** – Saddle Keys, Sunk Keys, Feather Keys, Woodruff Keys, Splines
- Cotter Joints** – with Sleeves, with Socket and Spigot ends, with Gibs
- Pin Joints** – Knuckle Joint.
- Riveted Joints:** Various types of Riveted Joints for plates.
- Welded Joints:** Various types of Welded Joints and symbols.
- Shaft coupling** – Sleeve or Muff Couplings, Flanged Couplings, Universal Couplings, Oldham Coupling.
- Pipe Joints:** Cast Iron Pipe Joints, Joints for Hydraulic Pipes, Pipe Fittings
- Pulleys:** Flat Belt Pulleys, V – Belt Pulleys, Rope Pulleys.
- Bearings:** Journal Bearings – Solid, Bushed and Collared Journal Bearings, Pivot or Foot-Step Bearings.

### Module 3: Assembly Drawings [35L]

Drawings of Assembled Views for the part drawings of the following using conventions and easy drawing proportions.

- Engine Parts:** Steam Engines: Stuffing Box, Cross Head, Eccentric. Petrol Engine: Connecting Rod, Piston Assembly.
- Other Machine Parts:** Screws Jack, Plain Machine Vice, Plummer Block, Tail-stock.
- Valves:** Gate Valve, Screw-down Stop Valve, Spring Loaded Safety / Relief Valve, SFeed Check Valve and Aircock.

### Text Books

- Machine Drawing: K. L. Narayana, P. Kannaiah & K. Venkata Reddy; New Age Publishers, 5th Edition, 2016.
- Machine Drawing: N.D. Bhatt; Charotar Publications, 47th Edition, 2012

## Reference Books

1. Ajeet Singh, "Machine Drawing", TMH Publications, 4th Edition, 2010.
2. P. S. Gill, "Machine Drawing", Kataria Publications, 16th Edition, 1996.
3. Junarkar. N. D, "Machine Drawing", Pearson Publication, 2009

## E-Resources

1. <https://rb.gy/elN9yk>
2. <https://rb.gy/p9q0o0>
3. <https://rb.gy/erlhm8>

## Course Outcomes

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

- CO1.** gain thorough knowledge of the conventional representation of common Machine Elements and Parts such as Screws, Nuts, Keys, Bearings, Springs, etc.
- CO2.** acquire Very good skills in drawing of joints used in engineering practice, such as Cotter and Knuckle Joints, Riveted Joints, Welded Joints, etc.,
- CO3.** draw the assembly drawings of Machine Parts such as Stuffing Box, Eccentric, Connecting Rod, Screw Jack, Valves, etc.,
- CO4.** Interpret the machine drawings that in turn help in the preparation of the production drawings.
- CO5.** draw the Assembly drawings of different valves

## 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	-	-	-	3	2	-	1	1	1
<b>CO2</b>	-	-	-	-	2	-	-	-	3	2	-	1	2	1
<b>CO3</b>	-	-	-	-	2	-	-	-	3	2	-	1	2	1
<b>CO4</b>	-	-	-	-	-	-	-	-	3	2	-	2	2	1
<b>CO5</b>	-	-	-	-	-	-	-	-	3	2	-	2	2	1
<b>Average</b>	-	-	-	-	<b>2</b>	-	-	-	<b>3</b>	<b>2</b>	-	<b>1.4</b>	<b>1.8</b>	<b>1</b>

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year - II Sem</b>			
Course Code: <b>L2232</b>	<b>MECHANICS OF FLUIDS AND</b> <b>HYDRAULIC MACHINES LAB</b>	L	T	P	D
Credits: 1		<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics, Mechanics of Fluids and Hydraulic Machines.

#### List of Experiments

1. Verification of Bernoulli's Theorems
2. Calibration of Venturi meter
3. Calibration of Orifice meter.
4. Calibration of Mouth piece / Orifice apparatus.
5. Determination of loss of head due to sudden contraction in pipeline
6. Determination of friction factor for a given pipe line
7. Impact of jets on Vanes
8. Performance Test on Pelton Wheel
9. Performance test on Francis Turbine.
10. Performance Test on Reciprocating Pump.
11. Performance Test on Single Stage Centrifugal Pump.
12. Performance Test on Multi Stage Centrifugal Pump.

#### E-Resources

1. [https://books.google.co.in/books?id=yCW\\_8APjwMkC&printsec=frontcover&source=gbs\\_ge\\_summary\\_r&cad=0#v=onepage&q&f=false](https://books.google.co.in/books?id=yCW_8APjwMkC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false)

#### Course Outcomes

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

- CO1.** Demonstrate skills in calibration of instruments such as Venturimeter, Orifice meter, etc.
- CO2.** Evaluate the minor and major losses in fluid flow.
- CO3.** Analyse the performance of hydraulic turbines and pumps used in power plants.
- CO4.** Carry out trouble shooting in hydraulic power plants.
- CO5.** Do the performance testing of pumps

#### 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	-	-
<b>CO2</b>	-	-	-	-	-	-	-	-	3	-	2	3	1	1
<b>CO3</b>	-	-	-	-	-	-	-	-	3	-	3	3	1	1
<b>CO4</b>	-	-	-	-	-	-	-	-	3	-	3	3	-	-
<b>CO5</b>	-	-	-	-	-	-	-	-	3	-	2.5	3	1	1
<b>Average</b>	-	-	-	-	-	-	-	-	3	-	2	3	-	-

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



<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year - II Sem</b>			
Course Code: <b>L2233</b>	<b>MACHINE TOOLS LAB</b>	L	T	P	D
Credits: 1		<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics, Mechanics of Fluids and Hydraulic Machines.

### List of Experiments

1. Introduction of general-purpose machines -Lathe, drilling machine, Milling machine.
2. Study parts of Shaper machine, slotting machine.
3. Study of parts of all grinding machines.
4. Study of material, geometry of tools used in metal cutting like single point, multipoint cutting tool.
5. Plain and step turning on lathe machine.
6. Taper turning on lathe machine.
7. Thread cutting and knurling on – lathe machine.
8. Drilling and Tapping.
9. Shaping.
10. Slotting.
11. Milling.
12. Surface Grinding. Experiment
13. Cylindrical grinding.
14. Tool and cutter grinder.

### E-Resources

1. [https://books.google.co.in/books?id=ojUSAga14cMC&printsec=frontcover&source=gbs\\_ge\\_summary\\_r&cad=0#v=onepage&q&f=false](https://books.google.co.in/books?id=ojUSAga14cMC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false)

### Course Outcomes

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

- CO1.** Use and apply various measuring instruments in carrying the machine operations.
- CO2.** Make various shapes to the given metal by using general purpose machines.
- CO3.** Make required shapes to the given metal objects by operating special purpose Machines like cylindrical grinding machines, surface grinding machines.
- CO4.** Make different rake angles to the given metal removing tools.
- CO5.** Handle the special purpose machines.

**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	-	3	2	-	-
<b>C02</b>	-	-	-	-	-	-	-	-	2	-	3	1	-	-
<b>C03</b>	-	-	-	-	-	-	-	-	2	-	3	1	2	-
<b>C04</b>	-	-	-	-	-	-	-	-	2	-	3	1	3	-
<b>C05</b>	-	-	-	-	-	-	-	-	2	-	3	1	2	-
<b>Average</b>	-	-	-	-	-	-	-	-	2	-	3	1.2	2.3	-

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>II Year-II Sem</b>			
Course Code: <b>L22M2</b>	<b>ENVIRONMENTAL SCIENCE</b> (Common to ALL)	L	T	P	D
Credits: 0		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Nil.

### Module 1:

#### Unit-1: Ecosystem and Natural Resources

Concept, Classification of Resources: Water resources, Land resources, land degradation, Forest resources, Mineral resources, Energy resources. Concept of ecosystem, Classification of ecosystem, Functions of ecosystem. Biodiversity, Level, values, hotspots of biodiversity, Threats to Biodiversity, Conservation of Biodiversity.

### Module 2:

#### Unit-1: Global Environmental Problems and Global Efforts

Deforestation, Greenhouse effect, Global Warming, Sea level rise, Ozone depletion. International conventions/protocols: green-belt-development, Concept of Green Building, Clean Development Mechanism (CDM).

#### Unit-2: Environmental Impact Assessment (EIA) And Environmental Management Plan

Definition of Impact, classification of impacts, methods of baseline data acquisition. Impacts on different components: such as human health resources, air, water, flora, fauna and society, impact assessment methodologies. Environmental management plan (EMP).

### Module 3:

#### Unit-1: Environmental Policy, Legislation, Rules and Regulations

Environmental Protection Act: Air (Prevention and control of pollution) Act-1981, Water (Prevention and control of pollution) Act-1974, Forest Conservation Act.

#### Unit-2: Towards Sustainable Future:

Concept of Sustainable Development, Threats to Sustainability, Strategies for achieving Sustainable development, Environmental Ethics, Environmental Economics, Concept of Green Computing.

### Text Books:

1. "Textbook of Environmental Science And Technology" by M Anji Reddy, BS Publications, 2007.
2. "Principles of Environmental Science and Engineering" by Rao P. Venugopala, Prentice Hall India Learning Private Limited (1 January 2006)

### Reference Books:

1. "Environmental Studies" by Benny Joseph, McGraw Hill Education 2008.
2. "Textbook of Environmental Studies for Undergraduate Courses" by Erach Bharucha 2005, University Grants Commission, University Press

### E-Resources

1. <https://nptel.ac.in/courses/120/108/120108004/#>

**Course Outcomes:**

On completion of the course, the students will be able to:

1. Compare the different natural resources available and how to use them.
2. Describe about biodiversity.
3. Analyze the Global Environmental Problems and Global Efforts.
4. Categorize the global environmental problems.
5. Prioritize the Sustainable development

**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	2	2	-	-	1	-	-	-	-	1	2	1
<b>CO2</b>	-	-	-	-	-	3	3	-	-	-	-	2	1	1
<b>CO3</b>	3	3	2	2	-	-	1	-	-	-	-	1	2	1
<b>CO4</b>	3	3	2	2	-	-	1	-	-	-	-	1	2	1
<b>CO5</b>	-	-	-	-	-	3	3	-	-	-	-	2	2	1
<b>Average</b>	1.8	1.8	1.2	1.2	-	1.2	1.8	-	-	-	-	1.4	1.8	1

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year-I Sem</b>			
Course Code: <b>L313A</b>	<b>DYNAMICS OF MACHINERY</b>	L	T	P	D
Credits: <b>4</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Mechanics, Kinematics of Machinery.

#### Module 1:

**Unit 1: Static and Dynamic Force Analysis of Planar Mechanisms:** Introduction– Free Body Diagrams – Conditions for equilibrium – Two, three and four force systems – Inertia forces and D’Alemberts Principle. Dynamic analysis of slider cranks mechanism.

**Unit 2: Precession:** Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero-planes and ships.

#### Module 2:

**Unit 1: Friction Clutches:** Introduction to Friction and its types, Single Plate clutch, Multi Plate clutch, Cone Clutch and Centrifugal Clutch.

**Unit 2: Brakes and Dynamometers:** Simple block brake, Band brake. Dynamometers – absorption and transmission types, General description and methods of operations.

#### Module 3:

**Unit 1: Turning Moment Diagram and Flywheels:** Engine Force Analysis, Inertia Force in Reciprocating Engine. Turning moment diagram: fluctuation of energy, flywheels and their design.

**Unit 2: Governors:** Watt, Porter and Proell governors, spring loaded governors – Hartnell and Hartung Governors with auxiliary springs. Sensitiveness, Isochronism and hunting.

#### Module 4:

**Unit 1: Balancing of Rotating Masses:** Balancing of rotating single and multiple masses in single and different planes.

**Unit 2: Balancing of Primary and Secondary Reciprocating Masses:** Primary and Secondary balancing of reciprocating masses, Analytical and graphical methods - Unbalanced forces and couples. Balancing of V, multi cylinder inline and radial engines for primary and secondary balancing.

#### Module 5:

**Unit 1:** Free Vibration of mass attached to vertical spring, Oscillations of Pendulum, Transverse loads, Vibrations of Beam with Concentrated and Distributed loads: Dunkerly’s Method Raleigh’s method

**Unit 2:** Whirling of shafts – Critical speeds of shafts. Frequency of forced vibration, free damped vibrations and forced damped vibration.

#### Text Books

1. S.S. Rattan, Theory of Machines, 4th edition, Tata-Mc Graw Hill, ,2014
2. T. Bevan, "Theory of Machines", S. Chand Publications, 3rd Edition.

## Reference Books

1. P. L. Ballaney, "Theory of Machines and Mechanisms", Orient Publishers.
2. R. L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw Hill.
3. J.S Rao and RV Dukkupati, "Mechanism and Machine Theory", New Age Publishers.

## E-Resources

1. <https://nptel.ac.in/courses/112/104/112104114/>
2. <https://urlzs.com/YTF41>
3. <https://urlzs.com/SqM8L>

## Course Outcomes

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

**CO1:** Design linkages and mechanisms for a given motion associated with forces.

**CO2:** Analyze the effect of precession motion and gyroscopic couples on moving bodies viz automobiles, aeroplanes and ships.

**CO3:** Analyze the effect of dynamics on various mechanical elements associated with IC engines and automobiles.

**CO4:** Understand the significance of balancing moving parts and its dynamic analysis to achieve the steady state of equilibrium.

**CO5:** Understand the behaviour of vibration and its effects on dynamic machine members.

## CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
<b>CO1</b>	3	3	2	2	2	-	-	-	-	-	-	2	3	3
<b>CO2</b>	3	2	2	2	2	-	-	-	-	-	-	2	3	3
<b>CO3</b>	3	3	2	2	2	-	-	-	-	-	-	2	3	3
<b>CO4</b>	3	3	2	2	2	-	-	-	-	-	-	2	3	3
<b>CO5</b>	3	3	2	3	2	-	-	-	-	-	-	2	3	3
<b>Average</b>	3	2.8	2	2.2	2	-	-	-	-	-	-	2	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year - I Sem</b>			
Course Code: <b>L313B</b>	<b>DESIGN OF MACHINE MEMBERS – I</b>	L	T	P	D
Credits: <b>4</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics, Engineering Mechanics and Mechanics of Solids.

#### Module 1:

**Unit 1: Introduction:** General considerations in the selection of Engineering Materials and their properties, Manufacturing considerations in design, BIS codes for steels. Design of solid and hollow shafts for strength and rigidity.

**Unit 2: Design for Fatigue Strength:** Stress concentration–Theoretical stress Concentration factor–Fatigue stress concentration factor- Notch Sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength –Goodman’s line– Soderberg’s line.

#### Module 2:

**Unit 1: Axially Loaded Joints:** Design of Keys, stresses in keys, cotter joints, spigot and socket, Gib and cotter joints, Knuckle joints.

**Unit 2: Shaft Couplings:** Rigid couplings -Muff, Split muff and Flange couplings (Unprotected and Protected). Flexible couplings- Pin bush coupling.

#### Module 3:

**Unit 1: Riveted Joints:** Modes of failure in riveted joints, Strength Equations, efficiency of the joints.

**Unit 2: Welded Joints:** Design of Fillet welds, axial loads, Circular fillet welds, bending and torsion

#### Module 4:

**Unit 1: Mechanical Springs:** Stresses and deflections of helical springs, Extension, compression springs, springs for static and fatigue loading, torsion springs.

**Unit 2: Bolted Joints:** Design of bolts with pre stresses, Design of joints under eccentric loading, bolts of uniform strength.

#### Module 5:

**Unit 1: Belt Drives:** Types of Belts, Materials for belts, types of Belt Drives and Transmission of power by Belt Drives.

**Unit 2: Rope Drives:** Transmission of power by Rope Drives Materials for rope drives. Pulleys for belt and rope drives.

#### Text Books

1. Bahl and Goel, "Mechanical Engineering Design", Standard Publications.
2. Pandya and Shah, "Machine Design", McGrahill, 2007

## Reference Books

1. V. Bhandari, "Design of Machine Elements"
2. R S Khurmi, "Machine Design", S Chand & Co. Publications, 2013.
3. S. Md. Jalaludeen, "Machine Design", Volume – II, 2016.

## E-Resources

1. <https://nptel.ac.in/courses/112/105/112105124/>
2. <https://www.coursera.org/learn/machine-design1>
3. <https://shorturl.at/gQY34>
4. [http://www.brainkart.com/subject/Design-of-Machine-Elements\\_72/](http://www.brainkart.com/subject/Design-of-Machine-Elements_72/)
5. <https://shorturl.at/oqsCX>

## Course Outcomes

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

- CO1:** Analyze, design and select machine elements for various applications.
- CO2:** Analyze Strength/Failure theories and Safety factors for machine members under steady and fatigue loads.
- CO3:** Acquire procedure to analyze and design of permanent joints such as Riveted and welded joints etc. for different applications, shafts, keys and shaft couplings.
- CO4:** Identify various types of springs and their applications and learn how to design helical and leaf springs with practical engineering problems.
- CO5:** Acquire procedure to analyze and design of temporary joints bolted joints for different 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	3	2	2	-	-	-	-	-	-	-	1	2	2
<b>CO2</b>	3	3	2	2	-	-	-	-	-	-	-	1	2	2
<b>CO3</b>	3	3	2	2	-	-	-	-	-	-	-	1	2	2
<b>CO4</b>	3	3	2	2	-	-	-	-	-	-	-	2	3	3
<b>CO5</b>	3	3	2	2	-	-	-	-	-	-	-	2	3	3
<b>Average</b>	3	3	2	2	-	-	-	-	-	-	-	1.4	2.4	2.4

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



<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year - I Sem</b>			
Course Code: <b>L313C</b>	<b>THERMAL ENGINEERING – II</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics, Thermodynamics, Thermal Engineering – I

#### Module 1:

**Unit 1: Vapour Power Cycles:** Carnot vapour power cycle, Rankine cycle - Schematic layout, Thermodynamic Analysis, Actual Vapour Power Cycle, Concept of Mean Temperature of Heat addition. Methods to improve Rankine cycle performance – Regeneration and Reheating, Fuels used in Power Plant.

**Unit 2: Boilers:** Classification – Working principles with sketches including H.P. Boilers – Mountings and Accessories. Equivalent evaporation, Efficiency

#### Module 2:

**Unit 1: Draught:** Classification – Height of chimney for given draught and discharge – condition for maximum discharge – efficiency of chimney. Artificial draught – induced and forced.

**Unit 2: Steam Nozzles:** Functions – types–applications. Flow through nozzles – thermodynamic analysis – assumptions – velocity of nozzle at exit. Ideal and actual expansion in nozzle – velocity coefficient – condition for maximum discharge – critical pressure ratio. Super saturated flow, effects, degree of super saturation and degree of under cooling – Wilson line. Criteria to decide nozzle shape.

#### Module 3:

**Unit 1: Steam Turbines:** Classification – Impulse turbine - Mechanical details – Velocity diagram–effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency – maximum work done and maximum efficiency.

**Unit 2: De-Laval Turbine:** Features – Methods to reduce rotor speed – Velocity compounding and Pressure compounding, Velocity and Pressure variation along the flow. Combined velocity diagram for a Velocity Compounded Impulse turbine – condition for maximum efficiency

#### Module 4:

**Unit 1: Reaction Turbine:** Mechanical details – principle of operation – thermodynamic analysis of a stage – degree of reaction – velocity diagram – Parson’s reaction turbine, condition for maximum efficiency – maximum work done and maximum efficiency.

**Unit 2: Steam Condensers:** Requirements of steam condensing plant – Classification of condensers – working principle of different types. Vacuum efficiency and condenser efficiency. Air leakage, sources and affects. Edward air pump. Cooling water requirement – cooling towers.

#### Module 5:

**Unit 1: Gas Turbines:** Simple gas turbine plant – Ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating – Closed and Semi-closed cycles, merits and demerits.

**Unit 2: Refrigeration and Cryogenic Engineering:** Vapour compression system – Components – Working – P-H and T-S diagrams – Calculation of COP – Effect of sub-cooling and super-heating – Vapour absorption system – NH<sub>3</sub> - water system, Vapour adsorption system. Cryogenic Engineering: Introduction, Application, Cryo-coolers.

### Text Books

1. R.K. Rajput, "Thermal Engineering", Lakshmi Publications, 2017.
2. V. Ganesan, "Gas Turbines", Tata McGraw Hill,, 3rd Edition, 2002.

### Reference Books

1. Dr. R. Yadav, "Thermodynamics and Heat Engines", Central Publishing House, 7th Edition, 2012
2. Manohar Prasad, Refrigeration and Air Conditioning, 3rd Edition, New Age International, 2015
3. Cohen, Rogers, Saravana Muttou, "Gas Turbines Theory", Pearson Publishers, 7th Edition, 2019.

### E-Resources

1. <https://nptel.ac.in/courses/112/103/112103277/>
2. <https://nptel.ac.in/courses/112/107/112107216/>
3. <http://www.thermopedia.com/content/1072/>
4. [http://www.iraj.in/journal/journal\\_file/journal\\_pdf/2-197-144801829853-59.pdf](http://www.iraj.in/journal/journal_file/journal_pdf/2-197-144801829853-59.pdf)

### Course Outcomes

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

- CO1:** Apply the knowledge of Rankine cycle in solving field problems while operating a power plant.
- CO2:** Analyze and incorporate suitable Draught system and Nozzle.
- CO3:** Install different types of steam turbines in the industry.
- CO4:** Investigate the operating principles and performance of Reaction turbine and Steam condensers.
- CO5:** Analyze working of gas turbines, Refrigeration and Cryogenics.

### 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	2	1	2	-	-	-	-	-	-	3	2	3
<b>CO2</b>	3	3	3	2	3	-	-	-	-	-	-	3	3	3
<b>CO3</b>	3	3	2	3	2	-	-	-	-	-	-	3	2	3
<b>CO4</b>	3	3	2	3	2	-	-	-	-	-	-	3	2	3
<b>CO5</b>	3	3	3	3	3	-	-	-	-	-	-	3	3	3
<b>Average</b>	3	3	2.4	2.4	2.4	-	-	-	-	-	-	3	2.4	3

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

<b>A.Y: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year - I Sem</b>			
Course Code: <b>L313E</b>	<b>UNCONVENTIONAL MACHINING PROCESS</b> (Professional Elective – I)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Mathematics – I, Thermodynamics, Basic of Electrical and Electronics Engineering, Engineering Physics, Materials Science.

#### Module 1:

**Unit 1: INTRODUCTION:** Unconventional machining Process – Need – classification – merits, demerits and applications.

**Unit 2: MECHANICAL ENERGY BASED PROCESSES:** Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining. (AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR- Applications.

#### Module 2:

**Unit 1: ELECTRICAL ENERGY BASED PROCESSES:** Electric Discharge Machining (EDM), Electron Beam Machining (EBM) – Wire cut EDM – Working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Applications.

**Unit 2: THERMAL ENERGY BASED PROCESSES:** Laser Beam machining and drilling, (LBM), plasma, Arc machining (PAM). Principles – Equipment –Types - Beam control techniques – Applications.

#### Module 3:

**Unit 1: CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES:** Chemical machining (CHM)- Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR-Applications.

**Unit 2: ELECTRO-CHEMICAL ENERGY BASED PROCESSES:** Principles of ECM- equipments- Surface Roughness and MRR Electrical circuit-Process Parameters- ECG and ECH - Applications.

#### Module 4:

**Unit 1: ADVANCED NANO FINISHING PROCESSES:** Abrasive flow machining, chemo-mechanical polishing their working principles, equipments, effect of process parameters, applications, advantages and limitations.

**Unit 2: ADVANCED NANO FINISHING PROCESSES:** magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations.

#### Module 5:

**RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES:** Recent developments in non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining processes.

## Text Books

1. Vijay.K. Jain Advanced Machining Processes Allied Publishers Pvt. Ltd., New Delhi, 2007.
2. Pandey P.C. and Shan H.S. Modern Machining Processes Tata McGraw-Hill, New Delhi, 2007.

## Reference Books

1. Benedict. G.F. Nontraditional Manufacturing Processes, Marcel Dekker Inc., New York, 1987.
2. Mc Geough, Advanced Methods of Machining, Chapman and Hall, London, 1998.
3. Paul De Garmo, J.T.Black, and Ronald. A.Kohser, Material and Processes in Manufacturing Prentice Hall of India Pvt. Ltd., 8thEdition, New Delhi , 2001.

## E-Resources

1. <https://nptel.ac.in/courses/112103202>
2. <https://archive.nptel.ac.in/courses/112/105/112105212/>
3. [https://onlinecourses.nptel.ac.in/noc22\\_me119/preview](https://onlinecourses.nptel.ac.in/noc22_me119/preview)

## Course Outcomes

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

- CO1:** Explain the need for unconventional machining processes and its classification.
- CO2:** Compare various thermal energy and electrical energy based unconventional machining processes.
- CO3:** Summarize various chemical and electro-chemical energy based unconventional machining processes.
- CO4:** Explain various nano abrasives based unconventional machining processes.
- CO5:** Distinguish various recent trends based unconventional machining processes.

## CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3	3	2	2	-	-	-	-	-	-	-	2	1	-
<b>CO2</b>	3	2	2	2	-	-	-	-	-	-	-	2	1	-
<b>CO3</b>	3	2	2	2	-	-	-	-	-	-	-	2	2	-
<b>CO4</b>	3	3	3	2	-	-	-	-	-	-	-	2	2	1
<b>CO5</b>	3	3	3	2	-	-	-	-	-	-	-	2	2	1
<b>Average</b>	3	2.6	2.4	2	-	-	-	-	-	-	-	2	1.6	1

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year - I Sem</b>			
Course Code: <b>L313F</b>	<b>THEORY OF METAL CUTTING</b> (Professional Elective – I)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Metal Cutting & Machine Tools.

#### Module 1:

**Unit 1: Introduction:** Geometry of Metal Cutting Process, Chip formation, Chip thickness ratio, radius of chip curvature, cutting speed, feed and depth of cut – Types of chips chip breakers.

**Unit 2: Orthogonal and Oblique cutting processes** – definition, Forces and energy calculations (Merchant's Analysis) – Power consumed – MRR- Effect of Cutting variables on Forces, Force measurement using Dynamometers.

#### Module 2:

**Unit 1: Geometry of cutting tools:** Single point and multi-point cutting tools, tools in hand nomenclature, tool point reference systems.

**Unit 2: Tool angle specifications** – ISO and ASA systems, Effect of cutting parameters on tool geometry.

#### Module 3:

**Unit 1: Tool wear:** Mechanisms of tool wear, Sudden, gradual wear, crater wear, flank wear,

**Unit 2: Tool life:** Tool failure criteria, tool life equations, effect of process parameters on tool life.

#### Module 4:

**Unit 1: Thermal aspects in metal cutting:** Heat sources in metal cutting, temperature in chip formation, temperature distribution, and experimental determination of tool temperatures.

**Unit 2: Cutting fluids:** functions of cutting fluids, properties of cutting fluids, selection of cutting fluids, application of cutting fluids.

#### Module 5:

**Unit 1: Tool materials and their properties:** Characteristics of tools materials, types of tool materials – carbon tool steels, high speed steels, cast alloys, cemented carbides, ceramics, diamonds, sialon, CBN, UCON.

**Unit 2:** Cutting speeds for the tools: high speed steels, carbides, diamond. Coated tools: CVD, PVD.

#### Text Books

1. G. C. Sen and A. Bhattacharya, "Principles of Metal Cutting", New Central Book Agency
2. I M C Shaw, "Metal Cutting Principles", Oxford and IBH Publications.

#### Reference Books

1. Boothroyd, "Fundamentals of Machining", Edward Arnold Publishers.
2. V. Arshinov & G. Alekseev, "Metal Cutting Theory and Cutting Tool Design", Mir Publishers.
3. B. L. Juneja, G. S. Sekhom & Nitin Seth, "Fundamentals of Metal Cutting and Machine tools", New Age International Publisher
4. G. Kuppaswamy, "Principles of Metal Cutting", Universities Press.

### E-Resources

1. <https://rb.gy/aqjyox>
2. <https://rb.gy/cihf5n>
3. <https://deewanbittal.files.wordpress.com/2017/12/manufacturing-engineering-ii.pdf>
4. <https://nptel.ac.in/courses/112/105/112105233/>

### Course Outcomes

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

**CO1:** Analyze a cutting tool, its geometry and arrive at the cutting process.

**CO2:** Create a cutting tool material and appropriate material to be cut.

**CO3:** Apply the methods of measuring the cutting forces, temperature and their significance

**CO4:** Apply a cutting tool with optimal tool life to maximize material removal rate.

**CO5:** Understand about Tool materials and their properties

### 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	3	2	-	-	-	-	-	-	2	2	3
<b>CO2</b>	2	3	3	2	2	-	-	-	-	-	-	2	3	2
<b>CO3</b>	3	3	3	2	2	-	-	-	-	-	-	2	3	3
<b>CO4</b>	2	3	2	3	3	-	-	-	-	-	-	2	2	2
<b>CO5</b>	3	3	3	3	3	-	-	-	-	-	-	2	3	3
<b>Average</b>	2.6	2.8	2.6	2.6	2.4	-	-	-	-	-	-	2	2.6	2.6

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year - I Sem</b>			
Course Code: <b>L313G</b>	<b>MACHINE TOOL DESIGN</b> (Professional Elective – I)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Mechanics, Kinematics of Machinery, Dynamics of Machinery

#### Module 1:

**Unit 1: Introduction to Machine Tool Drives and Mechanisms:** Introduction, Working and Auxiliary Motions in Machine Tools.

**Unit 2:** Kinematics of Machine Tools, Motion Transmission.

#### Module 2:

**Unit 1: Regulation of Speeds and Feeds:** Aim of Speed and Feed Regulation, Stepped Regulation of Speeds, Multiple Speed Motors.

**Unit 2:** Ray Diagrams and Design Considerations, Design of Speed Gear Boxes, Feed Drives, Feed Box Design.

#### Module 3:

**Unit 1: Design of Machine Tool Structures:** Functions of Machine Tool Structures and their requirements, Design for Strength, Design for Rigidity.

**Unit 2:** Materials for Machine Tool Structures, Machine Tool Constructional Features, Beds and Housings, Columns and Tables, Saddles and Carriages.

#### Module 4:

**Unit 1: Design of Guide ways, Power Screws and Spindles:** Functions and Types of Guide ways, Design of Guide ways, Design of Aerostatic Slide ways, Design of Anti-Friction Guide ways, Combination Guide ways, Design of Power Screws.

**Unit 2: Design of Spindles and Spindle Supports:** Functions of Spindles and Requirements, Effect of Machine Tool Compliance on Machining Accuracy, Design of Spindles, antifriction Bearings.

#### Module 5:

**Unit 1: Control systems in Machine Tools:** Functions, Requirements and Classification, Control systems for changing Speeds and Feeds. Control systems for Executing Forming and Auxiliary motions.

**Unit 2:** Manual Control Systems, Automatic Control Systems and Adaptive Control Systems.

#### Text Books

1. PB Mahapatra, "Operations Management", PHI Publications.
2. Dr.KC Arora & Shinde, "Aspects of Material handling", Lakshmi Publications.

#### Reference Books

1. K Pal, S. K. Basu, "Design of Machine Tools", Oxford Publications.
2. N. S. Acherkhan, "Machine Tool Design", Vol. I, II, III and IV, MIR.

### E-Resources

1. <https://nptel.ac.in/courses/112/105/112105126/>
2. <https://nptel.ac.in/courses/112/105/112105124/>
3. <https://rb.gy/w3ncv>
4. <https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod4.pdf>
5. <https://nptel.ac.in/courses/112/106/112106180/>

### Course Outcomes

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

- CO1:** Understand basic motions involved in a machine tool.
- CO2:** Design machine tool structures.
- CO3:** Design and analyze systems for specified speeds and feeds.
- CO4:** Select subsystems for achieving high accuracy in machining.
- CO5:** Understand functions of Manual Control Systems, Automatic Control Systems and Adaptive Control Systems

### 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	3	-	-	-	-	-	-	-	3	3	3
<b>CO2</b>	3	2	2	3	-	-	-	-	-	-	-	2	3	3
<b>CO3</b>	3	2	2	3	-	-	-	-	-	-	-	2	3	3
<b>CO4</b>	3	2	2	3	-	-	-	-	-	-	-	2	3	3
<b>CO5</b>	3	2	2	3	-	-	-	-	-	-	-	2	3	3
<b>Average</b>	3	2	2	3	-	-	-	-	-	-	-	2.2	3	3

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



<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year-I Sem</b>			
Course Code: <b>L3131</b>	<b>DYNAMICS OF MACHINERY LAB</b>	L	T	P	D
Credits: 1		<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics, Engineering Mechanics, Mechanics of Materials, Kinematics of Machines.

### List of Experiments

1. To determine the state of balance of machines for primary and secondary forces
2. To determine the frequency of torsional vibration of a given rod
3. Determine the effect of varying mass on the centre of sleeve in porter and proell governor
4. Find the motion of the follower if the given profile of the cam
5. The balance masses statically and dynamically for single rotating mass systems
6. Determine the critical speed of a given shaft for different n- conditions
7. For a simple pendulum determine time period and its natural frequency
8. For a compound pendulum determine time period and its natural frequency
9. Determine the effect of gyroscope for different motions
10. Determine the pressure distribution of lubricating oil at various load and speed of a Journal bearing.

### Text Books

1. <https://shorturl.at/wER23>

### Course Outcomes

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

- CO1.** Apply the knowledge of different types of motion in real time applications  
**CO2.** Analyse forces and torques of components in linkages  
**CO3.** Analyse the static and dynamic balance  
**CO4.** Apply forward and inverse kinematics of open-loop mechanisms

### 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	3	-	2	3	3
<b>CO2</b>	-	-	-	-	-	-	-	-	2	3	-	2	3	3
<b>CO3</b>	-	-	-	-	-	-	-	-	2	3	-	2	3	3
<b>CO4</b>	-	-	-	-	-	-	-	-	2	3	-	2	3	3
<b>CO5</b>	-	-	-	-	-	-	-	-	2	3	-	2	3	3
<b>Average</b>	-	-	-	-	-	-	-	-	2	3	-	2	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year-I Sem</b>			
Course Code: <b>L3132</b>	<b>THERMAL ENGINEERING LAB</b>	L	T	P	D
Credits: 1		<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**Pre-Requisites:** Thermodynamics, Thermal Engineering.

#### List of Experiments

1. To determine Flash and Fire point for a given liquid fuel – Pensky Marten / Abel’s Apparatus
2. To determine viscosity of given oil by Redwood Viscometer – I
3. To determine Carbon Residue of given fuel
4. To determine Calorific Value of a given fuel/ oil
5. I.C. Engines Valve Timing Diagram.
6. I.C. Engines Port Timing Diagram.
7. I.C. Engines Performance Test (4 Stroke Diesel engine)
8. I.C. Engines Performance Test (2 Stroke Petrol engine)
9. Evaluation of Engine friction by conducting Morse test on 4-stroke Multi cylinder Petrol Engine
10. Heat Balance Sheet on IC Engine
11. 4- Stroke Petrol Engine Assembly and Disassembly
12. Performance Test on Reciprocating Air – Compressor Test Rig

#### Text Books

1. <https://shorturl.at/bgIM5>

#### Course Outcomes

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

- CO1.** Evaluate the properties of fuels like Flash Point, Fire point, Viscosity and Calorific Value using Abel’s Apparatus, Redwood Viscometer, Calorimeter.
- CO2.** Obtain the Valve Timing Diagram and Port Timing Diagram of IC engines
- CO3.** Conduct Performance Tests on four-stroke diesel engine and two-stroke petrol engine and Morse test on four-stroke Multi cylinder Petrol Engine
- CO4.** Apply the knowledge to Disassemble and assemble the parts of IC engine.
- CO 5:** Conduct the Performance Test on Reciprocating Air – Compressor

**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	3	-	2	3	3
<b>C02</b>	-	-	-	-	-	-	-	-	2	3	-	2	3	3
<b>C03</b>	-	-	-	-	-	-	-	-	2	3	-	2	3	3
<b>C04</b>	-	-	-	-	-	-	-	-	2	3	-	2	3	3
<b>C05</b>	-	-	-	-	-	-	-	-	2	3	-	2	3	3
<b>Average</b>	-	-	-	-	-	-	-	-	2	3	-	2	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year-I Sem</b>			
Course Code: <b>L3133</b>	<b>INTERNSHIP – II</b>	L	T	P	D
Credits: 1		<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

### Guidelines:

The Internship-II is to be taken up during the summer vacation after II Year II Semester examination and it will be evaluated in III Year I semester for 50 marks. However, the process might be initiated before the end of II Year II Semester by the concerned department.

For the Internship, the student shall submit a report on the training undergone. The internship shall be evaluated by a three-member committee constituted by the Head of Department to assess the student performance on the following parameters. There shall be no Semester End Examinations for the Internships.

Parameter	Marks
Internship report	15
Quality of work	15
Presentation	15
Viva-Voce	5
Total	50

### 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	2	2	-	2	2	2	2	3	3
<b>C02</b>	2	-	-	-	3	2	2	-	2	2	2	3	3	3
<b>C03</b>	2	-	-	-	3	3	2	-	3	2	2	2	3	3
<b>C04</b>	2	-	-	-	2	2	3	-	2	3	3	2	3	3
<b>C05</b>	2	-	-	-	3	3	3	-	3	3	2	3	3	3
<b>Average</b>	2				2.6	2.4	2.4		2.4	2.4	2.2	2.4	3	3

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

<b>AY: 2022-23 Onwards</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME III Year- I Sem</b>			
<b>Course Code: L31M1</b>	<b>ARTIFICIAL INTELLIGENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>
<b>Credits: 0</b>		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Mathematics, Probability and statistics, Knowledge in programming Language

#### Module 1:

**Introduction:** AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents.

**Basic Search Strategies:** Problem Spaces, Uninformed Search (Breadth-First, Depth- First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A\*), Constraint Satisfaction (Backtracking, Local Search)

#### Module 2:

**Advanced Search:** Constructing Search Trees, Stochastic Search, A\* Search Implementation, Minimax Search, Alpha-Beta Pruning.

**Basic Knowledge Representation and Reasoning:** Propositional Logic, First Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem.

#### Module 3:

**Advanced Knowledge Representation and Reasoning:** Knowledge Representation Issues, Non- monotonic Reasoning, and Other Knowledge Representation Schemes.

**Reasoning Under Uncertainty:** Basic probability, acting under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks.

#### Module 4:

**Learning:** What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

#### Module 5:

**Expert Systems:** Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

#### Text Books

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice- Hall, 2010

#### Reference Books

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition, 2009.
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.

#### E-Resources

1. [https://www.tutorialspoint.com/artificial\\_intelligence/artificial\\_intelligence\\_pdf\\_v](https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_pdf_v)

er sion.htm

2. <https://www.alljntuworld.in/download/artificial-intelligence-ai-materials-notes/>
3. <https://drive.google.com/file/d/1mPiI4jy6YkJRDiCT21xgzN0VDNkrW23X/View>
4. <https://nptel.ac.in/courses/106/105/106105077/>

### Course Outcomes

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

- CO1.** Identify the AI based problems.
- CO2.** Apply AI techniques for representing the basic problem.
- CO3.** Apply Advanced AI techniques to solve the problem.
- CO4.** Analyse Learning and explain various learning techniques.
- CO5.** Illustrate the use of expert system

### 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	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
<b>CO1</b>	3	3	-		-	-	-	-	-	-	-	-	3	-
<b>CO2</b>	3	3	3		-	-	-	-	-	-	-	-	3	3
<b>CO3</b>	3	3	-		-	-	-	-	-	-	-	-	3	-
<b>CO4</b>	3	3	3		-	-	-	-	-	-	-	-	3	-
<b>CO5</b>	3	3	-		-	-	-	-	-	-	-	-	3	3
<b>Average</b>	<b>3.0</b>	<b>3.0</b>	<b>3.0</b>	<b>2.2</b>	-	-	-	-	-	-	-	-	<b>3.0</b>	<b>3.0</b>

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year-I Sem</b>			
Course Code: <b>L31T1</b>	<b>EMPLOYABILITY SKILLS</b> (Audit Course-III)	L	T	P	D
Credits: 0	COMMON TO: AI &ML, CE, EEE, ME, ECE, and MIE	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

### Pre-Requisites:

#### Module 1: SOFT SKILLS [6L]

Introduction - What are Soft Skills? - Importance of Soft Skills - Marketing Your Soft Skills - Negotiating - Exhibiting Your Soft Skills - Identifying Your Soft Skills - Improving Your Soft Skills - Top 60 Soft Skills.

Know Thyself/ Self – Discovery - Process of Knowing Yourself - SWOT Analysis.

#### Module 2: CAREER PLANNING [6L]

Introduction - Benefits of Career Planning - Guidelines for choosing a career - Myths about choosing a career goal - Final thoughts on career planning - Things one should know while starting career and during his/her career.

#### Module 3: ART OF SPEAKING [6L]

Introduction - What Makes Communication Important? - Defining Communication - Process of Communication - Channels of Communication - Formal and Informal Communication Network - Barriers to Communication - Tips for Effective Communication - Art of Public Speaking.

#### Module 4: ART OF WRITING [6L]

Introduction - Importance of Writing - Creative Writing - Writing Tips - Drawbacks of Written Communication - Letter Writing and Resume Writing.

#### Module 5: ETIQUETTES AND MANNERS [6L]

Introduction - Modern Etiquettes - Benefits of Etiquettes - Classification of Etiquettes.

Introduction - Practicing Good Manners - Manners at the Wheel - Professional Manners - Social Skills (Manners) - Getting Along with People - Corporate Grooming Tips.

#### Text Books

1. Dr. Alex. K. *Soft Skills: Know yourself and Know the World*. S. Chand & Company Pvt. Ltd: New Delhi: 2014.

#### Reference Books

1. Ashraf Rizvi. M. *Effective Technical Communication*. McGraw-Hill: New Delhi: 2010
2. K. R. Lakshminarayanan, *Speak in English*, Scitech Publications, Chennai, 2009.

#### E-Resources

- [https://en.wikipedia.org/wiki/Soft\\_skills](https://en.wikipedia.org/wiki/Soft_skills)

- <https://www.mbaskool.com/business-concepts/human-resources-hr-terms/1779-career-development.html>

### Course Outcomes

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

- CO1.** Learn the importance of soft skills and knowing thyself.
- CO2.** Understand how to build their (students) career.
- CO3.** Communicate effectively by applying appropriate speaking techniques.
- CO4.** Write letters and resumes effectively by applying appropriate writing techniques.
- CO5.** Learn the good manners and social etiquettes.

### 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>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: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year - II Sem</b>			
Course Code: <b>L323A</b>	<b>DESIGN OF MACHINE MEMBERS – II</b>	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Note:** Design data hand book is permitted.

**Pre-Requisites:** Engineering Physics, Engineering Mechanics, Mechanics of Solids, Design of Machine Members-I.

#### Module 1:

**Unit 1: Sliding Contact Bearings:** Types of Journal bearings – bearing construction – bearing design, bearing materials.

**Unit 2: Rolling Contact Bearings:** Ball and roller bearings – Static load – dynamic load – equivalent radial load – design and selection of ball & roller bearings.

#### Module 2:

**Unit 1: Design of IC Engine Parts:** Connecting Rod: Thrust in connecting rod, stress due to whipping action on connecting rod ends.

**Unit 2: Piston:** Forces acting on piston – Construction – Design and proportions of piston.

#### Module 3:

**Unit 1: Design of Spur Gears:** Lewis beam strength equation, Dynamic loads on gear tooth, Wear load and design for wear strength

**Unit 2: Helical Gears:** Design of gears using AGMA procedure involving Lewis equations. Check for wear

#### Module 4:

**Unit 1: Bevel Gears:** Lewis beam strength equation, Dynamic loads on gear tooth, Wear load and design for wear strength.

**Unit 2: Design of Worm Gears:** Properties of worm gears – Selection of materials, Strength and wear rating of worm gears, Force analysis, Friction in worm gears, thermal considerations.

#### Module 5:

**Unit 1: Power Screws:** Types of Screw Threads used for Power Screws, Torque Required to Raise and lower the Load by Square Threaded Screws and Efficiency of Square Threaded Screws.

**Unit 2:** Design of screw and nut, compound screw, differential screw, and ball screw.

#### Text Books

1. V. Bhandari , " Design of machine element", TMH publications
2. Pandya & Shah," Machine Design ".

#### Reference Books

1. P. Kannaiah, "Machine Design", SciTech Publications

2. S. Md. Jalaludeen, "Machine Design", Volume II.
3. PV Raman Murthi & M. Vidyasagar, "Design Data Book", BS Publications.

### E-Resources

1. <https://nptel.ac.in/courses/112/106/112106137/>
2. [https://www.academia.edu/38675030/A\\_Textbook\\_of\\_Machine\\_Design\\_by\\_R\\_S\\_KHURMI\\_AND\\_J\\_K\\_GUPTA](https://www.academia.edu/38675030/A_Textbook_of_Machine_Design_by_R_S_KHURMI_AND_J_K_GUPTA)
3. [http://www.brainkart.com/subject/Design-of-Machine-Elements\\_72/](http://www.brainkart.com/subject/Design-of-Machine-Elements_72/)
4. [https://www.researchgate.net/publication/328926726\\_Design\\_of\\_Machine\\_Elements](https://www.researchgate.net/publication/328926726_Design_of_Machine_Elements)

### Course Outcomes

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

- CO1:** Design various mechanical elements to arrive at dimensional geometry for a given loading systems and for its effective functional criteria.
- CO2:** Design various types of journal bearing ball bearings and roller bearings under dynamic conditions.
- CO3:** Design various parts of IC engines under the influence of dynamic and inertia forces.
- CO4:** Design Power Transmission Systems associated with use of belts, chains and ropes
- CO5:** Design critical components of Power Transmission Systems under severe conditions for dynamic forces, wear theories and heavy loading systems.

### 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	2	2	-	-	-	-	-	-	-	3	2	2
<b>CO2</b>	3	3	2	2	-	-	-	-	-	-	-	3	2	2
<b>CO3</b>	3	3	2	2	-	-	-	-	-	-	-	3	2	2
<b>CO4</b>	3	3	2	2	-	-	-	-	-	-	-	3	2	2
<b>CO5</b>	3	3	2	2	-	-	-	-	-	-	-	3	2	2
<b>Average</b>	3	3	2	2	-	-	-	-	-	-	-	3	2	2

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year-II Sem</b>			
Course Code: <b>L323B</b>	<b>HEAT TRANSFER</b>	L	T	P	D
Credits: <b>4</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>

**Pre - Requisites:** Differential Equations, Thermal Engineering, Fluid Mechanics.

### Module 1: Introduction

**Unit-1: Introduction:** Modes and mechanisms of heat transfer – Basic laws of heat transfer – General discussion about applications of heat transfer. Conduction Heat Transfer: Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates.

**Unit –2: Conduction Heat Transfer:** Simplification and forms of the field equation – steady, unsteady, and periodic heat transfer – Initial and boundary conditions

### Module 2: One Dimensional Steady State Conduction Heat Transfer

**Unit-1: One Dimensional Steady State Conduction Heat Transfer:** Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius of insulation. Variable Thermal conductivity – Systems with heat sources or Heat generation. Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin – Application to error measurement of Temperature.

**Unit-2: One Dimensional Transient Conduction Heat Transfer:** Systems with negligible internal resistance – Significance of Biot and Fourier Numbers – Chart solutions of transient conduction systems – Concept of Functional Body

### Module 3: Convective Heat Transfer

**Unit-1: Convection Heat Transfer:** Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham Pi Theorem – application for developing semi-empirical non-dimensional correlation for convection heat transfer – Significance of non-dimensional numbers.

**Unit-2: Forced Convection:** External Flows – Concepts about hydrodynamic and thermal boundary layer – use of empirical correlations for convective heat transfer – Flat plates and Cylinders Internal flows - Concepts about Hydrodynamic and Thermal Entry Lengths– Division of internal flow based on this –Use of empirical relations for Horizontal Pipe Flow and annulus flow.

### Module 4: Free Convection & Radiation of Heat Transfer

**Unit-1: Free Convection:** Development of Hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for Vertical plates and pipe.

**Unit-2: Radiation of Heat Transfer:** Emission characteristics and laws of black-body radiation– Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchhoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor– Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

## Module 5: Heat Exchangers & Heat Transfer with Phase change

**Unit-1: Heat Exchangers:** Classification of heat exchangers–overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods – Problems using LMTD and NTU method. Computational Fluid Dynamics: Introduction, Applications.

**Unit-2: Heat Transfer with Phase Change:** Boiling, Pool boiling–Regimes Calculations on Nucleate boiling – Critical Heat flux and Film boiling - Condensation: Film wise and drop wise condensation – Nusselt’s Theory of Condensation on a vertical plate – Film condensation on vertical and horizontal cylinders using empirical correlations.

### Text Books

1. Holman, “Heat Transfer”, Tata McGraw Hill, 8<sup>th</sup> Edition, 2000
2. P.K. Nag, “Heat Transfer”, Tata McGraw Hill, 2002.

### Reference Books

1. R.C.Sachdeva, “Fundamentals of Engineering Heat and Mass Transfer”, New Age International, 3<sup>rd</sup> Edition, 2008
2. Ghoshdastidar, “Heat Transfer”, Oxford University Press, 2<sup>nd</sup> Edition.
3. R.K. Rajput, “Heat and Mass Transfer”, S.Chand, 1<sup>st</sup> Edition, 2009.

### E-Resources

1. <https://rb.gy/fs1xm>
2. <https://rb.gy/xo7ai>
3. <https://nptel.ac.in/courses/112/108/112108149/>
4. <https://ocw.tudelft.nl/courses/fluid-flow-heat-mass-transfer/>
5. <https://www.sciencedirect.com/journal/international-communications-in-heat-masstransfer>

### Course Outcomes

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

**CO1.** Understand basic modes of heat transfer and compute problems in steady state and unsteady state heat conduction.

**CO2.** Explain steady and transient heat conduction in one dimension.

**CO3.** Interpret and analyze free and forced convection heat transfer, flow regimes of boiling and condensation

**CO4.** Understand the importance of free convection heat transfer with phase change and concept of condensation

**CO5.** Understand the principles of radiation heat transfer and apply LMTD and NTU methods to design heat exchangers.

### 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	-	-	-	-	-	-	-	3	1	3
<b>CO2</b>	3	3	2	3	-	-	-	-	-	-	-	2	3	2
<b>CO3</b>	2	3	3	3	-	-	-	-	-	-	-	3	2	3
<b>CO4</b>	3	3	2	3	-	-	-	-	-	-	-	3	2	3
<b>CO5</b>	3	3	2	3	-	-	-	-	-	-	-	3	2	3
<b>Average</b>	2.8	2.8	2.2	2.8	-	-	-	-	-	-	-	2.8	2	2.8

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year-II Sem</b>			
Course Code: <b>L323E</b>	<b>REFRIGERATION AND AIR CONDITIONING</b> (Professional Elective – II)	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics, Thermodynamics.

#### Module 1:

**Unit-1:** Introduction to Refrigeration: Necessity and applications – unit of refrigeration and C.O.P. – Mechanical Refrigeration – Types of Ideal cycles of refrigeration.

**Unit-2:** Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems – Actual air refrigeration system problems – Refrigeration needs of Aircrafts.

#### Module 2:

**Unit-1:** Vapour Compression Refrigeration: Working principle and essential components of the plant–simple Vapour Compression Refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis– Actual cycle Influence of various parameters on system performance – Use of p-h charts – Numerical Problems.

**Unit-2:** Refrigerants: Desirable properties – classification – refrigerants used – Nomenclature – Ozone Depletion – Global Warming.

#### Module 3:

**Unit-1:** System Components: Compressors – General classification – comparison – Advantages and Disadvantages. Condensers – classification. Principles of Evaporators: Classification – Working Principles – Expansion devices, Types, Working Principles

**Unit-2:** Vapour Absorption System: Calculation of maximum COP – description and working of NH<sub>3</sub>-water system and Li-Br – water (Two shell & Four shell) System, Principle of operation, Three Fluid absorption system, salient features.

#### Module 4:

**Unit-1:** Introduction to Air Conditioning: Psychometric Properties & Processes – Characterization of Sensible and latent heat loads – Need for Ventilation – Consideration of Infiltration – Load concepts of RSHF, GSHF – Problems – Concept of ESHF and ADP. Requirements of human comfort and concept of effective temperature: Comfort chart –Comfort Air conditioning, Air conditioning Load Calculations.

**Unit-2:** Air Conditioning systems: Classification of equipment – cooling, heating, humidification and dehumidification – filters – grills and registers – fans and blowers.

#### Module 5:

**Unit-1:** Cryogenics: Application of cryogenics, Gas liquefaction systems – Linde Hampson, Linde dual pressure, Claude cycle – merits of one system over other system.

**Unit-2:** Production of liquid air Production of liquid nitrogen and production of liquid oxygen.

#### Text Books

1. C.P. Arora, "Refrigeration and Air Conditioning", Tata McGraw Hill, 3rd Edition, 2009.

2. S.C. Arora, Domkundwar, "A Course in Refrigeration and Air conditioning", Dhanpatrai Publishers, 8th Edition, 2012.

### Reference Books

1. C. Thomas Olivo, R. Warren Marsh, "Principles of Refrigeration", Delmar Publishers, 3rd Edition.
2. P.L. Bellaney, "Refrigeration and Air Conditioning", Khanna Publishers, 7th Edition, 1985.
3. P N Ananthanarayanan, "Basic Refrigeration and Air-Conditioning", Tata McGraw Hill, 3rd Edtn.

### E-Resources

1. <https://shorturl.at/qFORS>
2. <https://nptel.ac.in/courses/112/107/112107208/>
3. <http://ecoursesonline.iasri.res.in/course/view.php?id=84>

### Course Outcomes

On completion of the course, the students will be able to:

- CO1:** Understand the principles and applications of refrigeration systems
- CO2:** Understand vapour compression refrigeration system and identify methods for performance improvement
- CO3:** Explain the working principles of steam jet, Vapour absorption, thermoelectric and vortex tube systems
- CO4:** Analyze air conditioning processes using principle of psychrometry and evaluate cooling and heating load in an air conditioning system
- CO5:** Understand the applications of cryogenics and gas liquefaction system.

### CO-PO/PSO Mapping

Course Outcomes (COs)	Program Outcomes (POs)/ Program Specific Outcomes (PSO)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
<b>CO1</b>	3	3	3	2	3	-	-	-	-	-	-	3	3	3
<b>CO2</b>	3	3	3	2	3	-	-	-	-	-	-	3	3	3
<b>CO3</b>	3	3	3	2	3	-	-	-	-	-	-	3	3	3
<b>CO4</b>	3	3	3	2	3	-	-	-	-	-	-	3	3	3
<b>CO5</b>	2	2	3	2	2	-	-	-	-	-	-	3	3	3
<b>Average</b>	2.8	2.8	3	2	2.8	-	-	-	-	-	-	3	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year - II Sem</b>			
Course Code: <b>L323F</b>	<b>AUTOMOBILE ENGINEERING</b> (Professional Elective – II)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics, Thermodynamics, Thermal Engineering – I

### Module 1:

**Unit 1: Introduction:** Components of four-wheeler automobile – chassis and body – Introduction to design and analysis of Chassis. Power unit – power transmission – rear wheel drive, front wheel drive, 4-wheel drive. Engine construction, Engine service – re-boring, decarburization, nitriding of crankshaft.

**Unit 2: Emission from Automobiles and control:** Pollution standards, National and International – Pollution Control Techniques, Energy alternatives – Solar, Photo-voltaic, Biomass, alcohols, LPG, CNG, liquid Fuels and gaseous fuels, Hydrogen as a fuel for IC Engines – their merits and demerits. Noise Pollution & control. Hybrid vehicles.

### Module 2:

**Unit 1: S.I. Engine Fuel System:** Fuel supply systems, Mechanical and electrical fuel pumps – Simple Carburettor, defects of Carburettor, Electronic injection system, Petrol injection, Multipoint fuel injection for SI Engines, air filters.

**Unit 2: C.I. Engines Fuel System:** Requirements of diesel injection systems – types of injection systems, Common rail diesel injection – fuel pump – nozzle. Alternative fuels for Automobile injection, Classification. Injection timing – testing of fuel pumps.

### Module 3:

**Unit 1: Cooling System:** Cooling Requirements – Air Cooling, Liquid Cooling and Forced Circulation System – Radiators – Types – Cooling Fan – water pump – thermostat – evaporating cooling – pressure sealed cooling – anti freeze solutions.

**Unit 2: Ignition System:** Function of an ignition system – battery ignition system, Lead-Acid and Lithium-Ion batteries, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system – electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

### Module 4:

**Unit 1: Electrical System:** Charging circuit – generator – current-voltage regulator – starting system – Bendix drive mechanism – solenoid switch – lighting systems – Horn – wiper – fuel gauge – oil pressure gauge – engine temperature indicator etc.

**Unit 2: Transmission System:** Clutches – principle – types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches. Gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes. Automatic Transmission System: Fluid fly wheel. Torque converter. Epicyclic gear box, over drive. Propeller shaft – Hoatch-Kiss drive, Torque tube drive. Universal joint – differential – rear axles, types – wheels and tyres.

### Module 5:

**Unit 1: Steering System:** Steering geometry – camber, castor, king pin rake, combined angle – toe in – center point steering. Types of steering mechanism, Ackerman steering mechanism,

Davis steering mechanism – steering gears, types – steering linkages

**Unit 2: Suspension System and Braking System:** Objects of suspension systems – rigid axle suspension system – torsion bar – shock absorber – Independent suspension system. Mechanical brake system, Hydraulic brake system – Master cylinder, Wheel cylinder, Tandem master cylinder – Requirement of brake fluid. Disc Brake, Anti-lock Braking System (ABS), Pneumatic and Vacuum brakes.

### Text Books

1. Kripal Singh, "Automobile Engineering", Standard Publishers Distributors, Vol.1, Vol 2.
2. K.M Gupta, "Automobile Engineering", Umesh publication, Vol. 1 & Vol. 2, 2012
3. K.K. Ramalingam, "Automobile Engineering", SciTech Publications Pvt Ltd, 2015.

### Reference Books

1. Jack Erjavec, "A System approach to Automotive Technology", YesDee Publishers.
2. William Crouse, "Automobile Engineering", Tata McGraw Hill Publishers, 10th Edition,
3. Joseph Heitner, "Automotive Mechanics", CBS Publishers, 2nd Edition, 2004.

### E-Resources

1. <https://shorturl.at/zFQW3>
2. <https://nptel.ac.in/courses/107/106/107106088/>
3. <https://shorturl.at/OR59>
4. <https://shorturl.at/iEKR5>

### Course Outcomes

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

- CO1:** Identify the basic automobile components, gain adequate knowledge of the Engine lubrication system, Crank case ventilation and Emission controls for Automobiles
- CO2:** Analyze the requirements and functioning of the Fuel Injection Systems and carry out testing of fuel pumps
- CO3:** Show reasonable prowess in gaining the knowledge on Cooling Systems and Ignition Systems of automobiles
- CO4:** Explain the working of various components of the automobile Electrical System and Transmission System
- CO5:** Analyze the working of Steering System, Suspension System and Braking system.

### 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	3	-	-	-	-	-	-	3	3	3
<b>CO2</b>	3	-	3	3	3	-	-	-	-	-	-	2	3	3
<b>CO3</b>	3	-	3	3	3	-	-	-	-	-	-	2	3	3
<b>CO4</b>	3	-	3	3	3	-	-	-	-	-	-	2	3	3
<b>CO5</b>	3	-	3	3	3	-	-	-	-	-	-	2	3	3
<b>Average</b>	3	-	3	3	3	-	-	-	-	-	-	2.2	3	3

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



<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year-II Sem</b>			
Course Code: <b>L323G</b>	<b>POWER PLANT ENGINEERING</b> (Professional Elective –II)	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Thermodynamics, Fluid Mechanics and Hydraulic Machines, Thermal Engineering.

### Module 1: Introduction

**Unit-1: Steam Power Plant:** Introduction to the Sources of Energy – Resources and Development of Power in India. Plant Layout – Working of different Circuits – Fuel and handling equipment's – types of coals – coal handling – choice of handling equipment coal storage and ash handling systems.

**Unit –2: Combustion Process:** Properties of coal – overfeed and under feed fuel beds traveling grate stokers, spreader stokers, retort stokers – pulverized fuel burning system and its components – combustion needs and draught system – cyclone furnace design and construction – Dust collectors – cooling towers and heat rejection. Corrosion and feed water treatment.

### Module 2: Internal Combustion Engine Plant & Gas Turbine Plant

**Unit-I: Internal Combustion Engine Plant:** Diesel power plant: Introduction – IC Engines, types, construction – Plant layout with auxiliaries – fuel supply system – air intake system – lubrication and cooling system – super charging.

**Unit-II: Gas Turbine Plant:** Introduction – Classification – construction – Layout with auxiliaries –Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison Direct Energy Conversion: Solar energy – Fuel cells – Thermo electric and Thermo Ionic – MHD generation

### Module 3: Hydro-Electric Power Plant

**Unit-I: Hydro Electric Power Plant:** Hydro Electric Power Plant: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways.

**Unit-II: Hydro Projects and Plant:** Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

### Module 4: Nuclear Power Station

**Unit-I: Nuclear Power Station:** Nuclear fuel –breeding and fertile materials – Nuclear reactor –reactor operation.

**Unit-II: Types of Reactors:** Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor. Radiation hazards and shielding – radioactive waste disposal.

### Module 5: Power Plant Economics and Environmental Considerations

**Unit-I: Power Plant Economics:** Capital cost – Investment of fixed charges – operating costs. General arrangement of power distribution – Load curves and load duration curve.

**Unit-II: Power Plant Environmental Consideration:** Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and their control.

### Text Books

1. P. C. Sharma, "Power Plant Engineering" S.K. Kataria Publishers.
2. Arora and S. Domkundwar, "A Course in Power Plant Engineering".

### Reference Books

1. Rajput, "A Text Book of Power Plant Engineerin", Laxmi Publications
2. P. K. Nag, "Power Plant Engineering", Tata McGraw Hill, 2nd Edition.
3. G.D. Rai, "An Introduction to Power Plant Technology".

### E-Resources

1. <https://www.goodreads.com/book/show/25723036-power-plant-engineering>.
2. <https://www.sciencedirect.com/topics/engineering/power-plant-technology>
3. <http://nptel.ac.in/courses/112106133/1>
4. <http://nptel.ac.in/courses/112106133/2>

### Course Outcomes

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

- CO1.** Select the suitability of site for a power plant and combustion processes.
- CO2.** Propose suitable power plant as per the requirement of industry.
- CO3.** Explain working of hydro-electric power plant and power generation from non-conventional sources.
- CO4.** Explain working principle of different types of nuclear power plant and radioactive waste disposable methods.
- CO5.** Identify the cost of power plant by calculating load factor, capacity factor, average load and peak load, etc on a power plant and Indicate safety aspects of power plants.

### 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	2	-	-	-	-	-	-	3	3	3
<b>CO2</b>	3	3	3	3	3	-	-	-	-	-	-	3	3	3
<b>CO3</b>	3	3	3	3	2	-	-	-	-	-	-	3	3	3
<b>CO4</b>	3	3	3	3	3	-	-	-	-	-	-	3	3	3
<b>CO5</b>	3	-	3	1	-	-	-	-	-	-	-	3	3	3
<b>Average</b>	3	2.8	3	2.4	2.3	-	-	-	-	-	-	3	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year-II Sem</b>			
Course Code: <b>L323H</b>	<b>FINITE ELEMENT METHODS</b> (Professional Elective – III)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Mathematics, Engineering Mechanics, Mechanics of Solids, Machine Design, Engineering materials.

### Module 1:

**Unit 1: Fundamental Concepts:** Introduction to Finite Element Methods for solving field problems, Methods of Engineering Analysis, Functional Approximation Methods: Rayleigh- Ritz Method, Weighted Residual Methods, Applications of FEM, Advantages and Disadvantages of FEM, Stress and Equilibrium, Strain–Displacement relations, Stress – strain relations. Basic Steps of FEM, Characteristics of Finite Element, Convergence Requirements.

**Unit 2: One Dimensional problem:** Formulation of Stiffness Matrix for a Bar Element using virtual work and potential energy approaches, Properties of Stiffness Matrix, Characteristics of Shape Functions, Quadratic shape functions. Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions. Problems on uniform and stepped bars for different loading conditions

### Module 2:

**Unit1: Analysis of Trusses:** Derivation of Stiffness Matrix for Trusses, Stress and strain Calculations, Calculation of reaction forces and displacements.

**Unit 2: Analysis of Beams:** Derivation of Stiffness matrix for two noded, two degrees of freedom per node beam element, Load Vector, Deflection, Stresses, Shear force and Bending moment, Problems on uniform and stepped beams for different types of loads applied on beams.

### Module 3:

**Unit 1: Finite element – formulation of 2D Problems:** Plane stress, plane strain and axis symmetry, Derivation of shape functions and Element stiffness matrix for two dimensional CST Element, Finite element modeling of axis symmetric solid subjected to axis symmetric loading with triangular elements.

**Unit 2: Isoperimetric Formulations & Numerical Integration:** Two dimensional Triangular and four noded quadrilateral Isoperimetric Elements. Numerical integration and Gauss quadrature.

### Module 4:

**Unit 1: Fluid Flow:** Flow through a porous medium, Flow through pipes of uniform and stepped sections, Flow through hydraulic networks.

**Unit 2: Dynamic Analysis:** Formulation of mass matrices for uniform bar and beam Elements using lumped and consistent mass methods, Evaluation of Eigen values and Eigen vectors for a stepped bar and beam Problems.

### Module 5:

**Unit1: Steady state heat transfer analysis:** One Dimensional Finite Element analysis of fin and composite slabs. 2D steady state heat transfer problems: Derivation of Thermal Stiffness matrix for 2D heat transfer problems-CST, Derivation of thermal force vector for 2D heat transfer problems.

**Unit 2: Introduction to Finite Element Analysis Software:** Mesh generation, techniques such as semi - automatic and fully automatic use of software's such as ANSYS, NISA, NASTRAN

### Text Books

1. S.S.Rao, "The finite element methods in Engineering", Elsevier, 4<sup>th</sup> Edition.
2. Tirupathi K. Chandrupatla and Ashok D. Belagundu, "Introduction to finite elements in engineering".

### Reference Books

1. Alavala, "Finite Element Methods", PHI, 2<sup>nd</sup> Edition, 2010.
2. J.N. Reddy, "An Introduction to Finite Element Methods", Tata McGraw Hill.
3. O.C. Zienkowitz, "The Finite Element Method in Engineering Science", Tata McGraw Hill.

### E-Resources

1. <https://nptel.ac.in/courses/112/104/112104116/>
2. <https://nptel.ac.in/courses/112/104/112104193/>

### Course Outcomes

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

**CO1:** FE method for solving field problems using Virtual work and Potential energy formulations.

**CO2:** Axial bar, truss and beam problems using FEM.

**CO3:** 2D structural problems using CST element and analyze plane stress, plane strain and axis symmetric problems and Apply the concepts of numerical integration in FE modelling.

**CO4:** Apply finite element method to estimate fluid flow and dynamic analysis for stepped bar and beam.

**CO5:** Linear 1D and 2D heat conduction and convection heat transfer problems, apply finite element analysis software for engineering solutions.

### CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
<b>CO1</b>	3	3	2	2	-	-	-	-	-	-	-	2	3	3
<b>CO2</b>	3	2	2	2	-	-	-	-	-	-	-	2	3	3
<b>CO3</b>	3	2	2	2	-	-	-	-	-	-	-	2	3	3
<b>CO4</b>	3	3	3	2	-	-	-	-	-	-	-	2	3	3
<b>CO5</b>	3	3	3	2	-	-	-	-	-	-	-	2	3	3
<b>Average</b>	3	2.6	2.4	2	-	-	-	-	-	-	-	2	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B.Tech: ME</b> <b>III Year - II Sem</b>			
Course Code: <b>L323I</b>	<b>ROBOTICS</b> (Professional Elective -III)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Mathematics, Instrumentation, CAD/CAM.

### Module 1:

**Unit 1: Introduction:** Automation and Robotics – An over view of Robotics classification by coordinate system and control systems

**Unit 2: Components of the Industrial Robotics:** Degrees of freedom – End effectors: Mechanical gripper – Magnetic – Vacuum cup and other types of grippers – General Consideration on gripper selection and design. Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators.

### Module 2:

**Unit 1 Motion Analysis:** Basic rotation matrices – Composite rotation matrices – Euler Angles –Equivalent Angle and Axis – Homogeneous transformation – Problems

**Unit 2: Manipulator Kinematics:** D-H notations – Joint coordinates and world coordinates – Forward and inverse kinematics – problems.

### Module 3:

**Unit 1: Differential Kinematics:** Differential Kinematics of planar and spherical manipulators – Jacobian – problems.

**Unit 2: Robot Dynamics:** Lagrange – Euler formulations – Newton-Euler formulations – Problems on planar two link manipulators.

### Module 4:

**Unit 1: Trajectory planning:** Joint space scheme – cubic polynomial fit – Avoidance of obstacles

**Unit 2: Types of motion:** Slew motion – joint interpolated motion – straight line motion – problems

### Module 5:

**Unit 1: Feedback components:** position sensors, resolvers and encoders – Velocity sensors – Tactile sensors.

**Unit 2 Robot Application in Manufacturing & Robotic Programming Methods:** Material handling – Assembly and inspection – Languages: Lead Through Programming, Textual Robotic Languages.

### Text Books

1. Groover M P, "Industrial Robotics", MCH Publishers, 2010.
2. JJ Craig, "Introduction to Robotic Mechanics and Control", Pearson, 3<sup>rd</sup> Edition, 2001.

## Reference Books

1. Fu K B, "Robotics", Tata McGraw Hill, 1987.
2. Asada and Slotine, "Robot Analysis and Intelligence", Wiley Inter-Science.
3. Mark W. Spong and M. Vidyasagar, "Robot Dynamics & Control", John Wiley & Sons (ASIA) Pvt.

## E-Resources

1. <https://rb.gy/dw0rkv>
2. <https://rb.gy/iayh9d>
3. <https://nptel.ac.in/courses/112/105/112105249/>
4. <https://nptel.ac.in/courses/112/101/112101098/>

## Course Outcomes

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

- CO1:** Understand the design and working of the various components of Robot such as End effectors, grippers, control systems etc.
- CO2:** Perform calculations of Robot motion involving forward kinematics, inverse kinematics, Homogeneous transformations etc.
- CO3:** Apply Differential Kinematics, Jacobian, Lagrange-Euler formulations, etc., to solve problems of planar and spherical manipulators.
- CO4:** Analyze the various types of motion (slew motion, straight line motion, etc.,) for solving problems in Trajectory planning.
- CO5:** Apply the knowledge of various types of Robot languages and Feedback components, and applications of industrial robots in the activities of manufacturing.

## 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	1	2	2	2	-	-	-	-	-	-	2	-	-
<b>CO2</b>	3	3	2	2	2	-	-	-	-	-	-	1	2	-
<b>CO3</b>	3	2	2	2	2	-	-	-	-	-	-	1	2	-
<b>CO4</b>	3	2	2	1	1	-	-	-	-	-	-	2	3	2
<b>CO5</b>	1	2	1	2	2	-	-	-	-	-	-	2	3	2
<b>Average</b>	2.6	2	1.8	1.8	1.8	-	-	-	-	-	-	1.6	2.5	2

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year - II Sem</b>			
Course Code: <b>L323J</b>	<b>PRODUCT DEVELOPMENT</b> (Professional Elective – III)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Manufacturing Technology.

#### Module 1:

**Unit 1: History of Product Development:** Major Products and systems. The Turning Points: Ford Assembly Lines, Japanese and American philosophies in product development. 21st Century product development paradigms.

**Unit 2: Basic Product Development Philosophies and Concept of Design Science:** Aristotle's poesies, Buckminster Fuller's concepts - doing more and more from less and less, Taguchi's concept.

#### Module 2:

**Unit 1: Underlying Pattern in Product Design and Development:** TRIZ, Axiomatic Design, Morphological Charts, Autogenic Design Theory.

**Unit 2: Special Design and Analysis Techniques:** Fault Tree Analysis (FTA), Failure Mode Effect and Criticality Analysis, Quality Analysis principles and methods, Design of Experiments, ANOVA Analysis, Introduction to lean and six –sigma.

#### Module 3:

**Unit 1: Decision Making:** Resolving Conflicts and Overcoming Constraints, Logical approach in achieving the customers requirement, Multi Actor Multi Criteria Analysis (MAMCA).

**Unit 2: Basic Design Principles and Methods:** Hevner's 3- Cycle presentation of design process and scenario, Solution Space, System Context, Design Drivers, Empirical Design, Heuristic Design, Design applying engineering principles and mathematical formulae, Margin of Safety, Modelling and Simulations.

#### Module 4:

**Unit1: Uncertainty and Risk Management:** Understanding Uncertainty, Uncertainty Cone, Uncertainty Estimation, VUCA Analysis, Risk identification, Assessment and management.

**Unit 2: DCCD – A Step by Step Design Process (Define-Configure-Connect):** Define Design Assignment Definition, Product Requirements, Design Assignment Analysis, Technology Intelligence, Product Profile, Design Strategy Planning, Documentation, review and appraisal.

#### Module 5:

**Unit 1: Configure: Configuration Design:** Configuration Design Prerequisites, Configuration Visualisation, Configuration Shaping, Configuration Design and Analysis. Connect: Establishing Interconnectivity. Product Function Network: Bird's Nest Diagram.

**Unit 2: Design and Analysis:** Design Planning, Design Inputs, Design Drivers, Design Options, Design Analysis, design Approach, Design validation and certification, DCCD documentation, Design Revies, Design Realisation.

### Text Books

1. Karl T. Ulrich, "Product Design and Development", Mc Graw Hill Education, 6<sup>th</sup> Edition.

### Reference Books

1. Karl T. Ulrich, "Product Design and Development", Mc Graw Hill Education, 6<sup>th</sup> Edition.

### E-Resources

1. <https://shorturl.at/qvJU3>
2. <https://shorturl.at/sCJX0>

### Course Outcomes

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

- CO 1:** The history of product development and emergence of various new philosophy, concepts and techniques that impacted greatly the development of modern products
- CO 2:** Analysis of the customer requirements critically to plan the strategy for design and development of new products
- CO 3:** Techniques to identify the design drivers and frame the design approach to solve critical issues innovatively
- CO4:** Configuration options and selection of the most suitable one. Technique to interconnect the modules within the system to identify various criticalities to be addressed.
- CO 5:** New techniques in design, simulation, optimisation.

### 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	3	-	-	-	-	-	-	3	3	3
<b>CO2</b>	3	-	2	3	3	-	-	-	-	-	-	2	3	3
<b>CO3</b>	3	-	2	3	3	-	-	-	-	-	-	2	3	3
<b>CO4</b>	3	-	2	3	3	-	-	-	-	-	-	2	3	3
<b>CO5</b>	3	-	2	3	3	-	-	-	-	-	-	2	3	3
<b>Average</b>	3	-	2	3	3	-	-	-	-	-	-	2.2	3	3

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



<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year-II Sem</b>			
Course Code: <b>L3231</b>	<b>HEAT TRANSFER LAB</b>	L	T	P	D
Credits: 1		<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**Pre-Requisites:** Thermodynamics, Heat Transfer

### List of Experiments

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin Apparatus
6. Experiment on Transient Heat Conduction.
7. Heat transfer in forced convection apparatus.
8. Heat transfer in natural convection
9. Determine LMTD, effectiveness and overall heat transfer coefficient for parallel flow and counter flow heat ex-changer.
10. Determine the emissivity of Gray surface.
11. Determine the value of Stefan Boltzman constant for radiation heat transfer.
12. Determine Critical Heat flux for test wire surrounded by water of constant temperature.
13. Study of heat pipe and its demonstration 6608

### Text Books

1. <https://shorturl.at/fhmrE>

### Course Outcomes

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

**CO1:** Apply the knowledge of heat transfer to perform experiments on conduction heat transfer

**CO2:** Evaluate heat transfer coefficient in free and forced convection heat transfer situation

**CO3:** Determine fin efficiency and emissivity in respective experiments.

**CO4:** Observe the phenomena of drop and film wise condensation

**CO5:** Evaluate the performance of heat exchangers in parallel & counter flow types

### 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	-	2	3	3	3
<b>CO3</b>	-	-	-	-	-	-	-	-	3	-	2	3	3	3
<b>CO4</b>	-	-	-	-	-	-	-	-	3	-	2	3	3	3
<b>CO5</b>	-	-	-	-	-	-	-	-	1	-	2	3	3	3
<b>Average</b>	-	-	-	-	-	-	-	-	2.6	-	2	3	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year-II Sem</b>			
Course Code: <b>L3232</b>	<b>LIFE SKILLS AND PROFESSIONAL SKILLS LAB</b> COMMON TO: ALL	L	T	P	D
Credits: 2		<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

### Pre-Requisites:

#### Module 1: COMMUNICATION SKILLS [8L]

Introduction- Channel of communication, Process of communication, Language as a tool of communication, levels of communication, the flow of communication, communication networks, Barriers to Communication; Body language – Eye contact, facial expressions, gestures, posture, and body movements.

#### Module 2: PRESENTATION SKILLS [8L]

Nature and Importance of Oral Presentation; Planning the Presentation-Define the Purpose, Analyze the Audience, Analyze the Occasion and Choose a suitable title; Preparing the Presentation-Develop the Central Idea, Develop the Main Ideas, Gather Supporting Material and Plan Visual Aids; Organizing the Presentation-Introduction, Body, Conclusion; Rehearsing the Presentation; Improving Delivery and Choosing Delivery Methods; Handling the Stage Fright.

#### Module 3: GROUP DISCUSSIONS [8L]

Nature of GD- What is a GD? GD and Debate, Importance of GD skills; Characteristics of successful GDs- Subject knowledge, Oral Communication skills, Leadership skills, Team Management; GD Strategies- Getting the GD Started, Contributing Systematically, Creating a Friendly Cooperative Atmosphere, Moving the Discussion along, Promoting Optimal Participation, Handling Conflict and Effecting Closure; Techniques for Individual Contribution- Topic Analysis, Discussing Problems, Discussing Case Studies; Group Interaction Strategies-Exchanging Opinions, Exchanging Suggestions and Proposals.

#### Module 4: INTERVIEW SKILLS [8L]

The Interview process; Characteristics of the Interview- Planning, Purpose, Conversation, Two-way Interaction and Informality; Pre-interview Preparation Techniques-Self-analysis, Research the Organization, Job Analysis, Revise your Subject Knowledge, Develop the Interview File; Interview Questions- Types of Interview Questions, Answering Strategies; FAQs and Practice; Projecting a positive image; Alternative Interview formats.

#### Module 5: PROFESSIONAL WRITING SKILLS [8L]

Resumes -Resume Design, Parts of Resume, Resume style; Job Applications-opening, body, and closing; E-mail writing-Format, Standard E-mail practices and E-mail writing strategies; Report writing-nature and significance, types of reports, formats of reports; Proposals- types of Proposals, structure of Formal Proposals, parts of a formal Proposals; Technical Articles-types of Technical Articles, Journal articles and Research papers-Review and Research Articles, Elements of Technical Articles and Writing Strategies.

#### Reference Books

1. Ashraf Rizvi. M. *Effective Technical Communication*. McGraw-Hill: New Delhi: 2010
2. K. R. Lakshminarayanan, *Speak in English*, Scitech Publications, Chennai, 2009. Print.

3. Dr. Alex. K. Soft Skills: *Know yourself and Know the World*. S. Chand & Company Pvt. Ltd: New Delhi: 2014. Print.
4. Raman Meenakshi and Sangeeta Sharma. *Technical Communication: Principles and Practice*. Oxford University Press: New Delhi: 2007. Print.

### E-Resources

1. <https://www.skillsyouneed.com/ips/communication-skills.html>
2. <https://www.skillsyouneed.com/presentation-skills.html>
3. <https://www.coursera.org/articles/presentation-skills>
4. <https://www.javatpoint.com/group-discussion>
5. <https://hbr.org/1964/01/strategies-of-effective-interviewing>
6. [https://en.wikipedia.org/wiki/Professional\\_writing](https://en.wikipedia.org/wiki/Professional_writing)

### Course Outcomes

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

- CO1.** Learn the importance of communication skills.
- CO2.** Understand how to give the presentation.
- CO3.** Participate in GDs by applying appropriate speaking techniques.
- CO4.** Know the required skills to face interviews.
- CO5.** Write letters and resumes effectively by applying appropriate writing techniques.

### 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>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 2020-21 onwards</b>	<b>J. B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)</b>	<b>B.Tech: ME III Year – IISem</b>			
<b>Course Code: L32M2</b>	<b>CYBER SECURITY (Common to all UG Courses)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>
<b>Credits: 0</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites : Nil**

**Course objectives:**

1. To familiarize various types of cyber-attacks and cyber-crimes
2. To give an overview of the cyberlaws
3. To study the defensive techniques against these attacks

**UNIT - I**

**Introduction to Cyber Security:** Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance—Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

**UNIT - II**

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.

Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

**UNIT - III**

**Cybercrime: Mobile and Wireless Devices:** Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile

Computing Era,Laptops.

#### UNIT- IV

**Cyber Security: Organizational Implications:** Introduction, cost of cybercrimes and IPR issues, web threatsfororganizations,securityandprivacyimplications,socialmediamarketing:securityrisksand perilsfororganizations,socialcomputingandtheassociatedchallengesfororganizations.

**CybercrimeandCyberterrorism:**Introduction,intellectualpropertyinthecyberspace,theethical dimensionofcybercrimesthepsychology,mindsetandskillsofhackersandothercybercriminals.

#### UNIT - V

PrivacyIssues:BasicDataPrivacyConcepts:FundamentalConcepts, DataPrivacyAttacks,Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial,etc.

#### Cybercrime: Examples and Mini-Cases

Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

**Mini-Cases:** The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

#### TEXT BOOKS:

1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm,Applications,andPerspectives,CRCPress,ISBN9780815371335,2018

#### REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

#### Web Resources:

- 1.

#### Course Outcomes:

The students will be able to understand cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year- Sem</b>			
Course Code: L32T2	<b>FOUNDATIONS OF ENTREPRENEURSHIP</b>	L	T	P	D
Credits: <b>0</b>		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:**

**MODULE:**

**UNIT - 1:**

**Understanding Entrepreneurial Mindset-** The revolution impact of entrepreneurship- The evolution of entrepreneurship - Functions of Entrepreneurs – types of entrepreneurs –

**UNIT - 2:**

Approaches to entrepreneurship- Process approach- Role of entrepreneurship in economic development- Twenty first century trends in entrepreneurship.

**MODULE:II**

**UNIT:1**

**The Individual Entrepreneurial Mind-Set and Personality-** The entrepreneurial journey-Stress and the entrepreneur - the entrepreneurial ego - Entrepreneurial motivations-

**UNIT:2**

Motivational cycle – Entrepreneurial motivational behavior – Entrepreneurial competencies.

Corporate Entrepreneurial Mindset, the nature of corporate entrepreneur- conceptualization of corporate entrepreneurship Strategy-sustaining corporate entrepreneurship.

**MODULE: III**

**UNIT - 1:**

**Launching Entrepreneurial Ventures** - opportunities identification- Finding gaps in the market place – techniques for generating ideas- entrepreneurial Imagination and Creativity- the nature of the creativity process - Innovation and entrepreneurship.

**UNIT -2:**

Methods to initiate Ventures- Creating new ventures-Acquiring an Established entrepreneurial venture- Franchising- advantage and disadvantages of Franchising.

**MODUL IV:**

**UNIT - 1:**

**Legal Challenges of Entrepreneurship** - Intellectual property protection - Patents, Copyrights - Trademarks and Trade secrets - Avoiding trademark pitfalls Feasibility Analysis - Industry and competitor analysis - Formulation of the entrepreneurial Plan-

**UNIT - 2:**

The challenges of new venture start-ups, developing an effective business model – Sources of finance - Critical factors for new venture development - The Evaluation process.

## **MODULE:V**

### **UNIT - 1:**

**Strategic Perspectives in Entrepreneurship** - Strategic planning - Strategic actions-strategic positioning- Business stabilization - Building the adaptive firms .

### **UNIT - 2:**

Understanding the growth stage – Internal growth strategies and external growth strategies, Unique managerial concern of growing ventures. Initiatives by the Government of India to promote entrepreneurship, Social and women entrepreneurship -T-hub, J-hub.

#### **Text Books**

1. S. S.Khanka, Entrepreneurship Development, S. Chand Publications, 2015. Stuart Read, Effectual Entrepreneurship, Routledge, 2013.
2. Rajeev Roy, Entrepreneurship, 2e, Oxford publications, 2012

#### **Reference Books**

- D F Kuratko and T V Rao, Entrepreneurship- A South-Asian Perspective, Cengage Learning, 2012.
- Bruce R. Barringer/ R. Duane Ireland, Entrepreneurship Successfully launching new ventures, 4e, Pearson, 2015
- Nandan .H, Fundamentals of Entrepreneurship, PHI, 2013
- Madhurima Lal Shikha Sahai – Entrepreneurship, Excel Books.

#### **E-Resources**

1. XXXXX
2. XXXXXX
3. XXXXXX
4. XXXXXX

#### **Course Outcomes**

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

**CO1.** XXXXX

**CO2.** XXXXX

**CO3.** XXXXX

**CO4.** XXXXX

**CO5.** XXXXX

**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>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO2</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO3</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO4</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO5</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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



<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year-I Sem</b>			
Course Code: <b>L413A</b>	<b>NON-DESTRUCTIVE TESTING METHODS</b>	L	T	P	D
Credits: <b>4</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics

#### Module 1:

**Unit 1: Overview of NDT:** NDT Versus Mechanical testing, Overview of the Non-Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations.

**Unit 2:** Various physical characteristics of materials and their applications in NDT. Visual inspection – Unaided and aided.

#### Module 2:

**Unit 1: Surface NDT Methods:** Liquid Penetrant Testing – Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results.

**Unit 2: Magnetic Particle Testing-** Theory of magnetism, inspection materials, magnetization methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

#### Module 3:

**Unit 1: Thermograph:** Thermograph- Principles, Contact and non -contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation – infrared radiation and infrared detectors, Instrumentations and methods, applications.

**Unit 2: Eddy Current Testing-**Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

#### Module 4:

**Unit 1: Ultrasonic Testing (UT) :** Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction.

**Unit 2: Acoustic Emission (AE):** Acoustic Emission Technique –Principle, AE parameters, Applications.

#### Module 5:

**Unit 1: Radiography (RT):** Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films – graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence.

**Unit 2: Fluoroscopy-** Xero-Radiography, Computed Radiography, Computed Tomography.

## Text Books

1. Practical Non-Destructive Testing Baldev Raj, T.Jayakumar, M.Thavasimuthu Narosa Publishing House 2009
2. Non-Destructive Testing Techniques Ravi Prakash New Age International Publishers 1st revised edition 2010

## Reference Books

1. ASM Metals Hand book, "Non Destructive Evaluation and Quality Control", Volume-17 American Society of Metals, Metals Park, Ohio, USA, 2000
2. Introduction to Non-destructive testing: a training guide Paul E Mix, Wiley 2nd Edition New Jersey,
3. Handbook of Non-destructive evaluation Charles, J. Hellier McGraw Hill, New York 2001

## Course Outcomes

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

**CO1:** Classify various non-destructive testing methods.

**CO2:** Check different metals and alloys by visual inspection method.

**CO3:** Explain and perform non-destructive tests like: Liquid penetrant test, Magnetic particle test, Ultrasonic test, X- ray and Gamma ray radiography, Leak Test, Eddy current test.

**CO4:** Identify defects using relevant NDT methods.

**CO5:** Differentiate various defect types and select the appropriate NDT methods for better evaluation and Document the testing and evaluation of the results.

## CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
<b>CO1</b>	2	3	2	3	-	-	-	-	-	-	-	-	3	2
<b>CO2</b>	2	3	2	3	-	-	-	-	-	-	-	-	3	2
<b>CO3</b>	2	3	2	3	-	-	-	-	-	-	-	1	3	2
<b>CO4</b>	2	3	2	3	-	-	-	-	-	-	-	1	3	2
<b>CO5</b>	2	3	2	3	-	-	-	-	-	-	-	1	3	2
<b>Average</b>	2	3	2	3	-	-	-	-	-	-	-	1	3	2

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year-I Sem</b>			
Course Code: <b>L413B</b>	<b>INSTRUMENTATION AND CONTROL SYSTEMS</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Mathematics-I, Thermodynamics, Basic of Electrical and Electronics Engineering, Engineering Physics, Materials Science.

#### Module 1:

**Unit 1: Definition:** Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics – sources of error, Classification and elimination of error.

**Unit 2: Measurement of Displacement:** Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

#### Module 2:

**Unit 1: Measurement of Temperature:** Classification – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers – Temperature Indicators.

**Unit 2: Measurement of Pressure:** Classification – different principles used. Manometers, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge.

#### Module 3:

**Unit 1: Measurement of Level:** Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Magnetic, Cryogenic Fuel level indicators –Bubbler level indicators

**Unit 2: Flow measurement:** Rotameter, magnetic, Ultrasonic, Turbine flowmeter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).

#### Module 4:

**Unit 1: Measurement of Speed:** Mechanical Tachometers – Electrical tachometers – Stroboscope, Non- contact type of tachometer.

**Unit 2: Measurement of Acceleration and Vibration:** Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle- Piezo electric accelerometer.

#### Module 5:

**Unit 1: Elements of Control Systems:** Introduction, Importance – Classification – Open and closed systems Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems- Transfer functions- First and Second order mechanical systems.

**Unit 2: Measurement of Humidity:** Moisture content of gases, Sling Psychrometer, Absorption Psychrometer, Dew point meter. Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

## Text Books

1. Principles of Industrial Instrumentation & Control Systems/Chennakesava R alaavala, - Cengage Learning/1st Edition, 2009.
2. Measurement Systems: Applications and Design: D.S. Kumar, Anuradha Agencies.
3. Instrumentation, Measurement and Analysis: B.C. Nakra & K.K. Choudhary, TMH.

## Reference Books

1. Instrumentation and Control Systems: S. Bhaskar, Newage Publications, 1998.
2. Measurement Systems: Applications & design, E. O. Doebelin, TMH, 6th Edition.
3. Instrumentation, Measurement & Analysis, B.C. Nakra & K.K. Choudhary, TMH, 4th Edition.

## E-Resources

1. <https://nptel.ac.in/courses/108105064>
2. <https://nptel.ac.in/courses/103103037>
3. [https://onlinecourses.nptel.ac.in/noc22\\_de09/preview](https://onlinecourses.nptel.ac.in/noc22_de09/preview)

## Course Outcomes

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

- CO1:** Know the basic knowledge of the functional blocks of measurement systems.
- CO2:** Describe the working of various physical variable Temperature and pressure measuring instruments.
- CO3:** Explain the working of various physical variable Level, flow, Speed and Acceleration measuring instruments.
- CO4:** Understand the working of various physical and Electrical variables Stress, Humidity, Force, Torque and Power measuring instruments.
- CO5:** Understand the concept of control system and calculate transfer functions of mechanical and translational systems with different techniques.

## CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3	3	2	2	-	-	-	-	-	-	-	2	1	-
<b>CO2</b>	3	2	2	2	-	-	-	-	-	-	-	2	1	-
<b>CO3</b>	3	2	2	2	-	-	-	-	-	-	-	2	2	-
<b>CO4</b>	3	3	3	2	-	-	-	-	-	-	-	2	2	1
<b>CO5</b>	3	3	3	2	-	-	-	-	-	-	-	2	2	1
<b>Average</b>	3	2.6	2.4	2	-	-	-	-	-	-	-	2	1.6	1

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B.Tech: ME</b> <b>IV Year - I Sem</b>			
Course Code: <b>L413C</b>	<b>CAD/CAM</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Drawing, Metal Cutting & Machine Tools.

#### Module 1:

**Unit 1: CAD and Computer Graphics Software:** CAD Fundamentals, Product life cycle in conventional and computer based manufacturing system, Hardware integration and networking. CAD Software: Definitions of system software and application software. Graphic Standards and Exchange Formats.

**Unit 2:** Transformation of geometry, 3D transformations, Numerical problems on transformations, Mathematics of projections, clipping, hidden surface removal.

#### Module 2:

**Unit 1: Geometric Modelling:** Requirements, geometric models, geometric construction models, Curve representation methods.

**Unit 2: Surface Modelling:** Basic surfaces entities, Surface of revolution, blends, intersections, modelling of analytical & sculptured surfaces.

#### Module 3:

**Unit 1: Solid Modelling:** Solid entities, Boolean operations, B-rep of Solid Modelling, CSG approach of solid modelling. Finite element modeling: Introduction, Meshing, Characteristics of different elements, different solvers and post processing.

**Unit 2: Group Technology:** Part family – coding and classification – production flow analysis – advantages and limitations – Computer Aided Processes Planning – Retrieval type and Generative type.

#### Module 4:

**Unit 1: Numerical control:** NC modes, NC elements, NC machine tools – structure of CNC machine tools, features of machining center – turning center.

**Unit 2: CNC Part Programming:** fundamentals - manual part programming methods – Computer Aided Part Programming.

#### Module 5:

**Unit 1: Flexible Manufacturing systems:** Basic concepts of FMS, Experts systems. Automated Material Handling Systems: Material Handling Equipment, Principles of material handling, working of Automated Guided Vehicles, Automated Storage and Retrieval Systems.

**Unit 2: Computer integrated manufacturing:** Integration, CIM implementation, CIMS functions & benefits. Computer aided Quality Control: Terminology in quality control- the computer in QC-contact inspection methods, non-contact inspection methods. Integration of CAQC with CAD/CAM.

#### Text Books

1. A Zimmers & P.Groover, "CAD / CAM", PHI, 1st Edition, 2009.
2. Ibrahim Zeid, "CAD / CAM Theory and Practice", TMH, 3rd Edition, 2001.

## Reference Books

1. P. Groover, "Automation, Production systems & Computer integrated Manufacturing", Pearson Education, 2014.
2. Radhakrishnan and Subramanian, "CAD / CAM / CIM", New Age, 2nd Edition, 2000.

## E-Resources

1. <https://rb.gy/2rnapi>
2. <http://nptel.ac.in/courses/112102101/>
3. <http://nptel.ac.in/courses/112102103>
4. <https://nptel.ac.in/courses/112/102/112102101/>

## Course Outcomes

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

- CO1:** Explain the basic structure and components of computer hardware used in CAD/CAM. Apply computer graphics techniques in modeling.
- CO2:** Know how to use drafting and modeling methods in CAD/CAE fields.
- CO3:** Apply the knowledge of CNC machining and part programming to produce objects of intricate shapes with high level of accuracy
- CO4:** Use the principles /methods of GT, CAPP and Computer Aided Quality Control for product development.
- CO5:** Understand get exposure various elements and their functions in CIM.

## CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
<b>CO1</b>	2	3	2	2	-	2	-	-	-	-	-	2	3	3
<b>CO2</b>	3	3	3	3	-	3	-	-	-	-	-	3	3	3
<b>CO3</b>	2	3	2	2	-	2	-	-	-	-	-	2	3	3
<b>CO4</b>	3	3	2	3	-	3	-	-	-	-	-	3	3	3
<b>CO5</b>	2	3	1	2	-	2	-	-	-	-	-	2	3	3
<b>Average</b>	2.4	3	2	2.4	-	2.4	-	-	-	-	-	2.4	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year - I Sem</b>			
Course Code: <b>L413E</b>	<b>OPERATIONS RESEARCH</b> (Professional Elective-IV)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Mathematics.

#### Module 1:

**Unit 1: Introduction:** Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.

**Unit 2: Allocation:** Linear Programming Problem - Formulation – Graphical solution –Simplex method – Artificial variables techniques: Two–phase method, Big-M method; Duality Principle.

#### Module 2:

**Unit 1: Transportation problem:** Formulation – Optimal solution, unbalanced transportation problem – Degeneracy

**Unit 2: Assignment problem:** Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

#### Module 3:

**Unit 1: Sequencing:** Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through “m” machines

**Unit 2: Replacement:** Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.

#### Module 4:

**Unit 1: Theory of Games:** Introduction – Terminology – Solution of games with saddle points and without saddle points- 2 x 2 games – m x 2 & 2 x n games - graphical method – m x n games - dominance principle.

**Unit 2: Inventory:** Introduction – Single item, Deterministic models – Types – Purchase inventory models with one price break and multiple price breaks – inventory models with and without shortage cost. Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

#### Module 5:

**Unit 1: Waiting lines:** Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.

**Unit 2: Dynamic programming:** Introduction – Terminology- Bellman’s Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

#### Text Books

1. P. Sankara Iyer, “Operations Research”, Mc Graw Hill, 2017.

2. J. K. Sharma, "Operation Research", MacMillan Publishers India Ltd, 4th Edition, 2009.

### Reference Books

1. Maurice Sase`ini, Arthur Yaspanand and Lawrence Friedman, "Operations Research: Methods and Problems", Literary Licensing Publisher, 2013
2. A. M. Natarajan, P. Bala Subramani and A. Tamilarasi "Operations Research" Pearson Education, 4th Edition, 2009.
3. Wagner H`. M, "Principles of Operations Research", PHI Publications, 2nd Edition, 2006.

### E-Resources

1. <https://rb.gy/1ckbxh>
2. <https://nptel.ac.in/courses/112/106/112106134/>
3. <https://nptel.ac.in/courses/111/107/111107128/>
4. <https://rb.gy/gev0g5>

### Course Outcomes

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

- CO1:** Allocate optimally the resources in any industry, to maximize the overall gain and determine the number of each item to be produced / procured, and the optimal product mix, within the framework of constraints in any organization
- CO2:** Find the optimal number of units to be transported such that the total transportation cost will be minimum and Assign the required men / machines to perform the given tasks in an optimal way
- CO3:** Schedule and sequence production runs by proper allocation of machines and men to get maximum gain or profit and Compute the economic order quantity
- CO4:** Decide the optimal inventory to be maintained under different situations involving different types of demand and inventory costs, find how to strike a balance between the waiting time cost and service facility cost for different waiting line models
- CO5:** Find how to strike a balance between the waiting time cost and service facility cost and apply the Dynamic Programming model to practical problems like finding the shortest path for a salesman, optimal solution to a linear programming problem.

### CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
<b>CO1</b>	2	3	2	-	-	2	-	-	-	-	-	2	3	3
<b>CO2</b>	3	3	3	-	-	2	-	-	-	-	-	2	3	3
<b>CO3</b>	2	3	2	-	-	1	-	-	-	-	-	2	3	3
<b>CO4</b>	3	3	2	-	-	2	-	-	-	-	-	2	3	3
<b>CO5</b>	2	3	1	-	-	1	-	-	-	-	-	2	3	3
<b>Average</b>	2.4	3	2	-	-	1.6	-	-	-	-	-	2	3	3

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



<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year - I Sem</b>			
Course Code: <b>L413F</b>	<b>QUALITY ENGINEERING IN MANUFACTURING</b> (Professional Elective - IV)	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-requisite:** Engineering Mathematics.

#### Module 1:

**Unit 1: Quality value and Engineering:** An overall quality system – Quality Engineering in product design – Quality engineering in design of production processes – Quality Engineering in production.

**Unit 2: Loss function and quality level:** Derivation and use of Quality Loss Function (QLF) – Economic consequences of tightening tolerances as a means to improve quality – Evaluations and types tolerances – N-type – S-type and L-type.

#### Module 2:

**Analysis of variance (ANOVA):** No-way ANOVA – One-way ANOVA – Two-way ANOVA – Critique of F-test – ANOVA for four level factors

#### Module 3:

**Unit 1: Orthogonal arrays:** Introduction to OA – Degrees of Freedom – Structure of OA – Linear Graphs & Interaction tables – Strategies in Experimentation – Typical test strategies – Better test strategies & Efficient test strategies – steps in designing – conducting and analyzing an experiment.

**Unit 2: Interpolation of experimental results:** Interpretation methods – Percent contribution – estimating the mean.

#### Module 4:

**Unit 1: Tolerance design and tolerance:** Functional limits – Tolerance design for N-type – L-type and S-type characteristics – Tolerance allocation for multiple components.

**Unit 2: Parameter and tolerance design:** Introduction to parameter design – Signal to noise ratios – Parameter design strategy – some of the case studies on parameter and tolerance designs.

#### Module 5:

**Quality Tools:** ISO-9000 Quality System – Business Process Re-engineering (BPRE) – Six-sigma – Bench making – Quality circles – Brain Storming – Fishbone diagram.

#### Text Books

1. Phillip J. Ross, "Taguchi Techniques for Quality Engineering", McGraw Hill Publishers, 2nd Edition, 1995.
2. G. Taguchi, A. Elsayed, "Quality Engineering in Production systems", Tata McGraw Hill Publishers. 3rd Edition, 1989.

## Reference Books

1. Madhav S. Phadke, "Quality Engineering using Robust Design", Pearson Education. 3rd Edition.
2. Poornima M. Charantimath, "Total Quality Management", Pearson Publications, 2nd Edition.
3. Tapan P. Bagchi, "Taguchi Methods Explained: Practical steps to Robust Resign", Prentice Hall.

## E-Resources

1. <https://rb.gy/q9egsh>
2. <https://rb.gy/joasdx>
3. <https://nptel.ac.in/courses/112/106/112106249/>

## Course Outcomes

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

1. Know how to implement Quality in the design and manufacturing of products, Use of Quality Loss Function and Evaluation methods of different types of tolerances.
2. Apply the methodology of ANOVA for experimental results.
3. Use different Strategies in Experimentation and obtain the necessary expertise for designing, conducting and analyzing an experiment, and apply the methods for Interpretation of experimental results.
4. Design various types of Tolerances, and Allocate Tolerance for multiple components.
5. Solve the problems concerned with parameter and tolerance designs

## CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
<b>CO1</b>	3	3	2	1	-	-	-	-	-	-	-	3	3	3
<b>CO2</b>	2	2	3	2	-	-	-	-	-	-	-	3	3	3
<b>CO3</b>	3	3	3	1	-	-	-	-	-	-	-	3	3	3
<b>CO4</b>	3	3	3	3	-	-	-	-	-	-	-	3	3	3
<b>CO5</b>	3	3	2	3	-	-	-	-	-	-	-	3	3	3
<b>Average</b>	2.8	2.8	3	2	-	-	-	-	-	-	-	3	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year - I Sem</b>			
Course Code: <b>L413G</b>	<b>CNC TECHNOLOGY</b> (Professional Elective - IV)	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Drawing, Basic Electrical and Electronics Engineering, CAD/CAM.

#### Module 1:

**Unit 1: Introduction to Computer Numerical Control:** Numerical Control, NC modes, NC Elements, NC Machine Tools.

**Unit 2: CNC hardware basics:** Structure of CNC machine tools, Spindle design, Drivers, Actuation systems, Feedback devices.

#### Module 2:

**Unit 1: CNC Tooling:** Cutting- tool materials, Turning-tool geometry, Milling tooling systems, Tool Presetting, Automatic tool changers, Work holding devices.

**Unit 2: CNC Machine tools and Control Systems:** CNC Machining Centers, CNC turning centers, High-speed machine tools, machine control unit, support systems.

#### Module 3:

**Unit 1: CNC Programming:** Part programming fundamentals, Manual part programming Methods, Preparatory functions, Miscellaneous Functions, Program Number, Tool length compensation, Canned cycles: Example CNC programs, Cutter radius compensation: Example CNC programs.

**Unit 2: Computer Aided Part Programming:** Concept of CAP, APT Language structure, Post processor commands, Compilation control commands, Geometry Commands: Examples, Motion Commands: Examples, Complete Part programs in APT.

#### Module 4:

**Unit 1: Direct Numerical Control:** Introduction, Typical functions served by the DNC: communication, Part program storage, Ancillary functions. Cell control, advantages and disadvantages of DNC.

**Unit 2: Communication:** Introduction, Serial and Parallel Communication, Communication Networks: Star network topology, Bus network, Ring topology.

#### Module 5:

**Unit 1: Flexible Manufacturing Systems:** Introduction, FMS equipment, Tool-management systems, System layouts, FMS control, FMS case study.

**Unit 2: Computer Aided Process Planning:** Introduction, Approaches to CAPP: Variant approach, Generative approach, advantages of CAPP.

#### Text Books

1. P. N. Rao, "CAD/CAM: Principles and Applications", The Tata McGraw-Hill companies, 3<sup>rd</sup> Edition.
2. Yoram Korem, "Computer control of manufacturing Systems", The Tata McGraw-Hill, 2010.

## Reference Books

1. P. Groover, "Automation, Production systems & Computer integrated Manufacturing", Pearson Education, 2014.
2. Radhakrishnan and Subramanian, "CAD / CAM / CIM", New Age, 2nd Edition, 2000.

## E-Resources

1. <https://rb.gy/2rnapl>
2. <http://nptel.ac.in/courses/112102101/>
3. <http://nptel.ac.in/courses/112102103>
4. <https://nptel.ac.in/courses/112/102/112102101/>

## Course Outcomes

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

**CO1:** Know the basic concepts about NC and CNC.

**CO2:** Understand the CNC tooling and Control systems

**CO3:** Write the CNC program with G, M codes and in APT language

**CO4:** Understand about DNC system and communication networks in CNC and DNC.

**CO5:** Know the importance of flexible Manufacturing and Computer Aided Process Planning.

## CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
<b>CO1</b>	3	3	2	1	-	-	-	-	-	-	-	3	3	3
<b>CO2</b>	2	2	3	2	-	-	-	-	-	-	-	3	3	3
<b>CO3</b>	3	3	3	1	-	-	-	-	-	-	-	3	3	3
<b>CO4</b>	3	3	3	3	-	-	-	-	-	-	-	3	3	3
<b>CO5</b>	3	3	2	3	-	-	-	-	-	-	-	3	3	3
<b>Average</b>	2.8	2.8	3	2	-	-	-	-	-	-	-	3	3	3

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

<b>AY: 2022-23 Onwards</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B.Tech: ME IV Year-I Sem</b>			
Course Code: <b>L413H</b>	<b>ENERGY CONSERVATION AND WASTE HEAT RECOVERY</b> (Professional Elective -V- online MOOC)	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre- Requisites:** Basic Thermodynamics.

#### Module 1:

**Unit-1:** Introduction to Waste Heat, Importance of Waste Heat Recovery, Review of Thermodynamics – Introduction to First and Second Laws.

**Unit-2: Review of Thermodynamics** – Entropy, Entropy Generation, First and Second Law efficiency.

#### Module 2:

**Unit-1:** Power Plant Cycles - Energy Cascading, Rankine Cycle, modification of Rankine cycle, examples.

**Unit-2:** Gas Turbine Cycle, Combined Cycle, Combined Gas Turbine-Steam Turbine Power Plant, Heat Recovery Steam Generators

#### Module 3:

**Unit-1:** Thermodynamic cycles for low temperature application, Cogenerations, Introduction to Heat Exchangers, Analysis – LMTD and  $\epsilon$ -NTU method

**Unit-2:** Analysis of Heat Exchanger – continued, Problem solving, Special Heat Exchangers for Waste Heat Recovery, Synthesis of Heat Exchanger.

#### Module 4:

**Unit-1:** Heat pipes & Vapor Chambers, Direct conversion technologies – Thermoelectric Generators

**Unit-2:** Direct conversion technologies – Thermoelectric Generators (contd.), Thermionic conversion, Thermo-PV, MHD.

#### Module 5:

**Unit-1:** Heat Pump; Heat Recovery from Incinerators, Energy Storage – Introduction.

**Unit-2:** Energy Storage Techniques – Pumped hydro, Compressed Air, Flywheel, Superconducting Magnetic storage, Thermal storage (Sensible & Latent), Battery, Chemical Energy Storage, Fuel cells- Energy Economics.

#### Reference Books

1. Institute of Fuel, London, Waste Heat Recovery, Chapman & Hall Publishers, London, 1963.
2. Seagate Subrata, Lee SS EDS, Waste Heat Utilization and Management, Hemisphere, Washington, 1983

#### E-Resources

1. [https://onlinecourses.nptel.ac.in/noc20\\_mm20/preview](https://onlinecourses.nptel.ac.in/noc20_mm20/preview)

## Course Outcomes

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

**CO1:** Estimation of waste heat recovery

**CO2:** Analyze the effect of heat recovery systems in power plants

**CO3:** Analyze the various heat recovery heat exchangers

**CO4:** Understand the significance of energy conversion systems.

**CO5:** Understand the significance energy storage techniques

## CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
<b>CO1</b>	3	3	3	3	-	-	-	-	-	-	-	2	3	3
<b>CO2</b>	3	3	3	3	-	-	-	-	-	-	-	2	3	3
<b>CO3</b>	3	3	3	3	-	-	-	-	-	-	-	2	3	3
<b>CO4</b>	3	3	3	3	-	-	-	-	-	-	-	2	3	3
<b>CO5</b>	3	3	3	3	-	-	-	-	-	-	-	2	3	2
<b>Average</b>	3	3	3	3	-	-	-	-	-	-	-	2	3	2.8

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year-I Sem</b>			
Course Code: <b>L413I</b>	<b>INTRODUCTION TO MECHANICAL MICRO MACHINING</b> (Professional Elective – V – online MOOC)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Manufacturing Technology, Machine tools, Metal cutting.

#### Module 1:

**Unit 1: Introduction to mechanical micro machining:** Scaling laws, difference between macro and Micro machining, micro tools fabrication, micro machines, diamond turning, miniaturization, Basic concepts in machining, MEMS vs mechanical micro-machining, mechanical Micromachining vs ultrasonic machining.

**Unit 2:** Operator's skill and sensing in microwave things to remember in Micro machining, things to remember in micro machining, habits for achieving good results, different types of scale reduction of a system, types of scaling law scaling factor.

#### Module 2:

**Unit 1:** Influence of size affect, grain size to chip thickness, uncut chip thickness versus cutting edge radius, material flow angle of four distinct mechanisms, specific cutting energy.

**Unit 2:** Reasons for high specific cutting energy, burr formation, schematic of burr formation with crack, surface roughness, instruments for surface roughness measurement.

#### Module 3:

**Unit 1:** Effect of material properties, key aspects in Micro-machining, summary of differences due to micro scale, advantages of micro mechanical machining, limitations of Micro mechanical machining, handling of micro components, accuracy, repeatability and resolution.

**Unit 2:** structural configurations of a machine tool, structural loop in machine, open loop structure, closed loop structure, parameters affecting structural loop, errors in machining, cost vs performance in error correction, sensitive directions, components of machine tools, errors in machine tools.

#### Module 4:

**Unit 1:** Error components in a linear movement (X-axis, Y-axis & Z-axis), error components in a rotational movement, summary of geometric errors, guideways-types, construction material for machine tool.

**Unit 2:** Properties of material for machine frame, density vs Young's modulus, strength and specific energy consumption. Wall constructions for a slide, light metal for machine tool structure.

#### Module 5:

**Unit 1:** Spindle-design constraints, major components, belt driven spindle, integral motor spindle, housings, bearings, bearings selection criteria, angular contact ball bearings, tapered and roller bearings.

**Unit 2:** Tool retention system: CAT, BT or ISO, Contact comparison, draw bar action comparison, 3 surface contact holders, micro tool by WEDG. Micro tool by EDM Process, micro tool by laser beam.

### Text Books

1. Micro-Cutting: Fundamentals and Applications by Cheng, Huo, Wiley Publication
2. Introduction to Micromachining 2nd Edition, Ed. V. K. Jain, Narosa Publishing House.
3. Precision Manufacturing by David Dornfeld and Dae-Eun Lee, Springer US

### E-Resources

1. [https://onlinecourses.nptel.ac.in/noc20\\_me15/preview](https://onlinecourses.nptel.ac.in/noc20_me15/preview)

### Course Outcomes

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

**CO1:** Analyze observations and theoretical prediction of constituents of an atom

**CO2:** Understanding the mechanical machining processes

**CO3:** Understanding the Micro machine structure

**CO4:** Understanding the Fabrication of micro cutting tools

**CO5:** Understanding the Metrology for micro machining

### CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
<b>CO1</b>	3	1	2	1	-	-	-	-	-	-	-	3	3	3
<b>CO2</b>	2	2	3	2	-	-	-	-	-	-	-	3	3	3
<b>CO3</b>	3	2	3	1	-	-	-	-	-	-	-	3	3	3
<b>CO4</b>	3	3	3	3	-	-	-	-	-	-	-	3	3	3
<b>CO5</b>	3	3	2	3	-	-	-	-	-	-	-	3	3	3
<b>Average</b>	2.8	3	3	2	-	-	-	-	-	-	-	3	3	3

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



<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b>			
Course Code: <b>L413J</b>	<b>PRODUCT DESIGN AND MANUFACTURING</b> (Professional Elective – V – online MOOC)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Design for Manufacturing, Metal Cutting & Machine Tools.

#### Module 1:

**Unit 1: Product Design and Manufacturing:** Introduction to Product Design and Manufacturing, Fundamentals of Manufacturing towards Product Development.

**Unit 2: Engineering Design Process:** Product Design Morphology, Product Characteristics, Elements of Visual Design, Translating Customer Needs.

#### Module 2:

**Unit 1: Value Engineering:** Value Engineering Methodology, Creative Phase, Fast Diagramming of Pen, Evaluation Phase, Development Phase, Case study on Value Engineering.

**Unit 2: Manufacturing Process Selection:** Materials Selection, Importance of Material Selection, Selection of Manufacturing Process, Product Costing: Introduction, Cost and Price Structure, Information need resources, Estimating Direct and Indirect Costs, Ways to model Manufacturing Costs.

#### Module 3:

**Unit 1: Design for Manufacturing:** Design Review, Need of DFM, Design for Manufacturing Guidelines. Design for Assembly and Disassembly: Design for Manufacturability, Design for Assembly, Design guidelines for different modes of Assembly, Methods for Evaluating Design for Assembly, Disassembly Process Planning, Design for Disassembly.

**Unit 2: Design for Maintenance: Introduction,** Importance of design, Total productive maintenance, and Design review for maintainability. Design for Environment: Product Design for Environment, Three R's, Life Cycle Analysis, Quality Control, Quality Assurance.

#### Module 4:

**Unit 1: Patent:** Introduction, Creativity Vs Innovation, Copyright, Types of Patent, Patent Procedure, Specification of Patent, Creativity techniques, Frugal Innovation.

**Unit 2 Rapid Prototyping:** Introduction to Rapid Prototyping, Rapid Prototyping Modelling, Rapid Prototyping Processes.

#### Module 5:

**Unit 1: 3D Printing: Demonstration** on 3D Printing, Plant Layout Planning, Demonstration on Plant Simulation.

**Unit 2: Computer integrated manufacturing:** integration, CIM implementation, Reverse Engineering, Managing Competitiveness.

#### Text Books

1. Prof. J. Ramkumar and Prof. Amandeep Singh , " Product Design and Manufacturing"
2. A. K Chitale, R.C Gupta, " Product Design and Manufacturing", Sixth edition.

3. G. Boothroyd, Peter Dewhurst, " Product Design for Manufacture and Assembly", Third Edition

### Reference Books

1. P. Groover, "Automation, Production systems & Computer integrated Manufacturing", Pearson Education, 2014.
2. Radhakrishnan and Subramanian, "CAD / CAM / CIM", New Age, 2nd Edition, 2000.

### E-Resources

1. <https://archive.nptel.ac.in/courses/112/104/112104230/>

### Course Outcomes

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

**CO1:** Explain the fundamentals of Manufacturing towards Product Development.

**CO2:** Know how to select different materials for manufacturing processes.

**CO3:** Apply the knowledge for designing for the environment.

**CO4:** Use the principles /methods of Rapid Prototyping.

**CO5:** Understand get exposure various elements and their functions in CIM.

### CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
<b>CO1</b>	3	1	2	1	-	-	-	-	-	-	-	3	3	3
<b>CO2</b>	2	2	3	2	-	-	-	-	-	-	-	3	3	3
<b>CO3</b>	3	2	3	1	-	-	-	-	-	-	-	3	3	3
<b>CO4</b>	3	3	3	3	-	-	-	-	-	-	-	3	3	3
<b>CO5</b>	3	3	2	3	-	-	-	-	-	-	-	3	3	3
<b>Average</b>	2.8	3	3	2	-	-	-	-	-	-	-	3	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year-I Sem</b>			
Course Code: <b>L4131</b>	<b>INSTRUMENTATION AND CONTROL SYSTEMS LAB</b>	L	T	P	D
Credits: 1		<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**Pre-Requisites:** Engineering Mathematics, Engineering Physics and Chemistry

#### List of Experiments

1. Calibration of Pressure Gauges.
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for temperature measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotameter for flow measurement.
10. Study and use of a Seismic pickup transducer
11. Study of McLeod gauge for low pressure.
12. Study of D.C position control system.
13. Study of D.C speed control system.

#### Text Books

1. <https://shorturl.at/NV379>

#### Course Outcomes

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

- CO1: Calibrate the measuring instruments, and conduct the experiments with minimum error in measurements.
- CO2: Apply the basic knowledge of Linear Displacement, Temperature, flow, speed and strain measurements, with good accuracy and precision, in practical situations.
- CO3: Use the various Metrological instruments like Vernier calipers, Micrometers, Bevel Protractor, Talysurf, and Tool Maker's Microscope.
- CO4: Use Bevel Protractor, Tool Maker's Microscope, Sine bar for Angle and Taper measurements.
- CO5: Interpret the results of experiments and draw correct inferences.

#### 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	-	2	3	3	3
<b>CO3</b>	-	-	-	-	-	-	-	-	3	-	2	3	3	3
<b>CO4</b>	-	-	-	-	-	-	-	-	3	-	2	3	-	3
<b>CO5</b>	-	-	-	-	-	-	-	-	1	-	2	3	3	3
<b>Average</b>	-	-	-	-	-	-	-	-	2.6	-	2	3	2.8	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year-I Sem</b>			
Course Code: <b>L4132</b>	<b>CAE AND PDP LAB</b>	L	T	P	D
Credits: 2		<b>0</b>	<b>0</b>	<b>4</b>	<b>0</b>

**Pre-Requisites:** Thermodynamics, Heat Transfer

### List of Experiments

1. Part modeling and Assembly of machine component Stuffing Box
2. Part modeling and Assembly of machine component Screw Jack
3. Part modeling and Assembly of machine component Connecting rod
4. Part modeling and Assembly of machine component Knuckle Joints
5. A Study of a FEA package and modeling stress analysis of a Bar of constant cross sectional area tapered and stepped bars.
6. Analysis of various Trusses, beams with various loads.
7. Workbench exercises (Structural, thermal)
8. Pinion Shaft, with Notes on Heat Treatment & Surface Treatment, Tolerances and Surface Finish Symbols.
9. Charts: (i) Electrical Symbol, (ii) Hydraulics Symbol, (iii) Pneumatics Symbols.
10. Limits, Fits and Tolerances, Representative Diagrams and Tables.
11. Helical Gear, with Dimensional Tolerances, Geometrical Tolerances, Gear Data, Heat Treatment Note and Surface Finish Symbols.
12. Symbols for Geometrical Tolerances (Position and Form Tolerances).
13. Representation of Geometrical Tolerances, Chart showing Various Manufacturing Processes for Achieving required Surface Finish Values, Surface Finish symbols.
14. Part Drawings with Bill of Material (Minimum 4 Exercises)

### Course Outcomes

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

- CO1:** Design a part or assembly of parts using Computer-Aided Design software.
- CO2:** Apply the knowledge of deflection and stresses on 2D and 3D Components.
- CO3:** Analyze stresses in 3D model and shell structures.
- CO4:** Analyze production drawing, conventional symbols and examine the conventional representation of manufacturing processes, heat treatment processes and dimensional tolerances.
- CO5:** Illustrate the geometrical dimensions, geometrical tolerances, bill of materials and process flow charts for manufacturing of a given product.

**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	-	-	-	3	-	2	-	2	-	-	2	3	3
<b>C02</b>	3	-	-	-	3	-	2	-	2	-	-	2	3	3
<b>C03</b>	2	-	-	-	3	-	2	-	3	-	-	2	3	3
<b>C04</b>	3	-	-	-	3	-	2	-	2	-	-	2	3	3
<b>C05</b>	2	-	-	-	3	-	2	-	1	-	-	3	3	3
<b>Average</b>	2.4	-	-	-	3	-	2	-	2	-	-	2.2	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year-I Sem</b>			
Course Code: <b>L4133</b>	<b>MINI PROJECT</b>	L	T	P	D
Credits: <b>2</b>		<b>0</b>	<b>0</b>	<b>4</b>	<b>0</b>

### Guidelines:

A student is required to undergo a Mini Project of his/her choice during the vacation after III Year II Semester Examination by applying theoretical concepts to develop a practical component /element/system that includes design/ testing/ analysis. The performance of a student in the Mini Project shall be evaluated in IV Year I Semester by a three-member committee constituted by the HoD as per the following parameters:

Parameter	Marks
Mini Project report	15
Quality of work	15
Presentation	15
Viva-Voce	5
Total	50

The performance of a student in Mini Project shall be evaluated based on two reviews, each carrying 50 marks. The average marks of these two reviews will be awarded. There shall be no Semester End Examination for the Industry Oriented Mini Project.

### 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	3	-	-	-	-	2	3	-	3	2	3	3
<b>CO2</b>	-	2	3	-	-	-	-	2	3	-	3	2	3	3
<b>CO3</b>	-	2	3	-	-	-	-	2	3	-	3	2	3	3
<b>CO4</b>	-	2	3	-	-	-	-	2	3	-	3	2	3	3
<b>Average</b>	-	2	3	-	-	-	-	2	3	-	3	2	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year-I Sem</b>			
Course Code: <b>L4134</b>	<b>PROJECT PHASE - I</b>	L	T	P	D
Credits: 2		<b>0</b>	<b>0</b>	<b>4</b>	<b>0</b>

### Guidelines:

The student is required to undertake a Project Work by using the knowledge acquired by him / her during the course of study. The student is expected to design and build a complete system or subsystem on his / her area of interest. The Project Work consists of two parts namely, Project Stage -I (Project Survey) and Project Stage – II (Project Implementation). Project Stage – I is carried out during IV Year I Semester and the Project Stage – II during IV Year II Semester. A project work shall be taken up by a batch of students not exceeding 4 members under the guidance of a faculty supervisor.

**For Project Stage – I,** the Project Review Committee (PRC) consisting of Head of the Department, Project Coordinator, Project supervisor and one senior faculty member shall evaluate the Project Work for 50 marks. **There shall be no End Semester Evaluation for Project Phase-I.** The student is deemed to have failed, if he

- (i) does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule
- (ii) Secures less than 40% marks in the CIE. A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he/she fails in such 'one reappearance' evaluation also, he/she has to reappear for the same in the next subsequent semester, as and when it is scheduled.

### Course Outcomes

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

**CO1:** Familiarize with the knowledge required for project completion.

**CO2:** Understand fundamentals and principles required for project completion.

**CO3:** Identify suitable procedure to complete the project.

**CO4:** Understand the techniques applied to complete the project

### 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	2	-	-	-	-	-	3	2	3	3
<b>CO2</b>	-	3	3	2	2	-	-	-	-	-	3	2	3	3
<b>CO3</b>	-	3	3	3	2	2	-	-	-	-	3	2	3	3
<b>CO4</b>	-	3	3	3	2	2	-	-	-	-	3	2	3	3
<b>Average</b>	-	3	2.75	2.25	2	2	-	-	-	-	3	2	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year - I Sem</b>			
Course Code: <b>L41M4</b>	<b>3D PRINTING AND DESIGN</b> (Mandatory Course - V)	L	T	P	D
Credits: 0		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Drawing, CAD/CAM.

#### Module 1:

**Unit 1: Introduction to Additive Manufacturing:** Description, Additive Manufacturing Process Chain, Current Usage of Additive Manufacturing, Advantages, Applications.

**Unit 2: Additive Manufacturing Technologies:** Material Extrusion, Material Jetting, Sheet Lamination, Vat Photo-polymerisation, Powder Bed Fusion, Direct Energy Deposition, Hybrid AM.

#### Module 2:

**Unit 1: General design considerations for 3D printing:** Layer height, Shrinkage and warping, Support structures, Fillets. Designing for SLA / DLP: Support structures and part orientation, Hollow sections. SLA/DLP design table.

**Unit 2: Designing for SLS:** Shrinkage and warping, Oversintering, Powder removal, Comparison with injection molding, Stepping effect, SLS design table.

#### Module 3:

**Unit 1: Designing for Material Jetting:** Support structures and part orientation, Full color printing, Multi-material integration, Material Jetting design table.

**Unit 2: Designing for Binder Jetting:** Binder, Green state, Full color prints, Infiltration and sintering, Binder Jetting design table.

#### Module 4:

**Unit 1: Designing for DMLS/SLM:** Supports and part orientation, Hollow sections, Build plate, Skin and cores, Common design parameters, Metal printing design table.

**Unit 2: Tools for producing 3D designs:** Introduction, CAD Design, Topology optimization, Reverse engineering.

#### Module 5:

**Unit 1: Post-processing:** Introduction, Support Material Removal: Polymer, Metal. Polymer Surface Treatments: Vapour Smoothing, Tumbling, Dying, Painting, Using Textures, Sand Blasting, Machining, Metalizing, Wrapping, Hydrographics.

**Unit 2: The future of Additive Manufacturing:** Functionally Graded Materials, Bioprinting, Construction Applications, Printed Electronics, Nano Printing, Food Printers.

#### Text Books

1. Olaf Diegel, Axel Nordin, Damien Motte, "A Practical guide to Design for Additive Manufacturing", Springer series, 2020.
2. Ben Redwood, Filemon schoffer, Brian Garret, "The 3D Printing Handbook- Technologies, design and applications", 3D Hubs, 2017.



## Reference Books

1. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.
2. Hilton P.D. and Jacobs P.F., "Rapid Tooling: Technologies and Industrial Applications", CRC press.

## E-Resources

1. <https://rb.gy/rfxjt>
2. <https://rb.gy/ndvq97>
3. <https://nptel.ac.in/courses/112/104/112104265/>

## Course Outcomes

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

**CO1:** Know the basic concepts of 3D printing and different processes.

**CO2:** Understand the design considerations for 3D printing, SLA and SLS.

**CO3:** gain the knowledge of design considerations for material jetting and binder jetting.

**CO4:** Understand about design considerations for DMLS and tooling for 3D printing Designs.

**CO5:** Know the Post-processing techniques and know the future of 3D printing.

## CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
<b>CO1</b>	3	1	3	3	-	-	-	-	-	-	-	3	3	3
<b>CO2</b>	2	2	3	2	-	-	-	-	-	-	-	3	3	3
<b>CO3</b>	3	2	3	3	-	-	-	-	-	-	-	3	3	3
<b>CO4</b>	3	3	3	3	-	-	-	-	-	-	-	3	3	3
<b>CO5</b>	3	3	3	3	-	-	-	-	-	-	-	3	3	3
<b>Average</b>	2.8	2.2	3	2.8	-	-	-	-	-	-	-	3	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year - II Sem</b>			
Course Code: <b>L423A</b>	<b>RENEWABLE ENERGY SOURCES</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-requisite:** Engineering Chemistry, Environmental Sciences.

#### Module 1:

**Global and National Energy Scenario:** Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non-renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO<sub>2</sub> reduction potential of renewable energy- concept of Hybrid systems.

#### Module 2:

**Solar Energy:** Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

#### Module 3:

**Wind Energy:** Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy – Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. Safety and environmental aspects, wind energy potential and installation in India.

#### Module 4:

**Biogas:** Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion, Biomass energy programme in India

#### Module 5:

**Ocean Energy:** Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion (OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy.

- 1. Small hydro Power Plant:** Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.
- 2. Geothermal Energy:** Geothermal power plants, various types, hot springs and steam ejection.

### Text Books

1. Renewable Energy Sources / Twidell, J.W. and Weir, A./ EFN Spon Ltd., 1986.
2. Non-Conventional Energy Sources / G.D Rai/ Khanna Publishers

### Reference Books

1. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi, 2012
2. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996

### Course Outcomes

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

**CO1:** Understand the Global and National Energy Scenario

**CO2:** Understand the concept of solar energy

**CO3:** Understand the concept of wind energy

**CO4:** Knowledge of working principle of various energy systems

**CO5:** Capability to carry out basic design of renewable energy systems

### CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
<b>CO1</b>	2	1	3	2	1	-	-	-	-	3	-	3	3	3
<b>CO2</b>	2	3	3	3	3	-	-	-	-	3	-	3	3	3
<b>CO3</b>	2	2	3	2	2	-	-	-	-	3	-	3	3	3
<b>CO4</b>	2	2	3	2	2	-	-	-	-	3	-	3	3	3
<b>CO5</b>	2	2	3	2	2	-	-	-	-	3	-	3	3	3
<b>Average</b>	2	2	3	2.2	2	-	-	-	-	3	-	3	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year - II Sem</b>			
Course Code: <b>L423A</b>	<b>ADDITIVE MANUFACTURING</b> (Professional Elective - VI)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Manufacturing Processes, Engineering Materials.

### Module 1:

**Unit 1: Introduction:** Prototyping fundamentals, Historical development, Fundamentals of Rapid Prototyping, Advantages and Limitations of Rapid Prototyping, commonly used Terms. Classification of RP systems.

**Unit 2: Rapid Prototyping Process Chain:** Fundamental Automated Processes, Process Chain, 3D modeling, Data Conversion and Transmission, Checking and Preparing, Building, Post-processing.

### Module 2:

**Unit 1: Rapid Prototyping Data Formats:** STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats.

**Unit 2: Liquid-based Rapid Prototyping Systems:** Stereo lithography Apparatus (SLA): Introduction, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages. Solid Ground Curing (SGC): Introduction, Process, working principle, Applications, Advantages and Disadvantages.

### Module 3:

**Unit 1: Solid-based Rapid Prototyping Systems:** Laminated Object Manufacturing (LOM): Introduction, Process, working principle, Applications, Advantages and Disadvantages. Fused Deposition Modeling (FDM): Introduction, Process, working principle, Applications, Advantages and Disadvantages.

**Unit 2: Powder Based Rapid Prototyping Systems:** Selective Laser Sintering (SLS): Introduction, Process, working principle, Applications, Advantages and Disadvantages. Rapid Tooling: Introduction, Rapid Tooling Classification; Direct soft tooling, Indirect soft, Direct hard tooling, Indirect hard tooling.

### Module 4:

**Unit 1: Directed Energy Deposition AM Processes:** Introduction, Process Description, Material Delivery, Laser Based Metal Deposition Processes, Electron Beam Based Metal Deposition Processes, Processing-structure-properties, relationships, Benefits and drawbacks, Applications of Directed Energy Deposition Processes.

**Unit 2: Direct Write Technologies:** Introduction, Ink-Based DW: Nozzle Dispensing Processes, Quill-Type Processes, Inkjet Printing Processes, Aerosol DW, Laser Transfer DW, Thermal Spray DW, Applications of Direct Write Technologies.

### Module 5:

**Unit 1: Design for Additive manufacturing:** Motivation, Design for Manufacturing and Assembly, AM unique capabilities: Shape complexity, Hierarchical complexity, Functional complexity, Material complexity.

**Unit 2: RP Applications:** Application - Material Relationship, Applications in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry.

**Text Books**

1. Chua C.K., Leong K.F. and Lim C.S., "Rapid Prototyping- Principles and Applications", World Scientific Publishers, 2<sup>nd</sup> Edition.
2. Ian Gibson, David Rosen, Brent Stucker, "Additive Manufacturing Technologies- 3D Printing, Rapid Prototyping and Direct Digital Manufacturing", Springer, 2<sup>nd</sup> Edition.

**Reference Books**

1. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.
2. Hilton P.D. and Jacobs P.F., "Rapid Tooling: Technologies and Industrial Applications", CRC press, 2000.

**E-Resources**

1. <https://rb.gy/rfxjt>
2. <https://rb.gy/ndvq97>
3. <https://nptel.ac.in/courses/112/104/112104265/>

**Course Outcomes**

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

- CO1:** Know the basic concepts and process chain in Additive manufacturing.
- CO2:** Understand the complete details about file formats and Liquid based Additive manufacturing processes.
- CO3:** Analyse the Solid based Additive manufacturing processes and Powder based manufacturing processes.
- CO4:** Produce the components by using Directed Energy Deposition AM Processes and Direct Write Technologies process.
- CO5:** Know the importance of AM in Design for manufacturing and learn the applications of AM in different fields.

**CO-PO/PSO Mapping**

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
<b>CO1</b>	2	1	3	2	1	-	-	-	-	3	-	3	3	3
<b>CO2</b>	2	3	3	3	3	-	-	-	-	3	-	3	3	3
<b>CO3</b>	2	2	3	2	2	-	-	-	-	3	-	3	3	3
<b>CO4</b>	2	2	3	2	2	-	-	-	-	3	-	3	3	3
<b>CO5</b>	2	2	3	2	2	-	-	-	-	3	-	3	3	3
<b>Average</b>	2	2	3	2.2	2	-	-	-	-	3	-	3	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year-II Sem</b>			
Course Code: <b>L423B</b>	<b>AUTOMATION IN MANUFACTURING</b> (Professional Elective - VI)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Manufacturing Systems, Production Technology, CAD/CAM

### Module 1:

**Unit 1: Introduction:** Types and strategies of automation – pneumatic and hydraulic components circuits – Automation in machine tools. Mechanical feeding and tool changing and machine tool control transfer the automation.

**Unit 2: Automated flow lines:** Methods or work part transport transfer Mechanical buffer storage control function – design and fabrication consideration.

### Module 2:

**Analysis of Automated flow lines:** General terminology and analysis of transfer lines without and with buffer storage – partial automation – implementation of automated flow lines.

### Module 3:

**Assembly system and line balancing:** Assembly process and systems assembly line – line balancing methods – ways of improving line balance – flexible assembly lines.

### Module 4:

**Unit 1: Automated material handling:** Types of equipment – functions – analysis and design of material handling systems conveyor systems – automated guided vehicle systems.

**Unit 2: Automated storage systems:** Automated storage and retrieval systems; work in process storage – interfacing handling and storage with manufacturing.

### Module 5:

**Unit 1: Fundamentals of Industrial controls:** Review of control theory – logic controls – sensors and actuators – Data communication and LAN in Manufacturing

**Unit 2: Business process Re-engineering:** Introduction to BPE logistics – ERP – Software configuration of BPE – concurrent Engineering – Techniques of Rapid Proto typing.

### Text Books

1. Mikell. P Groover, "Automation, production systems and computer integrated manufacturing", PHI, 3rd edition. 2012.
2. Mike P.Grower, "Automation, Production Systems and CIM", PHI.

### Reference Books

1. P. Radha Krishnan & S. Subrahmanyarn and Raju, "CAD/CAM/CIM", NewAge International Publishers. 2003.
2. Singh/JohnWiley, "System Approach to Computer Integrated Design and Manufacturing", 1996
3. Richard A. Wyskand Hsu-PinWang, "Computer Aided Manufacturing Tien- Chien Chang", Pearson, 2009.

- R Thomas Wright and Michael Berkeihiser, "Manufacturing and Automation Technology", GoodHeart Willcox Publishers.

### E-Resources

- <https://www.springer.com/gp/book/9781461295860>
- <https://rb.gy/j5sdk8>
- <https://rb.gy/vdqzct>
- <https://nptel.ac.in/courses/112/102/112102011/>
- <https://nptel.ac.in/courses/112/103/112103293/>

### Course Outcomes

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

- Apply the circuit knowledge in industrial applications
- Analyze the flow lines and implement buffer storage systems in real time industry applications
- Apply the knowledge of balance the assembly line for optimal output.
- Apply the design procedures of material handling equipments and components.
- Memorize fundamentals of Industrial controls and Business Process Re- engineering and apply in the industry

### 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	2	2	-	-	-	-	-	-	-	2	3	3
<b>CO2</b>	3	2	2	2	-	-	-	-	-	-	-	2	3	2
<b>CO3</b>	3	2	2	2	-	-	-	-	-	-	-	2	3	2
<b>CO4</b>	3	3	3	2	-	-	-	-	-	-	-	2	3	3
<b>CO5</b>	3	3	3	2	-	-	-	-	-	-	-	2	3	3
<b>Average</b>	3	2.6	2.4	2	-	-	-	-	-	-	-	2	3	2.6

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech ME</b> <b>IV Year-II Sem</b>			
Course Code: <b>L423C</b>	<b>PRODUCTION PLANNING AND CONTROL</b> (Professional Elective-VI)	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Management Science for Engineers, Operations Research.

#### Module 1:

**Unit-1: Introduction:** Definitions – objectives of production planning and control- functions of production planning and control-elements of production control.

**Unit-2: Types of production:** Batch production, Mass / Flow production and Continuous production.

#### Module 2:

**Unit-1: Forecasting:** Definition – Importance of forecasting – types of forecasting, their uses general principles of forecasting techniques – Qualitative methods and quantitative methods.

**Unit-2: Aggregate planning:** Concept of aggregate planning, decision rules, strategies and Methods.

#### Module 3:

**Unit-1: Inventory management:** Functions inventory- Relevant inventory cost- ABC analysis- VED Analysis- EOQ model.

**Unit-2: Inventory control systems:** P-Systems and Q-Systems Introduction to MRP and ERP, LOB (Line of balance), JIT inventory, Japanese concepts.

#### Module 4:

**Unit-1: Routing:** Definition – routing procedure – Route sheets – Bill of material – factors affecting routing procedure.

**Unit-2: Scheduling:** Definition – difference with loading. Scheduling polices – techniques, standard scheduling methods – job shop, flow shop.

#### Module 5:

**Unit-1: Dispatching:** Definition, Activities of dispatcher – Dispatching procedure.

**Unit-2: Follow up:** Definition – reasons for existence of functions – types of follow up – applications of computer in production planning control.

#### Text Books

1. M. Mahajan, "Production Planning and Control", Dhanpath Rai & Co, 2010.
2. Jain & Jain, "Production Planning and Control", Khanna publications, 7<sup>th</sup> Edition, 2014.

#### Reference Books

1. SK Mukhopadhyaya, "Production Planning and Control Text & cases", PHI.
2. R. PanneerSelvam, "Production and operations Management", PHI, 3rd Edition, 2014.
3. Chase, "Operations Management", PHI



## E-Resources

1. <https://rb.gy/6dz8fj>
2. <https://www.sciencedirect.com/book/9780128183649/production-planningand-control>
3. <https://nptel.ac.in/courses/112/107/112107143/>
4. <https://nptel.ac.in/courses/110/107/110107141/>

## Course Outcomes

On completion of the course, the students will be able to:

- CO1:** Understand the objectives and functions of PPC, also different types of production
- CO2:** Understand the importance and types of sales forecasting and different methods used for forecasting.
- CO3:** Understand the inventory management, EOQ models, ABC analysis, VED analysis, MRP. ERP, LOB, JIT principles.
- CO4:** Understand what is routing, the routing procedures, route sheets, difference between scheduling and loading, standard scheduling methods.
- CO5:** Understand in obtaining concepts of line balancing, aggregate planning, dispatching follow-up expediting and control aspects

## CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
<b>CO1</b>	2	3	2	2	-	2	-	-	-	-	-	2	3	3
<b>CO2</b>	3	3	3	3	-	3	-	-	-	-	-	3	3	3
<b>CO3</b>	2	3	2	2	-	2	-	-	-	-	-	2	3	3
<b>CO4</b>	3	3	2	3	-	3	-	-	-	-	-	3	3	3
<b>CO5</b>	2	3	1	2	-	2	-	-	-	-	-	2	3	3
<b>Average</b>	2.4	3	2	2.4	-	2.4	-	-	-	-	-	2.4	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year-II Sem</b>			
Course Code: <b>L4231</b>	<b>SEMINAR</b>	L	T	P	D
Credits: 1		<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

### Guidelines:

There is a Seminar in IV Year II Semester for 50 Marks. The student shall deliver a seminar on any emerging topic of his / her choice from the core technical domain. The student shall submit a duly-certified Seminar report. A three-member committee constituted by the HoD will evaluate the Seminar report submitted by the student. There shall be no Semester End Examination. If a student is absent for seminar on medical grounds / due to any emergency / unavoidable circumstances, the student may be permitted to reappear within a month.

### Course Outcomes

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

**CO1:** Acquired the basic skills to for performing literature survey and paper presentation

**CO2:** Provide students better communication skills.

**CO3:** Describe the current topics in Electronics, Communication, Electronic, Instrumentation and related areas based on current publications.

**CO4:** Prepare the report

**CO5:** Apply the knowledge of professional and ethical responsibilities.

### 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>	-	-	-	-	-	-	-	1	2	3	3	2	3	3
<b>CO2</b>	-	-	-	-	-	-	-	1	2	3	3	2	3	3
<b>CO3</b>	-	-	-	-	-	-	-	1	2	3	3	2	3	3
<b>CO4</b>	-	-	-	-	-	-	-	1	2	3	3	2	3	3
<b>CO5</b>	-	-	-	-	-	-	-	1	2	3	3	2	3	3
<b>Average</b>	-	-	-	-	-	-	-	1	2	3	3	2	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>IV Year-II Sem</b>			
Course Code: <b>L4232</b>	<b>PROJECT PHASE - II</b>	L	T	P	D
Credits: 8		<b>0</b>	<b>0</b>	<b>16</b>	<b>0</b>

### Guidelines:

For Project Stage – II, Project Review Committee (PRC) consisting of Head of the Department, Project supervisor, Project Coordinator and a senior faculty member **shall evaluate for 40 marks as continuous evaluation**. The External Examiner shall **evaluate the Project work for 60 marks as Semester End Examination**. The student is deemed to have failed, if he `

(i) does not submit a report on Project Stage - II, or does not make a presentation of the same before the External Examiner as per schedule, or

(ii) Secures less than 40% marks in the sum total of the CIE and SEE taken together.

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

For conducting Viva-Voce of Project Stage – II, Principal selects the External Examiner from the list of experts in the relevant branch of engineering submitted by the concerned Head of Department.

### Course Outcomes

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

**CO1:** Design innovative products.

**CO2:** Express engineering methodology to design product.

**CO3:** Publish the paper in the reputed journals.

**CO4:** Work efficiently in the teams

### 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	2	-	-	-	-	-	1	2	3	3
<b>CO2</b>	-	3	3	2	2	-	-	-	-	-	3	2	3	3
<b>CO3</b>	-	1	2	3	2	-	-	-	-	3	2	2	3	3
<b>CO4</b>	-	3	3	3	2	-	-	-	3	-	2	2	3	3
<b>Average</b>	-	2.5	2.5	2.25	2	-	-	-	3	3	2	2	3	3

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

# OPEN ELECTIVE-I

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE</b> <b>III Year-I Sem</b>			
Course Code: <b>L310A</b>	<b>ELEMENTS OF CIVIL ENGINEERING</b> <b>(OE-I)</b>	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Module 1:**

**Unit-1: Introduction:**

History of the civil engineering, sub – disciplines of civil engineering.

**Module2**

**Unit-1: Surveying**

Introduction, divisions of surveying, classification of surveying, principles of surveying. Linear measurements and errors–introduction, methods of linear measurements, chaining instruments, types of error and correction. Compass surveying – introduction, angular measurement using compass, whole circle bearing and reduced bearing, fore bearing, and back bearing. Traverse surveying –introduction, chain, and compass traversing, closing error and adjustments. Levelling– introduction, types of levelling instruments, dumpy level, adjustment of level, levelling staff

**Module 3: Unit-1: Building Materials and Construction**

Materials: Introduction to construction materials like ferrous and nonferrous metals, alloys, Stones, Bricks, Lime, Cement, Timber, Sand, Aggregates, Mortar, Concrete, and bitumen. Construction: Types of building, different loads considered in building design, types of foundation in building, other developments, and constructions of buildings

**Module 4: Unit-1: Fire and Earthquake Protection in Building:**

Introduction, fire protection in building, structural and architectural safety requirements of resistive structures, fire resistive properties of building materials, fire exit requirements, force and acceleration on building due to earthquake, building response characteristics, building drift

**Module 5: Unit-1: Water Supply, Sanitary and Electrical Works in Building:**

Introduction, water supply system, water supply layout of a building, house drainage, traps, electrical works in building.

**Unit-2: Highway Engineering:**

Introduction, historical background of road or highway, classification of roads, pavements and roads, traffic control mechanism.

**Text Books :**

1. "Elements of Civil Engineering" by Mimi Das Saikia, Bhargab Mohan Das and Madan Mohan Das, PHI Learning Private Limited New Delhi.

2. Elements of Civil Engineering” by Dr. R.K. Jain and Dr. P.P. Lodha, McGraw Hill Education, India Pvt. Ltd.
3. “Surveying Vol. I” by Dr. B. C. Punmia, Ashokkumar Jain, Arunkumar Jain 16th Edition Publisher: Laxmi Publication Delhi.

### Reference Books

1. “Surveying Theory and Practice” by James M Anderson and Edward M Mikhail McGraw Hill Education, India Pvt. Ltd. (7th Edition).
2. “Surveying and Leveling” by R. Subramanian, Oxford University.
3. “Building drawing” by M.G.Shah, C.M.Kale and S.Y.Patki, Tata McGraw Hill.
4. “Civil Engg. Drawing” by S. C. Rangwala, Charotar Pub. House Anand.

### E-Resources:

1. <https://nptel.ac.in/courses/105/106/105106201/>

### Course Outcomes

On completion of the course, the students will be able to:

1. Explain the basic requirements of civil engineering components.
2. Evaluate area for irregular shaped bodies.
3. Explain the various building materials.
4. Plan the building against the fire.
5. Discuss the highway development in India.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	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>CO1</b>	2	1	-	-	-	1	-	-	-	-	-	-	-	-
<b>CO2</b>	2	1	-	-	-	1	-	-	-	-	-	-	-	-
<b>CO3</b>	2	1	-	-	-	1	-	-	-	-	-	-	-	-
<b>CO4</b>	2	1	-	-	-	1	-	-	-	-	-	-	-	-
<b>CO5</b>	2	1	-	-	-	1	-	-	-	-	-	-	-	-
<b>Average</b>	2	1	-	-	-	1	-	-	-	-	-	-	-	-

<b>AY: 2022-23</b> Onwards	<b>J. B. INSTITUTE OF ENGINEERING AND TECHNOLOGY</b> (UGC Autonomous)	<b>B. Tech-CSE</b> <b>III Year- I</b> <b>Sem</b>			
Course Code: <b>L310B</b>	<b>Introduction to Computer Networks</b> <b>(Open Elective -I)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Knowledge on Programming for Problem Solving

**Course Objectives:**

The students should be able to

1. Understand importance of Internet, Computer networks, and their elements
2. Identify the data link layer design Issues and protocols.
3. Examine design issues of network layer and corresponding protocols.
4. Identify the transport layer services and demonstrate the working of its protocols.
5. Identify the application layer services, protocols like HTTP, FTP, E-Mail etc.

**Module 1:**

**Overview of the Internet:** Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Comparison of the OSI and TCP/IP reference model.

**Physical Layer:** Guided transmission media, wireless transmission media.

**Connecting Devices:** Repeaters, Hubs, Switches, Gateways and Bridges.

**Module 2:**

**Data Link Layer:** Design issues, Framing, Error Detection and Error Correction, Block Coding, Hamming Distance, CRC, Flow control and error Control.

**Protocols:** Noiseless Channels, Noisy Channels

**Multi Access protocols-** Random access - ALOHA, CSMA, CSMA/CD and CSMA/CA, Controlled access, Channelization

**Module 3:**

**Network Layer:** Network layer design issues, Store and forward packet switching, connection less and connection-oriented network services.

**Internetworking:** Protocols-IPV4 and IPV6, Logical Addressing-IPV4, IPV6, Tunnelling and Packet Fragmentation.

**Address Mapping:** ARP, RARP, DHCP, ICMP and IGMP.

**Routing Algorithms:** Shortest Path Finding and Distance Vector Routing Algorithms.

**Module 4:**

**Transport Layer:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), The TCP Connection Establishment, The TCP Connection Release, The TCP sliding window, The TCP congestion control.

**Module 5:**

**Application Layer:** Introduction, services, Application layer paradigms.

**Applications:** DNS, WWW, HTTP, FTP, E-MAIL, TELNET, SNMP, SSH.

## Textbooks

1. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.

## Reference Books

1. Computer Networks,5E, Peterson, Davie, Elsevier
2. Introduction to Computer Networks and Cyber Security, Chawan -HwaWu, Irwin, CRC Publications.
3. Computer Networks and Internets with Internet Applications, Comer.

## E - Resources:

1. [https://lecturenotes.in/subject/2234/Computer\\_Network](https://lecturenotes.in/subject/2234/Computer_Network)
2. <http://nptel.ac.in/courses/106102234/>
3. <https://www.iitg.ernet.in/dgoswami/CN-Notes.pdf>
4. <http://www.coursera.org/>
5. <http://ocw.mit.edu/index.htm>.

## Course Outcomes

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

**CO1.** Demonstrate the networking concepts, various Layering approaches, functionalities and internetworking devices used and some protocols of Link layer.

**CO2.** Identify how error control, flow control can be achieved, and a medium can be shared among multiple devices,

**CO3.** Identify how to do fragmentation, assigning of logical address and judge on routing, congestion.

**CO4.** Illustrate the working of IP Protocol, other protocols of internet layer and services of transport layer.

**CO5.** Demonstrate the transport layer and application layer protocols, their working.



<b>AY 2022-23 onwards</b>	<b>J. B. Institute of Engineering and Technology (UGC Autonomous)</b>	<b>B. Tech: AI&amp;ML III Year / I Sem</b>			
Course Code: <b>L310C</b>	<b>INTRODUCTION TO MACHINE LEARNING (Open Elective I)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>
<b>Credits: 3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Data Structures, Design and Analysis of Algorithms, Python Programming & Mathematics for Machine Learning

**Course objectives:**

**The student will:**

1. To introduce the fundamental concepts of machine learning and its applications.
2. To learn the classification, clustering, regression-based machine learning algorithms
3. To understand the deep learning architectures.
4. To understand the methods of solving real life problems using the machine learning techniques.
5. Understand the limitations of machine learning algorithms.

**Module 1:**

**Introduction:** Programming Vs Learning-Types of Learning- Statistical Decision Theory – Regression-Classification- Bias Variance-Linear Regression- Multivariate Regression- Subset Selection- Shrinkage Methods  
Principal Component Regression- Partial Least squares- Linear Classification- Logistic Regression- Linear Discriminant Analysis-Perceptron- Support Vector Machines

**Module 2:**

**Neural Networks**-Introduction- Early Models- Perceptron Learning- Backpropagation- Initialization- Training & Validation- Parameter Estimation – MLE- MAP-Bayesian Estimation

**Decision Trees**- Regression Trees- Stopping Criterion & Pruning loss functions- Categorical Attributes- Multiway Splits- Missing Values- Decision Trees – Instability Evaluation Measures

**Module 3:**

**Ensemble Learning**-Bootstrapping & Cross Validation-Class Evaluation Measures- ROC curve- MDL- Ensemble Methods – Bagging- Committee Machines and Stacking- Boosting

Gradient Boosting- Random Forests- Multi-class Classification- Naive Bayes- Bayesian Networks

**Module 4:**

Undirected Graphical Models- HMM- Variable Elimination-Belief Propagation- Partitional Clustering, Hierarchical Clustering

Birch Algorithm, CURE Algorithm, Density-based Clustering- Gaussian Mixture Models Expectation Maximization

## **Module 5:**

Deep Learning Architectures and Applications: Convolution neural networks (CNN) - Layers in CNN - CNN architectures.

Recurrent Neural Network. Applications: Speech-to-text conversion- image classification-time series prediction. Recent trends in various learning techniques of machine learning and classification methods for solving real world problems.

### **Text Books:**

1. The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman (2009). Springer-Verlag.
2. Pattern Recognition and Machine Learning, by Christopher Bishop, Springer 2006
3. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2019
4. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.

### **Reference Books:**

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2. Francois Chollet, "Deep Learning with Python, Manning Publications, Shelter Island, New York, 2018.
3. Navin Kumar Manaswi, Deep Learning with Applications using Python, Apress, New York, 2018.

### **Course outcomes:**

#### **The student will be able to:**

1. Identify the basic concepts of machine learning.
2. Predict the various classification, clustering, and regression algorithms.
3. Apply the deep learning architectures for real world problems.
4. Implement a method for solving real life problem using a suitable machine learning technique.
5. Prioritize the various Machine Learning algorithms.

<b>AY 2022-23 Onwards</b>	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: AI&amp;DS III Year –I Sem</b>			
<b>Course Code: L310D</b>	<b>OPEN ELECTIVE – I FUNDAMENTALS OF DATA SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>
<b>Credits: 3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

### **Module I: Introduction to Data Science & Big Data**

#### **Unit 1:**

Evolution of Data Science, Data Science Roles, Stages in a Data Science Project, Applications of Data Science in various fields, Data Security Issues.

#### **Unit 2:**

Introduction to Big Data, Elements of Big Data, Big Data Classification, Structured, Un Structured and Semi Structured Data

### **Module II: Data Collection and Data Pre processing**

Unit 1: Data Collection Strategies, Data Pre-Processing Overview

Unit 2: Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization

### **Module III: Exploratory Data Analytics**

#### **Unit 1:**

Introduction to Exploratory Data Analytics, Visualization the data (Histogram, bar plot, box plot, pie chart, scatter plots)

#### **Unit 2:**

Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, Box Plots, Pivot Table, Correlation Statistics, ANOVA

### **Module IV: Model Development**

#### **Unit 1:**

Introduction to Regression, Simple and Multiple Regression, Model Evaluation using Visualization

#### **Unit 2:**

Residual Plot, Distribution Plot, Polynomial Regression and Pipelines, Measures for In-sample Evaluation, Prediction and Decision Making.

### **Module V: Model Evaluation**

#### **Unit I:**

Generalization Error, Out-of-Sample Evaluation Metrics, Cross Validation, Overfitting, Under Fitting and Model Selection.

#### **Unit II:**

Prediction by using Ridge Regression, Testing Multiple Parameters by using Grid Search.

### **REFERENCES:**

1. Jojo Moolayil, "Smarter Decisions: The Intersection of IoT and Data Science", PACKT, 2016.
2. Cathy O'Neil and Rachel Schutt, "Doing Data Science", O'Reilly, 2015.
3. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big Data Analytics", EMC 2013
4. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data

Analytics”, IGI Global.

**Course outcomes:**

1. Analyze the fundamental concepts of Data Science.
2. Evaluate the Data analysis and Data Science Process and Linear Regression.
3. Analyze the various methods of Data Analysis.
4. Apply the Basics of R in its Environment
5. Evaluate the Data Science analysis using R programming and Data Visualization

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech:ECE</b> <b>III Year-I</b> <b>Sem</b>			
Course Code: <b>L31OE</b>	<b>PRINCIPLES OF COMMUNICATIONS</b> (OE-01)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Basic electronics and Electricals

**Course Objectives:** Distinguish analog and digital Modulation techniques used in various Communication systems.

**Module 1: Introduction [10L]**

**Unit-I: [6L]**

Block diagram of Electrical communication system, Radio communication: Types of communications, analog, pulse and digital types of signals, Introduction to Modulation, Need for Modulation,

**Unit-II: [4L]**

**Amplitude Modulation:** Ordinary Amplitude Modulation – Modulation index, Side bands, AM Power, Double Side Band Suppressed Carrier Modulation, Single Side Band Modulation, Vestigial Side Band Modulation, AM demodulation, Applications of AM.

**Module 2: Angle Modulation [9L]**

**Unit-I: [5L]**

**Angle Modulation:** Phase Modulation fundamentals, Frequency Modulation – Modulation index and sidebands, Narrowband FM, Wideband FM, Comparison of Phase Modulation and Frequency Modulation verses Amplitude Modulation, FM demodulation, Applications of FM.

**Unit-II: [4L]**

Types of noise, sources of noise, calculation of noise in Linear systems and noise figure.

**Module 3: Pulse Modulations [8L]**

**Unit-I: [4L]**

**Signal Sampling and Analog Pulse Communication:**

Sampling, Nyquist rate of sampling, sampling theorem for Band limited signals, PAM, regeneration of base band signal, PWM and PPM.

**Unit-II: [4L]**

Time Division Multiplexing, Frequency Division Multiplexing, Asynchronous Multiplexing.

**Module 4: Digital Communication [10L]**

**Unit-I: [5L]**

Advantages, Block diagram of PCM, Quantization, and effect of quantization, quantization error, Base band digital signal, DM, ADM, DPCM and comparison.

**Unit-II: [5L]**

**Transmission of Binary Data in Communication Systems:** ASK, FSK, PSK, DPSK, QPSK demodulation, coherent and incoherent reception,

**Module 5: Information Theory [9L]**

**Unit-I: [5L]**

Concept of information, rate of information and entropy, Source coding for optimum rate of information, coding efficiency,

**Unit-II: [4L]**

Shanon-Fano and Huffman coding and its problems

### Text Books

1. Communication Systems Analog and Digital – R.P. Singh and SD Sapre, TMH, 20th reprint, 2004.
2. Principles of Communications – H. Taub and D. Schilling, TMH, 2003.

### Reference Books

1. Electronic Communication Systems – Kennedy and Davis, TMH , 4th edition, 2004.
2. Communication Systems Engineering -John. G. Proakis and MasoudSalehi, PHS, 2nd ed.2004.

### E-Resources

1. <https://nptel.ac.in/courses/Nanoelectronics/IITMadras/ab1011/102/111102111/>

### Course Outcomes

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

**CO1. Illustrate** the main concepts of analog and digital communication systems.

**CO2. Analyze** the AM and FM modulator/demodulator

**CO3. Explain**, discuss, and compare different binary digital modulation techniques.

**CO4. Distinguish** different types of noise and explain the effects of noise on communication system.

**CO5. Use** the basic concepts of information theory.

### 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	PS O1	PS O2
<b>CO1</b>	3	1	-	-	-	-	-	-	-	-	-	1	1	-
<b>CO2</b>	2	2	1	-	-	-	-	-	-	-	-	-	2	-
<b>CO3</b>	1	1	-	-	-	-	-	-	-	-	-	-	1	-
<b>CO4</b>	1	1	-	-	-	-	-	-	-	-	-	-	2	-
<b>CO5</b>	2	2	-	-	-	-	-	-	-	-	-	-	1	-
<b>Average</b>	<b>2.0</b>	<b>2.0</b>	<b>1.0</b>	-	-	-	-	-	-	-	-	<b>1.0</b>	<b>1.2</b>	-

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech ECM</b> <b>III Year-I</b> <b>Sem</b>			
Course Code: <b>L310F</b>	<b>FUNDAMENTALS OF DIGITAL LOGIC DESIGN</b> <b>(Open Elective -I)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Basics of Boolean algebra

**Course Objectives:**

Students will learn to

1. Understand basic tools for the design of digital circuits and fundamental concepts used in the design of digital systems.
2. Understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
3. Implement simple logical operations using combinational logic circuits.
4. Design combinational logic circuits, sequential logic circuits.
5. Impart the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.

**Module 1:**

**Unit 1: Binary Systems:**

Digital systems, binary numbers, number base conversions, octal and hexadecimal numbers, complements, signed binary numbers, binary codes, binary storage and registers, binary logic.

**Module 2:**

**Unit-I: Boolean Algebra And Logic Gates**

Basic definitions, axiomatic definition of boolean algebra, basic theorems and properties of boolean algebra, boolean functions canonical and standard forms, other logic operations, digital logic gates, integrated circuits.

**Module 3:**

**Unit-I: Gate – Level Minimization**

The map method, four-variable map, five-variable map, product of sums simplification don't-care conditions, nand and nor implementation other two-level implementations, exclusive – or function, hardware description language (hdl).

**Module 4:**

**Unit-I: Combinational Logic**

Combinational circuits, analysis procedure design procedure, binary adder-subtractor decimal adder, binary multiplier, magnitude comparator, decoders, encoders, multiplexers, hdl for combinational circuits.

**Module 5:**

**Unit-I:**

Registers, shift registers, ripple counters synchronous counters, other counters, hdl for registers and counters.

### Text Books

1. Digital design – third edition ,m.morrismano, pearson education/phi.
2. Fundamentals of logic design, roth, 5th edition,thomson.

### Reference Books

1. Switching and finite automata theory by zvi. Kohavi, tatamcgraw hill.
2. Switching and logic design, c.v.s. rao, pearson education
3. Digital principles and design – donaldd.givone, tatamcgraw hill, edition.
4. Fundamentals of digital logic & micro computer design , 5th edition, m. Rafiquzzaman john wiley

### E-Resources

1. <https://nptel.ac.in/courses/106/105/106105185/>
2. <https://www.coursera.org/learn/digital-systems>

### Course Outcomes

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

**CO1.** Manipulate numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, gray, and BCD.

**CO2.** Build Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.

**CO3.** Design and analyze small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.

**CO4.** Analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.

**CO5.** Construct digital systems by Algorithmic State Machine Charts

### 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	PS O1	PS O2
<b>CO1</b>	3	2	1	-	-	-	-	-	-	-	-	2	2	-
<b>CO2</b>	3	2	-	-	1	-	-	-	-	-	-	2	1	2
<b>CO3</b>	3	-	2	2	1	-	-	-	-	-	-	-	2	2
<b>CO4</b>	3	2	2	2	1	-	-	-	-	-	-	-	2	-
<b>CO5</b>	2	2	2	1	1	-	-	-	-	-	-	-	-	2
<b>Average</b>	2.4	2	1.75	1.67	1	-	-	-	-	-	-	-	1.75	2

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



<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: EEE</b> <b>III Year-I</b> <b>Sem</b>			
Course Code: <b>L310G</b>	<b>Energy Engineering</b> <b>(OPEN ELECTIVE-I)</b>	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

#### **MODULE-I: Fundamentals of Energy: [10L]**

Energy consumption and standard of living, Classification of energy resources, Consumption trend of primary energy resources, importance and salient features of conventional energy sources and non- conventional energy sources, Energy scenario in India.

#### **MODULE-II: Energy Sources-I: :( Elementary Aspects) [10L]**

Coal fired steam thermal power plant – layout, working, Gas turbine power plant, Nuclear power plants, Hydro Electric plants.

#### **MODULE-III: Energy Sources-II :( Elementary Aspects): [10L]**

Solar energy, OTEC, Wind power plants, Tidal power plants and geothermal resources, Biomass, Fuel cell.

#### **MODULE-IV: Environmental Pollution and Control: [10L]**

Overview of Environmental Concepts: Global Warming - Ozone Layer & UV Radiations - Deforestation Pollution Control: Air Pollution, Solid Waste, Water Pollution, Influence of pollution regionally and globally.

#### **MODULE-V: Energy Conservation And Management: [10L]**

Principle of energy conservation, electrical energy conservation opportunities, Definition and Objectives of Energy Management, Energy Management System, Top management support, Energy policy purpose, Roles and responsibilities of energy manager.

#### **Text Books**

1. S.Rao and Dr.B.B.Parulekar, "Energy Technology", Khanna pub., Third edition, 1999.
2. Non-conventional energy resources by B.H.Khan, TMH, 2006.
3. Desai,AV, "Energy Demand: Analysis, Management and Conservation", Wiley Eastern Limited,1990.

#### **Reference Books**

1. Management of Energy Environment Systems, W.K.Foell, John Wiley and Sons.
2. Environmental Impact Analysis Handbook, J.G.Rau, D.C.Wood, Mc Graw Hill.
3. Energy & Environment, J.M. Fowler, Mc Graw Hill.
4. Power Plant Engineering, P.K.Nag / Tata McGraw Hill.
5. G.D.Rai, "Non-conventional energy sources", Khanna pub. Fourth Edition, 2002.
6. Energy Management Handbook, John Wiley & Sons, Wayne C.Turner.

#### **E-Resources**

1. <http://nptel.ac.in/courses/112105051/>
2. [https://www.youtube.com/watch?v=Ota2\\_LUuar0](https://www.youtube.com/watch?v=Ota2_LUuar0)
3. <https://www.youtube.com/watch?v=3dJAtHaSQ98>
4. <https://www.youtube.com/watch?v=xokHLFE96h8>
5. <http://www.tatapower.com/businesses/renewable-energy.aspx>
6. <http://www.cleanlineenergy.com/technology/wind-and-solar>

### Course Outcomes

The students will be able to:

- CO 1.**Collect and organize information on renewable energy technologies as a basis for further analysis
- CO 2.**Describe the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the impact on the environment.
- CO 3.**List and describe the primary renewable energy resources and technologies.
- CO 4.**Understand effect of using these sources on the environment and climate.
- CO 5.**To quantify energy demands and make comparisons among energy uses, resources, and technologies

### 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>CO1</b>	-	-	2	-	-	3	2	3	-	-	-	-	-	2
<b>CO2</b>	-	-	3	-	-	2	3	2	-	-	-	-	-	3
<b>CO3</b>	-	-	3	-	-	3	3	3	-	-	-	-	-	2
<b>CO4</b>	-	-	3	-	-	3	3	2	-	-	-	-	-	3
<b>CO5</b>	-	-	3	-	-	2	3	3	-	-	-	-	-	2
<b>Average</b>	-	-	2.8	-	-	2.6	2.8	2.6	-	-	-	-	-	2.4

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech:IT</b> <b>III Year - I</b> <b>Sem</b>			
Course Code: <b>L310H</b>	(Open Elective-I)	L	T	P	D
Credits: <b>3</b>	<b>Open Source Software's</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

### **Unit I introduction to Open-Source:**

Open Source, Need and Principles of OSS, Open-Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Free Software Vs. Open-Source Software, Public Domain. History of free software, Proprietary Vs Open-Source Licensing Model, use of Open- Source Software, FOSS does not mean no cost. History: BSD, The Free Software Foundation and the GNU Project.

### **Unit II Open-Source Principles and Methodology:**

Open-Source History, Open- Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open-Source Software Development, Licenses, Copyright vs. Copy left, Patents, Zero marginal cost, Income-generation Opportunities, Internationalization.

### **Unit III Understanding Open-Source Ecosystem:**

Open-Source Operating Systems: GNU/Linux, Android, Free BSD, Open Solaris. Open-Source Hardware, Virtualization Technologies, Containerization Technologies: Docker, Development tools, IDEs, Debuggers, Programming languages, LAMP, Open-Source Database technologies.

### **Unit IV Open-Source Ethics and Social Impact:**

Open source vs. closed source, Open-source Government, Ethics of Open-source, Social and Financial impacts of open-source technology, shared software, Shared source, Open Source as a Business Strategy

### **Unit V Case Studies:**

Example Projects-Mozilla (Firefox), Wikipedia, GitHub, Open Office, LibreOffice.

### **Course Outcomes:**

**CO 1:** Differentiate between Open Source and Proprietary software and Licensing.

**CO 2:** Recognize the applications, benefits and features of Open-Source Technologies

**CO 3:** Gain knowledge to start, manage open-source projects

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year - I</b> <b>Sem</b>			
Course Code: <b>L310I</b>	<b>AUTOMOTIVE TECHNOLOGY</b> (Open Elective-I)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics.

### Module 1:

**Unit-1: Structural Systems of Automobile**– Chassis and Body, Power unit, Transmission System, Rear wheel drive, Front wheel drive, 4-wheel drive.

**Unit-2: Other systems of Automobile**- Ignition systems, Fuel System, Cooling System, Electrical System.

### Module 2:

**Unit-1: Fuels:** Types of Fuels – Gasoline fuels, CNG, Biofuels, Hydrogen as a fuel for IC Engines, advantages and limitations.

**Unit-2: Steering, Suspension and Braking Systems:** Terminology in Steering geometry, Ackerman steering mechanism, Davis steering mechanism, steering linkages. Objects of suspension systems – Rigid axle suspension system. Mechanical brake system, Hydraulic brake system – Requirement of brake fluid. Pneumatic and Vacuum brakes.

### Module 3:

**Unit-1: Fuel Cell and Solar Vehicles:** Fuel cell vehicle – Operating principle, types of fuel cells, fuel cell options for fuel cell vehicle and fuel cell hybrid vehicle. Solar vehicle - Solar photovoltaic cell, solar array, solar car electrical system and drive train.

**Unit-2: Electric and Hybrid Vehicles:** Electric vehicles - Layout of an electric vehicle, performance, energy consumption, advantage and limitations. Hybrid electric vehicles - Concepts, types of hybrid drive train architecture, merits and demerits.

### Module 4:

**Unit-1: Telematics Systems:** Global positioning system, geographical information systems, navigation system.

**Unit-2: Comfort Systems:** Automotive vision system, active suspension system, power steering and power windows.

### Module 5:

**Unit-1: Safety Systems:** Active and passive safety, airbags, seat belt tightening system, collision warning systems, anti-lock braking systems, traction control system.

**Unit-2: Emission and noise control regulations**- Pollution standards, National and international – Pollution Control – Techniques – Noise Pollution & control.

### Text Books

1. William B Riddens, "Understanding Automotive Electronics", 5th edition, Butter worth Heinemann Woburn, 1998.

2. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2005.
3. Kripal Singh, "Automobile Engineering", Standard Publishers, Vol. 1 & 2, 2007

### Reference Books

1. Automotive Hand Book" Robert Bosch, SAE, 5th edition, 2000.
2. Ljubo Vlacic, Michel Parent and Fumio Harashima, "Intelligent Vehicle Technologies", Butterworth-Heinemann publications, Oxford, 2001.
3. Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
4. "Navigation and Intelligent Transportation Systems – Progress in Technology", Ronald K Jurgen, Automotive Electronics Series, SAE, USA, 1998.

### E-Resources

1. <https://rb.gy/zm8le8>
2. <https://rb.gy/ceck4k>
3. <https://nptel.ac.in/courses/107/106/107106088/>
4. <https://nptel.ac.in/courses/108/102/108102121/>

### Course Outcomes

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

**CO1:** Outline the overview of automobile engineering

**CO2:** Identify the different fuels and control systems

**CO3:** Develop the concepts and drive train configurations of electric and hybrid-electric vehicles

**CO4:** Apply the use of intelligent vehicle technologies like navigation in automobiles

**CO5:** Aware of safety, security and regulations

### 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	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
<b>CO1</b>	3	-	3	3	3	-	-	-	-	-	-	2	3	3
<b>CO2</b>	3	-	3	3	3	-	-	-	-	-	-	2	3	3
<b>CO3</b>	3	-	3	3	3	-	-	-	-	-	-	2	3	3
<b>CO4</b>	3	-	3	3	3	-	-	-	-	-	-	2	3	3
<b>CO5</b>	3	-	3	3	3	-	-	-	-	-	-	2	3	3
<b>Average</b>	3	-	3	3	3	-	-	-	-	-	-	2	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech -MIE</b> <b>III Year-I</b> <b>Sem</b>			
Course Code: <b>L310J</b>	<b>INTRODUCTION TO MINING TECHNOLOGY</b> <b>(OPEN ELECTIVE – I)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Nil

### **Course Objectives**

This course will enable students to:

1. To introduce about distribution of mineral deposits in India
2. To acquaint with different stages of mining process
3. To get idea about Drilling and its machinery
4. To get idea about Explosives and blasting in mines
5. To know about shaft sinking methods, precaution & lining during shaft sinking

### **Module 1**

**Introduction:** Distribution of mineral deposits in India and other countries, mining contributions to civilization, mining terminology.

### **Module 2**

**Stages in the life of the mine** - prospecting, exploration, development, exploitation, and reclamation. Access to mineral deposit- selection, location, size, and shape (incline, shaft and Adit), brief overview of underground and surface mining methods.

### **Module 3**

**Drilling:** Types of drills, drilling methods, electric, pneumatic, and hydraulic drills, drill steels and bits, drilling rigs, and jumbos.

### **Module 4**

**Explosives:** Classification, composition, properties and tests, fuses, detonators, blasting devices and accessories, substitutes for explosives, handling and storage, transportation of explosives.; **Rock blasting:** Mechanism of rock blasting, blasting procedure, and pattern of shot holes.

### **Module 5**

**Shaft sinking:** Ordinary and special methods, problems, and precautions, shaft supports and lining.

### **Textbooks**

1. R. P. Pal, Rock blasting effect and operation, A. A. Balkema, 1st Ed, 2005.
2. D. J. Deshmukh, Elements of mining technology, Vol. 1, Central techno, 7th Ed, 2001.

### **Reference Books**

1. C. P. Chugh, Drilling technology handbook, Oxford and IBH, 1st Ed, 1977.
2. R. D. Singh, Principles and practices of modern coal mining, New age international, 1st Ed, 1997.

### **Course Outcomes**

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

**CO1:** Learn about distribution of mineral deposits in India

**CO2:** Learn about stages on mining process

**CO3:** Learn about drilling and its machinery

**CO4:** Understand about explosives, blasting and blasting mechanism

**CO5:** Understand about shaft sinking methods, precautions, and lining of shafts

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	B. Tech - <b>MBA</b> III Year-I Sem			
Course Code: <b>L310K</b>	Open Elective-I <b>Entrepreneurship for Micro, Small and Medium Enterprises</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Course Objective:**

To understand the setting up and management of MSMEs and initiatives of Government and other institutions support for growth and development of MSMEs.

**UNIT-I:**

**Introduction for Small and Medium Entrepreneurship (SME):** Concept & Definition, Role of Business in the modern Indian Economy SMEs in India, Employment and export opportunities in MSMEs. Issues and challenges of MSMEs

**UNIT-II:**

**Setting of SMEs':** Identifying the Business opportunity, Business opportunities in various sectors, formalities for setting up an enterprise - Location of Enterprise – steps in setting up an enterprise – Environmental aspects in setting up, Incentives and subsidies, Rural entrepreneurship – Women entrepreneurship.

**UNIT-III:**

**Institutions supporting MSMEs:** –Forms of Financial support, Long term and Short term financial support, Sources of Financial support, Development Financial Institutions, Investment Institutions, Central level institutions, State level institutions, Other agencies, Commercial Bank – Appraisal of Bank for loans. Institutional aids for entrepreneurship development – Role of DST, SIDCO, NSIC, IRCI, NIDC, SIDBI, SISI, SIPCOT, Entrepreneurial guidance bureaus

**UNIT-IV:**

**Management of MSME:** Management of Product Line; Communication with clients - Credit Monitoring System - Management of NPAs - Restructuring, Revival and Rehabilitation of MSME, Problems of entrepreneurs – sickness in SMI – Reasons and remedies -- Evaluating entrepreneurial performance.

**UNIT-V:**

**Role of Government in promoting Entrepreneurship:** MSME policy in India, Agencies for Policy Formulation and Implementation: District Industries Centers (DIC), Small Industries Service Institute (SISI), Entrepreneurship Development Institute of India (EDII), National Institute of Entrepreneurship & Small Business Development (NIESBUD), National Entrepreneurship Development Board (NEDB).

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

- a) Issues and Challenges in MSMEs
- b) Setting up of MSMEs



- c) Management of MSMEs
- d) Institution and Government support.

**Suggested Readings:**

1. Vasant Desai, Small Scale Industries and Entrepreneurship, Himalaya Publishing House, 2003.
2. Poornima M Charanthimath, Entrepreneurship Development Small Business Enterprises, Pearson, 2006.
3. Paul Burns & Jim Dew Hunt, Small Business Entrepreneurship, Palgrave Macmillan publishers, 2010.
4. Suman Kalyan Chaudhury, Micro Small and Medium Enterprises in India Hardcover, Raj Publications, 2013.
5. Aneet Monika Agarwal, Small and medium enterprises in transitional economies”, challenges and opportunities, DEEP and DEEP Publications.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech SH</b> <b>III Year-I</b> <b>Sem</b>			
Course Code: <b>L310L</b>	<b>Open Elective-I</b> <b>Numerical Solution of Ordinary</b> <b>Differential Equations</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

### Pre-Requisites:

#### **Module –I Solution of Equations and Eigen value Problems [ 10L ]**

Solution of algebraic and transcendental equations - Fixed point iteration method - Newton Raphson method- Solution of linear system of equations - Gauss elimination method - Pivoting - Gauss Jordan method - Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method.

#### **Module 2: Interpolation and Approximation [9L]**

Interpolation with unequal intervals - Lagrange's interpolation - Newton's divided difference interpolation - Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

#### **Module 3: Numerical Differentiation and Integration [10L]**

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule - Romberg's method - Two point and three point Gaussian quadrature formulae Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

#### **Module 4: Initial Value Problems for Ordinary Differential Equations[10L]**

Single Step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and AdamsBash forth predictor corrector methods for solving first order equations.

#### **Module5: Boundary Value Problems in Ordinary Differential Equations[9L]**

Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two-dimensional Laplace's and Poisson's equations on rectangular domain - One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods - One dimensional wave equation by explicit method.

### Text Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2015
2. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill, 5<sup>th</sup> Edition, New Delhi, 2007.

### Reference Books

1. R.K.Jain & S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5<sup>th</sup> Edition, 2015.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,11<sup>th</sup>Reprint, 2010.

## E-Resources

1. [http://www.brainkart.com/article/Solution-of-Equations-and-Eigenvalue-Problems\\_6462/](http://www.brainkart.com/article/Solution-of-Equations-and-Eigenvalue-Problems_6462/)
2. <http://www.cs.nthu.edu.tw/~cchen/CS3331/ch6.pdf>
3. <http://www.vbspu.ac.in/wp-content/uploads/2016/02/Differentiation-and-Integration.pdf>
4. [https://link.springer.com/chapter/10.1007/978-1-4612-6390-6\\_4](https://link.springer.com/chapter/10.1007/978-1-4612-6390-6_4)
5. <https://www.youtube.com/watch?v=ZaaeInBsRfo>

## Course Outcomes

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

**CO1.** Understand the basic knowledge on solution of Eigen values

**CO2.** Use interpolation and approximation to solve engineering problems.

**CO3.** Discuss the numerical differentiation and integration.

**CO4.** Apply initial value problems for solving first order differential equation.

**CO5.** Apply the boundary value problems in ordinary and partial differential equations

## 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	PS O1	PS O2
<b>CO1</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-
<b>CO2</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-
<b>CO3</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-
<b>CO4</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-
<b>CO5</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-
<b>Average</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech -SH</b> <b>III Year- I</b> <b>Sem</b>			
Course Code: <b>L310M</b>	<b>NANOMATERIALS</b> <b>(Open Elective-I)</b>  (COMMON TO: All branches)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Fundamentals of Physics.

### **Module -1: Introduction to Nanomaterials [9L]**

Introduction to nanotechnology and materials, Nano materials, Introduction to nano sizes and properties comparison with the bulk materials, Different Shapes and Sizes and Morphology. Classification of nanomaterials. Fullerene, carbon, Nanotubes (CNT's), Nanoparticles. Physical, Chemical, Electrical, Optical, Magnetic and mechanical properties of nanomaterials.

### **Module -2: Physical and Chemical methods [9L]**

#### **Physical Methods:**

Bottom-up approach and Top-down approach, Inert gas condensation, Arc Discharge, lasers ablation, laser pyrolysis, ball milling, and electro deposition.

**Chemical Methods:** Nanocrystals by chemical reduction, photochemical synthesis, electrochemical synthesis, Nano crystals of semiconductors.

### **Module-3: Synthesis of Nanomaterials [9L]**

Thermolysis route – spray pyrolysis and solvated metal atom dispersion, sol-gel method solvothermal and hydrothermal routes, solution combustion synthesis, CVD method, PVD method.

### **Module-4: Properties of Nanomaterials [9L]**

Quantum Structure: 3D-Potential Wells (Spherical & Rectangular Parallelepiped), 2D (Circular & Square, Quantum Corrals), 1D (Quantum Wires), 0D (Quantum Dots).

### **Module-5: X-RAY Characterization techniques [9L]**

X-Ray Photoelectron Spectroscopy (XPS), Energy Dispersive X-Ray Analysis (EDAX), Principles and applications of X-Ray Diffraction, Electron Diffraction, and Electron probe microanalysis(EPMA), SEM and TEM method.

### **Text Books**

- 1.C N R Rao, A Muller and A K Cheetham "The chemistry of Nano materials: Synthesis, Properties and Applications" John Wiley, First Edition, 2004
2. Hari Singh Nalwa, "Nano structured Materials and Nanotechnology", Academic Press, First Edition, 2002.

### **Reference Books**

- 1.Charles P Poole Jr "Introduction to Nanotechnology", John Willey & Sons, 1st Edition, 2003
- 2.C Dupas, P Houdy, M Lahmani, Nanoscience: "Nanotechnologies and Nano physics", Springer-Verlag Berlin Heidelberg, 1st Edition, 2007.

## **E-Resources**

1. <http://nptel.ac.in/courses/103103033/module9/lecture1.pdf>
2. [http://courses.washington.edu/overney/NME498\\_Material/NME498\\_Periods/Lecture4-Overney-NP-Synthesis.pdf](http://courses.washington.edu/overney/NME498_Material/NME498_Periods/Lecture4-Overney-NP-Synthesis.pdf).
3. <http://www.materialstoday.com/nanomaterials/journals/>
4. <https://www.journals.elsevier.com/nanoimpact>
5. <http://www.springer.com/materials/nanotechnology/journal/12274>

## **Course Outcomes**

After completion of this course the student is able to

1. Understand the properties of Nano-structured materials.
2. Get the knowledge of different physical and chemical methods of synthesis of Nano materials.
3. Apply basic knowledge on the properties and applications of few nanomaterials.
4. Understand different thermal methods of synthesis of nano materials and to learn different surface characterization techniques.
5. Acquire the different compositional and structural characterization techniques.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech -SH</b> <b>III Year-I</b> <b>Sem</b>			
Course Code: <b>L310N</b>	<b>Chemistry of Engineering Materials</b> <b>(Open Elective-I)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Nil

### **Module 1: Phase Rule and alloys [8L]**

Phase Rule: Definition of terms: Phase, component, degree of freedom, phase rule equation. Phase diagrams-one component system-water system. Two component system Lead-Silver, cooling curves, heat treatment based on iron-carbon phase diagram - hardening, annealing and normalization. Introduction to alloys-fabrication of alloys-ferrous alloys-nonferrous alloys-industrial applications.

### **Module 2: Composites, Abrasives and Adhesives [10L]**

Composites: Basics of composites, composition and characteristics-types of composites -particle and fiber reinforced composites and their applications. Abrasives- natural and artificial abrasives-grinding wheels-abrasive paper and cloth. Adhesives- classification -action of adhesives- factors influencing adhesive action development of adhesive strength.

### **Module 3: Cement and Concrete: [10L]**

Introduction-Classification of cement-natural-chemical composition of cement-Portland cement-chemical reactions involved in setting and hardening of cement-additives for cement-mortars and concretes-pre stressed concrete-post tensioning-curing-overall scenario of cement industry-Reinforced concrete, constructions-testing and decaying of cement-prevention of cement decay.

### **Module 4: Glass, Ceramics and Refractories:[9L]**

Structure of glass-properties-Manufacturing of glass-Types of glasses-uses Ceramics-clays-methods for fabrication of ceramic ware plasticity of clays. Ceramic products-glazes. Porcelain and vitreous enamels. Requisites of a good refractory-classification, properties and applications of refractories.

### **Module 5: Colloids and surfactants[9L]**

Introduction to solution-types of colloids-characteristics of lyophilic and lyophobic solutions-preparation of colloids (Dispersion methods & Aggregation methods)-purification of colloids (Dialysis, Electro dialysis and Ultrafiltration).Characteristics of colloidal solutions-coagulation of colloids-origin of charge on colloids-protective colloids-emulsions-gels-applications of colloids. Introduction to surfactants-classification of surfactants-CMC (critical micelle concentration)-HLB scale-detergents-cleaning action.

### **Text Books**

1. "A text Book of Engineering Chemistry", P.C.Jain and Monica Jain, Dhanpat Rai Publications, New Delhi, 12th Edition 2006.
2. "Text Book of Engineering chemistry", B.Rama Devi, Ch.VenkataRamana

Reddy and PrasanthaRath, Cengage Learning India Pvt. Ltd, 2016.

3. "Colloids and Interfaces with Surfactants and Polymers", J. Goodwin, 2nd Edition 2009.

### Reference Books

1. "Principles of Physical Chemistry", B.R.Puri, L.R.Sharma and M.S.Pathania, S.Nagin Chand &Co., New Delhi, 23rd Edition, 1993.
2. "Engineering Chemistry", M.ThirumalaChary and E.Laxminarayana, SciTech publications(INDIA) PVT Ltd, Third Edition, 2016

### E-Resources

1. <https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/materials-science.html>
2. <https://www.sciencedirect.com/science/article/pii/S1369702110701875>
3. <https://engineering.purdue.edu/MSE/aboutus/whatsmaterials>
4. <https://www.engineergirl.org/32721/Difference-between-chemical-and-materials-engineering>
5. <https://www.webpages.uidaho.edu/catalog/2013/chemical-and-materials-engineering.htm>

### Course Outcomes

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

1. Interpret the vitality of phase rule in metallurgy and application of phase rule to one and two component systems.
2. Understand the concepts of abrasives, adhesives and liquid.
3. Know the importance of basic constructional material, Portland cement in Civil Engineering works.
4. Acquire the knowledge about properties and applications of glass, ceramics and refractories.
5. Understand the relationships between macroscopic material properties and microscopic structures.

<b>AY 2022-23 onwards</b>	<b>J. B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)</b>	<b>B. Tech -SH III Year – I Sem</b>			
Course Code: <b>L3100</b>	<b>TECHNICAL WRITING SKILLS (COMMON TO ALL)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>
<b>Prerequisites: Nil</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Course Objectives:** To learn

1. Know the elements of effective writing
2. Understand the letter writing and resume writing
3. Classify the types and styles of report writing
4. Understand the proposal writings
5. Examine the research papers and research articles

#### **Module-I Elements of Effective Writing**

Introduction-Characteristics of Good Writing-words, phrases, sentences and developing effective paragraphs.

#### **Module -II Academic Writing**

Letter writing and Job Application: Introduction-types of letter writing-the seven C's of letter writing- significance- purpose-structure-layout-principles-planning a letter and cover letter.

Resume writing: Introduction-Resume design- parts of a Resume-Resume Styles and final tips.

#### **Module -III Technical Report Writing**

Introduction-importance of Reports-Objectives of Reports-Categories of Reports-Formats-prewriting-structures of reports-types of reports- short reports- long reports-research and writing the report-first draft-revising, editing, and proofreading.

#### **Module -IV Technical Proposals**

Introduction-definition and purpose-types-characteristics-structure of proposals-style and appearance-evaluation of proposals.

#### **Module -V Writing Research Papers and Articles**

Introduction-writing strategies-nature and significance-types of research papers and articles-journal articles-conference papers-review and research articles and elements of articles.

#### **References:**

1. Raman, Meenakshi and Sangeeta Sharma. Technical Communication- Principles and Practice. Third Edition, New Delhi: UP., 2015.
2. Rizvi, M Ashraf. Effective Technical-Communication. New Delhi: Tata McGraw-Hill., 2005.
3. Butterfield, Jeff. Soft Skills for Everyone. Delhi: Cenege., 2010.
4. Cooper, Donald R. Pamela S Schindler. Business Research Methods. New Delhi: Tata McGraw-Hill, 2006.

#### **Web Sources:**

**Course outcomes:** At the end of this course students will be able to

1. Use the characteristics of good writing like words, phrases, sentences and paragraphs.
2. Understand the role of letters and resumes getting jobs.
3. Utilize the report writing skills in business environment



4. Define the style, appearance, and evaluation of proposals.
5. Write the academic and research papers and articles

<b>CO-Articulation Matrix</b>														
<b>CO-PO/PSO Mapping Chart</b>														
<b>3/2/1 indicates the strength of the calculation</b>														
<b>3-Strong, 2-Medium, 1-Low</b>														
<b>Course Outcomes (COs)</b>	<b>Program Outcomes (POs)</b>												<b>Program Specific Outcomes*</b>	
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	..	..	..	..	..	..	..	..	<b>2</b>	3	..	3	..	..
<b>CO2</b>	..	..	..	..	..	..	..	..	<b>2</b>	3	..	3	..	..
<b>CO3</b>	..	..	..	..	..	..	..	..	<b>2</b>	3	..	3	..	..
<b>CO4</b>	..	..	..	..	..	..	..	..	<b>2</b>	3	..	3	..	..
<b>CO5</b>	..	..	..	..	..	..	..	..	2	3	..	3	..	..
<b>Total</b>	..	..	..	..	..	..	..	..	<b>2</b>	<b>3</b>	..	3	..	..
The above syllabus is approved														
<b>Signature of the members:</b>														

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech -SH</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L31OP</b>	<b>Indian Constitution</b> (COMMON TO: All branches)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites: Nil**

**Module 1: Evolution of the Indian Constitution**

1909 Act, 1919 Act end 1935 Act. Constituent Assemtily Composition and Functions Fundamentals features of the Indian Constitution.

**Module 2: Union Government**

Executive: President. Prime Minister, Council of Minister

Executive: Governor, Chief Minister, Council of Minister

Local Government: Panchayat Raj Institutions, Urban Government.

**Module 3: Rights and Duties**

Fundamental Rights. Directive principles. Fundamental Duties.

**Module 4: Relation between Federal and provincial units**

Union State relations. Administrative, legislative and Financial. Inter State council. NITI Ayog Finance Commission of India

**Module 5: Statutory Institutions.**

Elections-Election Commission of India, National Human Rights Commission National Commission for Women.

**Text Books:**

1 D.D. Basu, Introduction to the constitution of India. Lexis Nexis. Now Delhi

2. Subhash Kashyap, Our Parliament, National Book Trust. New Delhi.

**Reference Books:**

1. Peu Ghosh Indian Government & Polities. Prentice Hell of India, New Delhi

2 B.Z. Fadia & Kuldeep Fadia, Indian Government & Polices, LexisNexis. New Delhi

**Course Outcomes:**

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

COI: Know the background of the present constitution of India.

CO2: Understand the working of the union, state and local levels.

CO3. Gain consciousness on the fundamental rights and duties

CO4. Be able to understand the functioning and distribution of financial resources between center and states.

Be exposed to the realty of hierarchical Indian social structure and the way the grievances the deprived sections can be addressed to raise human dignity in a democratic way

# OPEN ELECTIVE-II

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L320A</b>	<b>CONSTRUCTION MANAGEMENT, CONTRACTS AND VALUATION</b> <b>(OE-II)</b>	L	T	P	D
Credits: 3		<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Construction Technology and Project Management, Estimation and Costing.

**Module 1: Unit-I: Concept of a Project**

Characteristic features – Project Life cycle – Phases – Project Management – tools and techniques for project management – role of project managers.

**Module 2: Unit-I: Project management plan and objectives**

Programming – scheduling – project organization – organization and project team – role of communication in project management – controlling systems.

**Module 3: Unit-I: Safety Management Function**

Importance of safety in construction industry, Line versus staff authority, Safety responsibility and accountability in construction industry, Safety organizations, Role of various parties, duties, responsibilities of top management, site managers, supervisors etc., Role of safety officers, Responsibilities of general employees, Safety administration.

**Module 4: Unit-I: Types of contract documents**

Essentials of contract agreement – legal aspects, penal provisions on breach of contract. Definition of the terms – Tender, earnest money deposit, security deposit, tender forms, documents, and types. Acceptance of contract documents. Termination of contract, completion certificate, quality control, right of contractor, refund of deposit. Administrative approval – Technical sanction. Nominal muster roll, measurement books – procedure for recording and checking measurements – preparation of bills.

**Module 5: Unit-I: Valuation**

Types of value, purposes of valuation factors affecting value. Different methods of valuation for

different types of assets such as land and building, horticulture, historical places. Valuation Report, contents, standard formats, Case study of any one Report.

**Text Books**

1. "Construction Technology" by Subira K. Sarkar, Subhajit Saraswathi / Oxford University Press, 3rd edition, Apr 2009.
2. "Project management- strategic Financial Planning, Evaluation and Control" by B M Patel, Vikas Publishing House Pvt. Ltd. New Delhi, 2nd edition oct 2000.

## Reference Books

1. "Total Construction Project Management" by George J.Ritz , McGraw-Hill Inc, 2nd edition Jan 2013.
2. "Construction Project Management Planning, Scheduling and Control" by K K Chitkara

## E-Resources

1. <https://nptel.ac.in/courses/105/103/105103093/>
2. <https://nptel.ac.in/courses/105/103/105103023/>

## Course Outcomes

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

1. **Describe** the different approaches for successful handling of the project
2. **Apply** different plans and schedules for the development of the project.
3. **Describe** the importance of safety management in construction industry.
4. **List** out the different tenders and contract document for a construction project.
5. **Evaluate** the different types of reports for different construction projects

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	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>CO1</b>	2	1	-	-	2	1	-	-	2	-	3	1	1	-
<b>CO2</b>	2	1	2	-	-	-	-	-	-	-	2	2	2	-
<b>CO3</b>	2	1	-	-	-	3	-	-	-	-	-	1	1	-
<b>CO4</b>	2	1	-	-	-	2	-	-	-	-	3	-	1	-
<b>CO5</b>	2	2	-	-	-	-	-	-	-	-	2	-	1	-
<b>Average</b>	2	1.4	0.4	-	0.4	1.2	-	-	0.4	-	2	0.8	1.4	-

<b>AY: 2022-23</b> Onwards	<b>J. B. INSTITUTE OF ENGINEERING AND TECHNOLOGY</b> (UGC Autonomous)	<b>B. Tech-CSE</b> <b>III Year- II</b> <b>Sem</b>			
Course Code: <b>L32OB</b>	<b>Principles of Operating Systems</b> <b>(Open Elective -II)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:**

Knowledge on Programming for Problem Solving

**Course Objectives:**

The students should be able to

1. Understand the basic concepts and functions of computer operating systems.
2. Apply the concurrency control among the operating system programs execution.
3. Demonstrate the techniques used to manage the memory during program execution.
4. Explain the various storage management methods and functions of operating systems.
5. Design the security features against attacks on computer system.

**Module 1:**

**Overview:** Basic Elements, Evolution of the Microprocessor, Instruction Execution, Interrupts, Cache Memory, Direct Access Memory.

**System Structures:** Computer Systems Organization, Computer System Architecture, Operating System Architecture, Systems Calls, Operating System structure, Building and Booting an Operating System.

**Module 2:**

**Process Concepts:** Introduction, Process Scheduling, Scheduling Criteria, Scheduling Algorithms, Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Mutex Locks, Semaphores, Monitors, Classic Problems of Synchronization.

**Deadlock:** Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

**Module 3:**

**Main Memory:** Background, Contiguous Memory Allocation, Paging, Page-Table Structure, Swapping, Segmentation.

**Virtual Memory:** Background, Demand Paging, Page Replacement Algorithms, Frames Allocation, Thrashing.

**Module 4:**

**Mass-Storage Structure:** Overview, Disk Structure, Disk Attachment, Disk Scheduling, Swap-Space Management, RAID Structure.

**File system Management:** File Concepts, File System Structure, File System Operations, Directory Implementation, Allocation Methods, Free-Space Management.

## Module 5:

**Security Threats:** Computer security concepts, Threats, Attacks and Assets, Intruders, Malicious software, Viruses, Worms, Bots, Rootkits.

**Security Techniques:** Authentication, Access Control, Intrusion Detection, Malware Defense, Dealing with Buffer Overflow attacks.

## Textbooks

1. Operating System Concepts-A. Silberschatz, Peter B. Galvin, Greg Gagne, 10th Edition, John Wiley& Sons inc.
2. Operating Systems Internals and Design Principles – William Stallings, 7th Edition, Prentice Hall.

## Reference Books

1. Principles of Operating Systems-Naresh Chauhan, Oxford Higher Education.
2. Operating System A Design Approach-Crowley, TMH.
3. Modern Operating Systems-Andrew S Tanenbaum, 2nd Edition Pearson, PHI.

## E - Resources:

1. [https://lecturenotes.in/subject/2234/Computer Network](https://lecturenotes.in/subject/2234/Computer%20Network)
2. <http://nptel.ac.in/courses/106102234/>
3. <https://www.iitg.ernet.in/dgoswami/CN-Notes.pdf>
4. <http://www.coursera.org/>
5. <http://ocw.mit.edu/index.htm>.

## Course Outcomes

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

**CO1:** Identify the different structures and functions of operating systems and it's components.

**CO2:** Apply different algorithms and methods to achieve concurrency among the operating system programs.

**CO3:** Analyse the memory management techniques used in the execution of operating system programs.

**CO4:** Implement the suitable methods to improve the efficiency of storage management devices.

**CO5:** Apply suitable algorithms to ensure the security of computer system.

<b>AY 2022-23 onwards</b>	<b>J. B. Institute of Engineering and Technology (UGC Autonomous)</b>	<b>B. Tech: AI&amp;ML III Year / II Sem</b>			
Course Code: <b>L320C</b>	<b>INTRODUCTION TO PREDICTIVE ANALYTICS (Open Elective II)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>
<b>Credits: 3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:**

Data mining, Machine Learning

**Course objectives:**

**The student will:**

1. Know the basics of predictive analytics and summarize Data, Categorize Models, and techniques
2. Know about the Decision tree, Support Vector Machine for Data Classification
3. Describe Methods such as Naïve Bayes Markov Model, Linear Regression, Neural Networks to Boost Prediction Accuracy for Data Classification.
4. Study the predictive models for various Real-Time Applications.
5. Study the Analysis and Visualized predictive Model's results using Data Visualization tools.

**Module 1:**

**INTRODUCTION TO PREDICTIVE ANALYTICS**

Introduction – Predictive Analytics in the Wild – Exploring Data types and associated Techniques - Complexities of data - Applying Models: Models and simulation, Categorizing Models, Describing, summarizing data, and decisions – Identify similarities in Data: Data Clustering, converting Raw Data into a Matrix, Identify K-groups in Data.

**Module 2:**

**DATA CLASSIFICATION – PART I**

Background – Exploring Data classification process - Using Data Classification to predict the future: Decision tree, Algorithm for generating Decision Trees, Support Vector Machine.

**Module 3:**

**DATA CLASSIFICATION – PART II**

Ensemble Methods to Boost Prediction Accuracy: Naïve Bayes Classification Algorithm, The Markov Model, Linear Regression, Neural Networks – Deep learning.

**Module 4:**

**DATA PREPARATION AND MODELLING**

Adopt predictive analytics - Processing data: identifying, cleaning, generating, reducing dimensionality of data – Structuring Data – Build predictive model: develop and test the model.

**Module 5:**

**FORECASTING AND TIME SERIES ANALYSIS**

Forecasting- Time Series Analysis-Additive & Multiplicative models- Exponential smoothing techniques - Forecasting Accuracy - Auto-regressive and moving average models.

**Text Books:**

1. Anasse Bari, Mohamed Chaouchi, Tommy Jung, "Predictive Analytics For Dummies", Wiley Publisher, 2nd Edition, 2016.



**Reference Books:**

1. Bertt Lantz, Machine Learning with R: Expert techniques for predictive modeling to solve all your data analysis problems, Pack Publisher, 2nd Edition, 2015.
2. Aurelien, "Hands-On Machine Learning with Scikit-Learn & TensorFlow", O'Reilly Publisher, 5th Edition, 2017.
3. Max Kuhn, Kjell Johnson, " Applied Predictive Modeling" Springer, 2013.

**E - Resources:**

1. [https://vuquangnguyen2016.files.wordpress.com/2018/03/applied-predictive-modeling-max-kuhn-kjell-johnson\\_1518.pdf](https://vuquangnguyen2016.files.wordpress.com/2018/03/applied-predictive-modeling-max-kuhn-kjell-johnson_1518.pdf)
2. [https://www.researchgate.net/publication/329873035\\_Prediction\\_Modeling\\_Methodology](https://www.researchgate.net/publication/329873035_Prediction_Modeling_Methodology)
3. <https://www.coursera.org/learn/predictive-modeling-analytics>
4. <https://www.edx.org/course/predictive-analytics>

**Course Outcomes:****The student will be able to:**

1. Identify the basics of predictive analytics and summarize Data, Categorize Models, and techniques
2. Apply Decision tree, Support Vector Machine for Data Classification
3. Apply Methods such as Naïve Bayes Markov Model, Linear Regression, Neural Networks to Boost Prediction Accuracy for Data Classification.
4. Construct predictive models for various Real-Time Applications.
5. Analyze and Visualize predictive Model's results using Data Visualization tools

<b>AY 2022-23 Onwards</b>	<b>J. B. Institute of Engineering and Technology (UGC Autonomous)</b>	<b>B.Tech: AI&amp;DS III Year – II Sem</b>			
Course Code: <b>L320D</b>	<b>OPEN ELECTIVE – II BUSINESS DATA ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>
<b>Credits: 3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Course Objective:**

This course enables the students to have a formal introduction to Business Analytics and Fundamentals of R Programming

**MODULE 1: Introduction Business Analytics**

**Unit 1:**

Introduction to Business Analytics -Competing on Analytics - The New Science of Winning Business Analytics.

**Unit 2:**

Introduction to Market, Trends and People- The Paradigm Shift from Data to Insight and from Business.

**MODULE 2: Intelligence to Business Analytics**

**Unit 1:**

Intelligence to Business Analytics- Descriptive, Predictive and Prescriptive Analytics - Introduction to R programs-Running R programs.

**Unit 2:**

Mastering Fundamental R concepts -How to diagnose and correct syntax errors-

**MODULE 3: Data Sets &Variables**

**Unit 1:**

Getting familiar with R data sets- Creating R data sets- Reading data files into R - Excel, .txt, SPSS, SAS.

**Unit 2:**

Html-Assigning variable attributes Changing variable attributes,

**MODULE 4: Data Visualization**

**Unit 1:** Pixel-Oriented Visualization Techniques, Geometric Projection

Visualization Techniques. Icon-Based Visualization Techniques, Hierarchical Visualization Techniques.

**Unit 2:** Visualizing Complex Data and Relations, Charts, Plots, Maps, Diagrams and Matrices

**MODULE 5: Visualization Patterns Unit 1:**

Visualize Patterns over Time- Visualizing Relationship- Spotting Differences- Visualizing Spatial Relationships.

**Unit 2:**

Data Visualization Using R, Tools, Ggplot2, Bar chart, Pie Chart, Tableau, Plotly, Histogram, Box Plot, Scatter Plot, Heat Map.

**Text Books**

1. Essentials of Business Analytics: Camm, Cochran, others, Cengage Learning,2016

2. R for Dummies: Andrie De Vries and Joris Mays: Wiley,2016

3. Introductory Statistics with R: Peter Dalgaard, Spr

**Course Outcomes:**

1. Identify the source of a quantifiable problem, recognize the issues involved and produce an appropriate action plan.
2. Translate a problem into a statistical model
3. Gather Data and Employ R Programming software to fit model to data and solve problem
4. Calculate and interpret numerous statistical values and appreciate their value to the business Manager

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech ECE</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L320E</b>	<b>Basics of IC Technology</b> (Open Elective)	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites: NIL**

### **Module 1: INTRODUCTION TO IC TECHNOLOGIES [10L]**

#### **Unit-I: [6L]**

Fabrication steps for BJT Transistor, Fabrication steps for MOSFET Transistor, Comparison between BJT and MOSFET fabrication.

#### **Unit-II: [4L]**

Semiconductor Substrate-Crystal defects, Electronic Grade Silicon, Czochralski Growth, Float Zone Growth

### **Module 2: Wafer Preparation & Epitaxy [9L]**

#### **Unit-I: [5L]**

Wafer Preparation-Silicon Shaping, Etching and Polishing, Chemical cleaning.

#### **Unit-II: [4L]**

Epitaxy. Defects in Epitaxial growth, Liquid phase Epitaxy, Vapor Phase Epitaxy and Molecular Beam Epitaxy.

### **Module 3: Oxidation and Diffusion [8L]**

#### **Unit-I: [4L]**

Oxidation and Kinetics of oxide growth, Deal-Grove Model of oxidation, Linear, and Parabolic Rate coefficient.

#### **Unit-II: [4L]**

Diffusion- Ficks First law and Second law of Diffusion.

### **Module 4: Ion Implantation and Chemical Vapour Deposition [10L]**

#### **Unit-I: [5L]**

Diffusion Vs Ion Implantation, Ion Implantation system

#### **Unit-II: [5L]**

CVD for deposition of dielectric and polysilicon- a simple CVD system, Chemical equilibrium and the law of mass action

### **Module 5: Pattern Transfer and Etching[9L]**

#### **Unit-I: [5L]**

Lithography and types. Step by step process of Photo Lithography, photo resist, Figures of Merit.

#### **Unit-II: [5L]**

Wet etching, Plasma etching, Reaction ion etching.

### **Text Books**

1. S.M. SZE "VLSI Technology" 2nd edition
2. Plummer Deal griffin, "Silicon VLSI Technology" Pearson Publication

### Reference Books

1. VLSI Design by Sujata Pandey.
2. J. Bhasker "VHDL for Beginner" Pearson

### E-Resources

1. NPTEL-VLSI Design by Dr. Nandita Das Gupta, IIT Madras

### Course Outcomes

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

- CO1.** Familiarize with IC fabrication steps.
- CO2.** Examine Wafer Preparation and Epitaxies.
- CO3.** Analyse oxidation and Diffusion Techniques.
- CO4.** Explain Ion Implantation and Chemical Vapour Deposition
- CO5.** Assess Photolithography and Etching process.

### 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	PS O1	PS O2
<b>CO1</b>	3	3		-	-	-	-	-	-	-	-	-	3	-
<b>CO2</b>	3	2		-	-	-	-	-	-	-	-	-	3	-
<b>CO3</b>	3	1		-	-	-	-	-	-	-	-	-	3	-
<b>CO4</b>	3	3		-	-	-	-	-	-	-	-	-	3	-
<b>CO5</b>	3	2		-	-	-	-	-	-	-	-	-	3	-
<b>Average</b>	<b>3</b>	<b>2.2</b>		-	-	-	-	-	-	-	-	-	<b>3</b>	-

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech ECM</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L320F</b>	<b>INTRODUCTION TO MICROPROCESSORS AND MICRO CONTROLLERS</b> (Open Elective -II)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Basic of ICs

**Course Objectives:**

Students will learn to:

1. Study the Architecture of 8085&8086 microprocessor
2. Learn the design aspects of I/O and Memory Interfacing circuits.
3. Study the Architecture of 8051 microcontroller

**Module 1**

**Unit-I: 8086 Introduction**

8086 Architecture Functional diagrams, Register organization, memory segmentation, programming model, memory addresses, physical memory organization

**Unit-II: 8086 Architecture**

Architecture of 8086, signal descriptions of 8086-common function signals, Timing diagrams, interrupts of 8086.

**Module 2**

**Unit-I: Instruction set of 8086**

Instruction formats, addressing modes, instruction set, assembler directives, macros.

**Unit-II: Assembly language programming of 8086**

Simple programs involving logical, branch and call instructions, sorting, evaluating arithmetic expressions, string manipulations.

**Module 3**

**Unit-I: I/O Interface**

8255 PPI, Various modes of operation and interfacing to 8086, interfacing keyboard, Display, D/A and A/D converter.

**Unit-II: Interfacing with advanced devices**

Memory Interfacing to 8086, Interrupt Structure of 8086, Vector Interrupt Table, Interrupt Service Routine.

**Module 4**

**Unit-I: Introduction to Microcontrollers**

Overview of 8051 microcontrollers, architecture, I/O ports, memory organization.

**Unit-II: Addressing Modes**

Addressing modes and instruction set of 8051, simple programs.

**Module 5:**

**Unit-I: 8051 Real Time control 1**

Programming Time Interrupts, Programming External Hardware Interrupts.

## Unit-II: 8051 Real Time control 2

Programming the serial communication interrupts, programming 8051 Timers and counters

### Text Books

1. D.V.Hall, Microprocessors and interfacing, TMGH,2nd Edition 2006.
2. Kenneth.J.Ayala, The8051Microcontroler,3rdEd., C engage Learning

### Reference Books

1. Advanced Microprocessors and peripherals-A.K.Ray and K.M Bhurchandani, TMH,2 nd Edition 2006.
2. The 8051 Microcontrollers. Architecture and programming and applications- K.Uma Rao, Andhe Pallavi, Pearson, 2009.
3. Micro computer system 8086/8088 family architecture. Programming and design-Du and GA Gibson, PHI 2nd Edition.

### E-Resources

1. <https://nptel.ac.in/courses/106/108/106108100/>
2. <https://www.youtube.com/watch?v=o6W0opScrKY&list=PLuv3GM6-gsE01L9yDO0e5UhQapkCPGnY3>
3. <https://www.youtube.com/watch?v=liRPtvj7bFU&list=PL0E131A78ABFBFDD0>

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

**CO1.** Design programs on 8085 microprocessors

**CO2.** Implement programs on 8086 microprocessors.

**CO3.** Design interfacing circuits with 8086.

**CO4.** Design and implement 8051 microcontroller-based systems.

**CO5.** Understand the concepts related to I/O and memory interfacing.

### 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	PS O1	PS O2
<b>CO1</b>	3	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO2</b>	2	2	-	1	-	-	-	-	-	-	-	-	-	-
<b>CO3</b>	2	-	2	2	-	-	-	-	-	1	1	-	-	2
<b>CO4</b>	2	-	-	2	-	-	-	-	-	-	-	-	-	-
<b>CO5</b>	2	-	2	1	-	-	-	-	-	-	-	-	-	-
<b>Average</b>	2	2	2	1.5	-	-	-	-	-	1	1	-	-	2

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech EEE</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L320G</b>	<b>HYBRID ELECTRIC VEHICLES</b> <b>(Open Elective-II)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

### **Pre-Requisites:**

#### **Module 1: History of hybrid and electric vehicles [12L]**

History of hybrid and electric vehicles – social and environmental importance of hybrid and electric vehicles – impact of modern drive-trains on energy supplies – Basics of vehicle performance, vehicle power source characterization transmission characteristics – Mathematical models to describe vehicle performance.

#### **Module 2: Hybrid traction [8L]**

Basic concept of hybrid traction – Introduction to various hybrid drive train topologies – power flow control in hybrid drive – train Topologies-Fuel efficiency analysis.

#### **Module 3: DC & AC Electrical Machines [14L]**

Introduction to electric components used in hybrid and electric Vehicles- Configuration and control of DC motor Drives-Configuration and control of introduction motor drive configuration and control of permanent magnet motor drives configuration and control of switch reluctance- motor drives, drive system efficiency.

#### **Module 4: Batteries [12L]**

Matching the electric machine and the internal combustion engine (ICE) Sizing the propulsion motor, sizing the power electronics selection the energy storage technology – Communications, supporting subsystems.

#### **Module 5: Energy management and their strategies [6L]**

Introduction to energy management and their strategies used in hybrid and electric vehicle Classification of different energy management strategies comparison of different energy management strategies implementation issues of energy strategies.

### **Text Books**

1. Iqbal Husain, "Electric and Hybrid Electric Vehicles", CRC Press, 2011..
2. Wei Liu, "Hybrid Electric Vehicle System Modeling and Control", Second Edition, WILEY,
3. Sira – Raminez ,R.SilvaOrtigoza, control Design techniques in power electronics Devices, Springer.
4. Siew – Chong tan, Yuk-Ming lai Chi Kong Tse, "Sliding mode control of switching power Converters" ..



## Reference Books

1. James Larminie and John Lowry, "Electric Vehicle Technology Explained", Second Edition 2012.
2. Christopher D Rahn, Chao-Yang Wang, "Battery Systems Engineering", Wiley, 2013.

## E-Resources

1. <https://nptel.ac.in/courses/108/103/108103009/>
2. <https://nptel.ac.in/courses/108/102/108102121/>
3. <https://nptel.ac.in/content/storage2/courses/108103009/download/M12.pdf>
4. <https://nptel.ac.in/content/storage2/courses/108103009/download/M1.pdf>
5. <https://nptel.ac.in/content/storage2/courses/108103009/download/M3.pdf>

## Course Outcomes

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

- CO 1.** Understand the working of different configurations of electric vehicles, hybrid vehicles and its components.
- CO 2.** Apply the basic concepts of batteries and Motors in the design of Electric and Hybrid Vehicles.
- CO 3.** Differentiate the modes of operation of Hybrid Vehicles.
- CO 4.** Analyze the performance of hybrid vehicles.
- CO 5.** Design the basic parameters of Electric and Hybrid Electric Vehicles.

### 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	PS O1	PS O2
<b>CO1</b>	3	-	2	-	-	-	2	-	-	-	-	-	3	2
<b>CO2</b>	3	2	3	2	-	-	2	-	-	-	-	2	2	2
<b>CO3</b>	3	2	3	-	-	-	-	-	-	-	-	-	2	2
<b>CO4</b>	2	3	2	-	-	-	-	-	-	-	-	-	3	3
<b>CO5</b>	2	3	3	-	-	-	-	2	-	-	-	-	2	2
<b>Average</b>	<b>2.6</b>	<b>2.5</b>	<b>2.6</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>2.4</b>	<b>2.2</b>

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech IT</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L320H</b>	<b>Distributed Systems</b> <b>(Open Elective-II)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Unit I: Characterization of Distributed Systems:**

Introduction, Examples of distributed systems, Trends in distributed systems, Focus on resource sharing, Challenges

**Unit II: System Models:**

Introduction, Physical models, Architectural models, Fundamental models.

**Unit III: Inter process Communication:**

Introduction, The API for the Internet protocols, External data representation and marshalling, Multicast communication, Network virtualization: Overlay networks.

**Unit IV: Remote Invocation:**

Introduction, Request-reply protocols, Remote procedure call, Remote method invocation. Indirect Communication: Introduction, Group communication, Publish-subscribe systems, Message queues, Shared memory approaches.

**Unit V: Distributed Objects and Components:**

Introduction, Distributed objects, Case study: CORBA, From objects to components.

**Text Book**

1. Distributed System: Concepts and Design, Coulouris, Dollimore, Kindberg, 2006, Pearson Education.

**Course Outcomes:**

**CO 1:** Understand of the principles and foundations on which the Internet and other distributed systems are based.

**CO 2:** Apply different approaches for supporting distributed applications.

**CO3:** Analyze the role of middleware technologies in designing Distributed systems

**CO 4:** Analyze the sharing of data in distributed environment using various distributed algorithms

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year - II</b> <b>Sem</b>			
Course Code: <b>L32OI</b>	<b>FUNDAMENTALS OF OPERATIONS RESEARCH</b> (Open Elective - II)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Mathematics.

#### **Module 1:**

**Unit 1: Introduction:** Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.

**Unit 2: Allocation:** Linear Programming Problem - Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two-phase method, Big-M method; Duality Principle.

#### **Module 2:**

**Unit 1: Transportation problem:** Formulation – Optimal solution, unbalanced transportation problem – Degeneracy

**Unit 2: Assignment problem:** Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

#### **Module 3:**

**Unit 1: Sequencing:** Introduction – Flow – Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through “m” machines

**Unit 2: Replacement:** Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.

#### **Module 4:**

**Unit 1: Inventory:** Introduction – Single item, Deterministic models – Types – Purchase inventory models with one price break and multiple price breaks – inventory models with and without shortage cost. Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

**Unit 2: Waiting lines:** Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.

#### **Module 5:**

**Unit 1: Theory of Games:** Introduction – Terminology – Solution of games with saddle points and without saddle points- 2 x 2 games – m x 2 & 2 x n games - graphical method – m x n games - dominance principle.

**Unit 2: Dynamic programming:** Introduction – Terminology- Bellman’s Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem

### Text Books

1. P. Sankara Iyer, "Operations Research", Mc Graw Hill, 2017.
2. J. K. Sharma, "Operation Research", MacMillan Publishers India Ltd, 4th Edition, 2009.
3. A.C.S Kumar, "Operations Research (Quantitative Analysis for Business decision)", Yesdee, 2015.

### Reference Books

1. Maurice Saseini, Arhur Yaspanand and Lawrence Friedman, "*Operations Research: Methods and Problems*", Literary Licensing Publisher, 2013
2. A. M. Natarajan, P. Bala Subramani and A. Tamilarasi "*Operations Research*" Pearson Education, 4th Edition, 2009.
3. Wagner H. M, "*Principles of Operations Research*", PHI Publications, 2nd Edition, 2006.

### E-Resources

1. <https://rb.gy/1ckbxh>
2. <https://nptel.ac.in/courses/112/106/112106134/>
3. <https://nptel.ac.in/courses/111/107/111107128/>

### Course Outcomes

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

- CO1:** Allocate optimally the resources in any industry, to maximize the overall gain and determine the number of each item to be produced / procured, and the optimal product mix, within the framework of constraints in any organization
- CO2:** Find the optimal number of units to be transported such that the total transportation cost will be minimum and Assign the required men / machines to perform the given tasks in an optimal way
- CO3:** Schedule and sequence production runs by proper allocation of machines and men to get maximum gain or profit and Compute the economic order quantity
- CO4:** Decide the optimal inventory to be maintained under different situations involving different types of demand and inventory costs, find how to strike a balance between the waiting time cost and service facility cost for different waiting line models
- CO5:** Find how to strike a balance between the waiting time cost and service facility cost and apply the Dynamic Programming model to practical problems like finding the shortest path for a salesman, optimal solution to a linear programming problem.

## 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	3	2	-	-	3	-	-	-	-	-	2	2	2
<b>C02</b>	3	3	3	-	-	3	-	-	-	-	-	2	3	3
<b>C03</b>	2	3	2	-	-	3	-	-	-	-	-	2	2	2
<b>C04</b>	3	3	2	-	-	3	-	-	-	-	-	2	3	3
<b>C05</b>	2	3	1	-	-	3	-	-	-	-	-	2	2	2
<b>Average</b>	2.4	3	2	-	-	3	-	-	-	-	-	2	2.4	2.4

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: MIE</b> <b>III Year - II</b> <b>Sem</b>			
Course Code: <b>L320J</b>	<b>INTRODUCTION TO SURFACE MINING</b> <b>(OPEN ELECTIVE – II)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Nil

**Course Objectives:**

This course will enable students to:

1. To introduce surface mining terms and applicable conditions
2. To acquaint with different machinery used in surface mining
3. To get idea about Drilling and blasting of surface ore bodies
4. To get idea about lighting, dust, and slopes in surface mines.
5. To know about ore and waste transportation.

**Module 1**

Definition, Terminology, Applicability and limitations of surface mining, Classification, Advantages, and dis-advantages of surface mining.

**Module 2**

Introduction to surface mining machinery: Equipment selection; Working with rippers, shovels, draglines, shovel-dragline combination; bucket wheel excavator. Disposal of OB/waste material

**Module 3**

Drilling & blasting: Drilling mechanism, drilling patters, Drill bits Explosives, Blasting accessories, Bulk explosives, problems in blasting.

**Module 4**

Basics of Mine lighting, Sources of dust in surface mining, dust control, and slope stabilization

**Module 5**

Methods of excavation & transportation – shovel-dumper combination, draglines, surface miner, bucket wheel excavator. Impacts on environment due to surface mining

**Text Books**

1. D.J. Deshmukh, Elements of Mining Technology, Vol 1, Central Techno, 7th Edition, 2001.
2. Principles & Practices of Coal Mining, R.D. Singh

**Reference Books**

1. Surface Mining Technology, by Prof S.K. Das, Lovely Prakashan, Dhanbad

### **Course Outcomes**

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

**CO1:** Understand about surface mining terms and conditions of applicability

**CO2:** Learn about different machinery used in surface mining

**CO3:** Learn drilling and blasting in surface mining

**CO4:** Understand mine lighting, dust, and slopes in surface mining

**CO5:** Understand the transportation of ore and waste in surface mining.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: MBA</b> <b>III Year - II</b> <b>Sem</b>			
Course Code: <b>L320K</b>	<b>INTELLECTUAL PROPERTY RIGHTS</b> <b>(Open Elective - II)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

### Course Objectives:

1. The main objective of the IPR is to make the students aware of their rights for the protection of their invention done in their project work.
2. To get registration in our country and foreign countries of their invention, designs and thesis or theory written by the students during their project work and for this they must have knowledge of patents, copy right, trademarks, designs and information Technology Act.
3. Further teacher will have to demonstrate with products and ask the student to identify the different types of IPR's.

### UNIT - I:

**Introduction to Intellectual property:** Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

### UNIT - II:

**Trade Marks:** Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

### UNIT - III:

**Law of copy rights:** Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

### UNIT - IV:

**Trade Secrets:** Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets, and protection for submission, trade secrets litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

### UNIT - V:

**New development of intellectual property:** New developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international - trade mark law, copy right law, international patent law, and international development in trade secrets law.

### Course outcomes:



The students once they complete their academic projects, they get awareness of acquiring the patent and copyright for their innovative works. They also get the knowledge of plagiarism in their innovations which can be questioned legally.

**Text Books:**

1. Intellectual property right, Deborah, E. Bouchoux, cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, prabuddhaganguli, Tata McGraw Hill Publishing Company Ltd.
3. Managing Intellectual Property-The Strategic Imperative, Second Edition by Vinod V Sople, PHI.
4. Intellectual Property –Copyrights, Trademarks and patents by Richard Stim, Cengage Learning.
5. Niraj Pandey & Khushdeep Dharani –Intellectual Property rights
6. V.K. AHUJA – Law relating to Intellectual Property

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech -SH</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L320L</b>	<b>Open Elective-II</b> <b>Numerical Solution of Partial</b> <b>Differential Equations</b>	L	T	P	D
Credits: 3		<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>

### Pre-Requisites:

#### Module 1: Linear Systems of Equations [10L]

Iterative methods for solving large linear systems of algebraic equations: Jacobi, Gauss-seidel and S.O.R methods - Conditions for convergence of them - Methods for accelerating convergence: Lyusternite's & Aitken's methods - Optimum acceleration parameter for S.O.R method.

#### Module 2: One Dimensional Parabolic Equations [9L]

Explicit and Crank-Nicolson Schemes for - Weighted average approximation - Derivative boundary conditions - Truncation errors - Consistency, Stability and convergence - Lax Equivalence theorem.

#### Module 3: Matrix Norms & Two Dimensional Parabolic Equation [10L]

Vector and matrix norms - Eigen values of a common tridiagonal matrix - Gerischgorin's theorems - Stability by matrix and Fourier-series methods - A.D.I. methods.

#### Module 4: Hyperbolic Equations [10L]

First order quasi-linear equations and characteristics - Numerical integration along a characteristic - Lax- Wendroff explicit method - Second order quasi-linear hyperbolic equation - Characteristics - Solution by the method of characteristics.

#### Module 5: Elliptic Equations [10L]

Solution of Laplace and Poisson equations in a rectangular region - Finite difference in Polar coordinate Formulas for derivatives near a curved boundary when using square mesh - Discretisation error - Mixed Boundary value problems

### Text Books

1. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill, 5<sup>th</sup> Edition, New Delhi, 2007.
2. Equations", John Wiley and sons, New York, 1980.
3. Smith G.D., "Numerical Solution of P.D.E.", Oxford University Press, New

### Reference Books

1. Morton K.W., Mayers, D.F., "Numerical Solutions of Partial Differential Equations", Cambridge University Press, Cambridge, 2002.
2. Iserles A., "A first course in the Numerical Analysis of Differential Equations", Cambridge University press, New Delhi, 2010. xx t u u □

- Mitchel A.R. and Griffiths S.D.F., "The Finite Difference Methods in Partial Differential

### E-Resources

- <https://www.purplemath.com/modules/systlin1.htm>
- <https://nptel.ac.in/courses/111/107/111107063/>
- [https://www.researchgate.net/publication/227760098\\_Numerical\\_solution\\_of\\_twodimensional\\_parabolic\\_equation\\_subject\\_to\\_nonstandard\\_boundary\\_specifications\\_using\\_the\\_pseudospectral\\_Legendre\\_method](https://www.researchgate.net/publication/227760098_Numerical_solution_of_twodimensional_parabolic_equation_subject_to_nonstandard_boundary_specifications_using_the_pseudospectral_Legendre_method)
- [https://link.springer.com/chapter/10.1007/978-3-662-09207-1\\_2](https://link.springer.com/chapter/10.1007/978-3-662-09207-1_2)
- [https://www.researchgate.net/publication/310744390\\_Numerical\\_Solutions\\_of\\_Elliptic\\_Partial\\_Differential\\_Equations\\_by\\_Using\\_Finite\\_Volume\\_Method](https://www.researchgate.net/publication/310744390_Numerical_Solutions_of_Elliptic_Partial_Differential_Equations_by_Using_Finite_Volume_Method)

### Course Outcomes

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

**CO1.** Know the knowledge of solving large number of algebraic linear equation.

**CO2.** Understand the knowledge of solving one dimensional parabolic equations by numerical methods

**CO3.** Recognize the knowledge of solving two dimensional parabolic equations by numerical methods.

**CO4.** Apply and understand the knowledge of solving hyperbolic equation by numerical methods

**CO5.** Know the knowledge of solving elliptic equations by numerical methods.

### 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	PS O1	PS O2
<b>CO1</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-
<b>CO2</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-
<b>CO3</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-
<b>CO4</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-
<b>CO5</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-
<b>Average</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech -SH</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L320M</b>	<b>ADVANCED PHYSICS FOR ENGINEERS</b> <b>(Open Elective)</b>	L	T	P	D
Credits: <b>3</b>	(COMMON TO: All branches)	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Foundations of Mechanics & Physics

### **Module- 1: Special Theory of Relativity [9L]**

Introduction, Concept of theory of relativity, Frames of reference-Inertial, noninertial; Galilean transformation equations, Michelson-Morley experiment, Einstein theory of relativity, Lorentz transformation of space and time, Length contraction, Time dilation, Variation of mass with velocity, Relativistic relation between energy and momentum.

### **Module -2: Holography [9L]**

Introduction, Basic principle, Construction and Reconstruction of Hologram, Properties of Hologram, Types of Holograms, Applications- Holographic Interferometry, Acoustic Holography, Holographic Microscopy.

### **Module -3: Thin films Synthesis [9L]**

Introduction, Deposition Techniques-Pulsed Laser Deposition (PLD), Spray Pyrolysis; Nucleation and growth of the thin films, properties (Mechanical, Electrical, Magnetic and Optical).

### **Module -4: Photonic Crystals [9L]**

Important features of photonic crystals, Presence of photonic band gap, anomalous group velocity dispersion, Micro cavity, effects in Photonic Crystals, fabrication of photonic Crystals, Dielectric mirrors and interference filters, PBC based LEDs, Photonic crystal fibers (PCFs), Photonic crystal sensing.

### **Module- 5: Solar cell Physics[9L]**

Single, poly and amorphous silicon, GaAs, CdS, Cu<sub>2</sub>S, CdTe; Origin of photovoltaic effect, Homo and hetero junction, working principle of solar cell, Evaluation of Solar cell parameters, I-V, C-V and C-f characteristics.

### **Text Books**

1. R K Gaur and SL Gupta, "Engineering Physics" Dhanpat Rai Publications, 8th revised Edition, 2006.
2. B K Pandey and S Chaturvedi, "Engineering Physics" Cengage Learning India, Revised Edition, 2014.

### **Reference Books**

1. R F Bun shah, "Hand Book of Technologies for Films and coating", Noyes publishers, 1st Edition, 1996.
2. B E A Saleh and A C Tech, "Fundamentals of Photonics", John Wiley and Sons, New York, 1st Edition, 1993.

### **E-Resources**

1. <http://physics.mq.edu.au/~jccresser/Phys378/LectureNotes/SpecialRelativityNotes.pdf>
2. <http://www.kfupm.edu.sa/centers/CENT/AnalyticsReports/KFUPM-TFSCDec20.pdf>
3. <https://www.journals.elsevier.com/solar-energy-materials-and-solar-cells>
4. <https://www.journals.elsevier.com/journal-of-alloys-and-compounds/>
5. <http://aip.scitation.org/journal/apl>
6. <http://nptel.ac.in/courses/115101011/>

### **Course Outcomes**

After completion of this course the student is able to

1. Explain special theory of relativity and apply its concepts in various fields of physics and engineering.
2. Analyze the basic concepts of Holography and applications.
3. Identify different concepts of film deposition.
4. Apply basic knowledge on the photonic crystals.
5. Apply the basic concepts of solar cell physics.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech -SH</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L32ON</b>	<b>Nano Chemistry</b> (COMMON TO: All branches)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Nil

### **Module 1: Synthesis of Nano materials [8L]**

Introduction -synthesis of Nanostructure materials, Bottom-up approach and Top-down approach with examples-sol-gel method-solvothermal and hydrothermal routes, Chemical Vapor Deposition and precipitation methods.

### **Module 2: Properties of Nano materials [10L]**

Properties of Nanomaterials-Electronic properties, Energy bands and gaps in semiconductors, Fermi Surfaces-Optical properties- Fluorescence, Photoluminescence, Electroluminescence. Magnetic properties-mechanical properties-thermal properties.

### **Module 4: Instrumental Analysis [10L]**

Characterization techniques- Principle and block diagram of Scanning Electron Microscopy (SEM), Electron Dispersion Spectroscopy(EDS). Principle and block diagram of Electron Microscopy (TEM), Dynamic Light Scattering (DLS) and Atomic Force Microscopy(AFM) -Illustrative examples.

### **Module 5: Carbon Nano structures and Applications [10L]**

Carbon Nano structures, carbon clusters, types and preparation of carbon Nano tubes-optical and telecommunication applications, Nano structured crystals (graphite), graphene, carbon fibers, fullerenes and their applications. Nano solar cells and its applications.

### **Module 5: Environmental Nanotechnology [9L]**

Implications of Nanotechnology & Research needs-Nanostructured Catalysts TiO<sub>2</sub> Nanoparticles for Water purification- Nano membranes in drinking water treatment and desalination, Nanomembranes in Sea desalination-Nano particles for treatment of Chlorinated Organic Contaminants.

### **Text Books**

1. "Nanotechnology a gentle introduction to the next big idea", Mark A. Ratner, D. Ratner. Pearson Education Inc., Asia, 2003.
2. "Nano: The essentials-understanding Nanoscience and Nanotechnology", Pradeep.T. Tata Mc.Graw Hill, New Delhi, 2007.

### **Reference Books**

1. "Green Chemistry: Theory and Practice", Anastas, P.; Warner, J. Oxford University Press: London, 1998.

2. "Nanomaterials: Synthesis, Characterization, and Applications", A. K. Haghi, Ajesh K. Zachariah, Nandakumar Kalariakkal. Apple Academic Press, 2013.
3. "Nanomaterials and Nanochemistry", Brechignac C., Houdy P., Lahmani M. (Eds.) (Springer,) 748p. ISBN 978-3-540-72993-8, 2007
4. "Principles of Nanotechnology", Phanikumar. SciTech Publications 2nd Edition, 2010.
5. "Environmental Nanotechnology" Preetijain, Shankar LalGarg. Lap Lambert Academic publishing, 2015.

### **E-Resources**

1. <https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/nanochemistry.html>
2. <https://www.sciencedirect.com/book/9780444519566/nanochemistry>
3. [https://www.researchgate.net/publication/320068992\\_Introduction\\_to\\_Nano-chemistry\\_and\\_Nano-materials](https://www.researchgate.net/publication/320068992_Introduction_to_Nano-chemistry_and_Nano-materials)
4. <https://www.kemi.dtu.dk/english/research/organic-inorganic-chemistry/nanochemistry>
5. <https://www.cambridge.org/core/books/engineering-chemistry/nanochemistry/D6DB35E32E530525DD927E68CED43197>

### **Course Outcomes**

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

1. Learn the different synthetic methods of the Nano materials.
2. Know the student Electronic, optical and magnetic properties of Nano materials.
3. Acquire the knowledge various instrumental methods of analysis (TEM, EDS, SEM, DLS &AFM).
4. Know the carbon nanotubes, carbon Nano fibers, Nano structured catalysts and Nano solar cells.
5. Learn usage of Nano materials in the purification of water.

<b>AY 2022-23 onwards</b>	<b>J. B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)</b>	<b>B. Tech-SH III Year – II Sem</b>			
Course Code: <b>L3200</b>	<b>TEAMWORK AND TEAM BUILDING (COMMON TO ALL)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>
<b>Credits: 3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites: Nil**

**Objectives:**

1. Know the working experience in the group and team
2. Understand the process and role of the team
3. Apply the knowledge of team building
4. Understand the role of team leader.
5. Plan the meetings and understanding the role of meetings

### **Module -I Working in Groups and Teams**

Introduction-defining Types of Groups and Teams- Understanding the role of Teams in Organization; Recognizing differences between group and Teams-ensuring team success-empowering teams- working with a distributed team-technology @work: virtual worlds.

### **Module -II Exploring Team Roles and Processes**

Defining common team roles-selecting team members-choosing the optimal team size-establishing team rules-clarifying team objectives-making collective decisions etc.

### **Module -III Building and Developing Team**

Understanding the benefits of working in teams-fostering Resistance-using team-building activities-creating a team identity-coping with conflict and ego-dealing with difficult team members and celebrating successes.

### **Module -IV Leading a Team**

Pursuing team leadership-preparing to be a team leader-getting start with your team-taking a project management approach- managing a team diplomatically-being sensitive to intangibles and concluding team activities.

### **Module -V Managing Meetings**

Scheduling meeting-developing meeting agenda- planning meetings-understanding the role of meetings-conducting meetings effectively-taking notes and publishing minutes-concluding meetings and creating action plans and solving common meeting problems.

**Reference/text book:**



1) Butterfield, Jeff. Soft Skills for Everyone. Delhi: Cenege., 2010.

**Course outcomes:**

1. Recognize differences between group and team, ensuring team success, and empowering teams.
2. Define common team roles, establishing team rules, selecting team members, and making collective decisions
3. Understand the benefits of working in teams, fostering Resistance, using team-building activities
4. Manage a team diplomatically, and preparing to be a good team leader.
5. Create action plans and solving common meeting problems

<b>CO-PO/PSO Mapping Chart</b> <b>(3/2/1 indicates strength of correlation)</b> <b>3 – Strong; 2 – Medium; 1 - Weak</b>														
<b>Course Outcomes (COs)</b>	<b>Program Outcomes (POs)</b>												<b>Program Specific Outcomes*</b>	
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	..	..	..	..	..	..	..	..	3	2	..	3	..	..
<b>CO2</b>	..	..	..	..	..	..	..	..	3	2	..	3	..	..
<b>CO3</b>	..	..	..	..	..	..	..	..	3	2	..	3	..	..
<b>CO4</b>	..	..	..	..	..	..	..	..	3	2	..	3	..	..
<b>CO5</b>	..	..	..	..	..	..	..	..	3	2	..	3	..	..
<b>Total</b>	..	..	..	..	..	..	..	..	3	2	..	3	..	..

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech-SH</b> <b>III Year-I Sem</b>			
Course Code: <b>L320P</b>	<b>Essence of Indian Traditional Knowledge</b> (COMMON TO: All branches)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

### **Pre-Requisites:**

#### **Module 1: Introduction to Culture**

Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

#### **Module 2: Indian Languages, Culture and Literature**

Indian Languages and Literature-I the role of Sanskrit, significance of scriptures to scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India

Indian Languages and Literature-II. Northern Indian languages & literature

#### **Module 3: Religion and Philosophy**

Religion and Philosophy in ancient India Religion and Philosophy in Medieval India Religious Reform Movements in Modern India (selected movements only)

#### **Module 4: Fine Arts in India (Art, Technology & Engineering)**

Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient medieval, and modern) Science and Technology in India, development of science in ancient medieval and modern India.

#### **Module 5: Education System in India**

Education in ancient, medieval and modern India, aims of education, subjects' languages

Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India.

### **Text Books**

1. Kapil Kapoor. "Text and Interpretation: The India Tradition" ISBN: 81246013375 2005.

1. "Science in Sanskrit". Samskrita Bharti Publisher, ISBN 978-8187276731.2007

### **Reference Books**

1.NCERT, "Position paper on Arts, Music, Dance and Theatre". ISBN 81-7450 494- 200.

### **Course Outcomes**

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

COI: Understand philosophy of Indian culture.

CO2: Distinguish the Indian languages and literature

CO3: Learn the philosophy of ancient, medieval and modern India.

CO4: Acquire the information about the fine arts in India.

COS: Know the contribution of scientists of different eras.

# Open Elective-III

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE III Year-II Sem</b>			
Course Code: <b>L320Q</b>	<b>ROAD SAFETY ENGINEERING</b> <b>(OE-III)</b>	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites: NIL**

**Module 1: Fundamentals of Traffic Engineering**

**Unit-I:**

Road User Characteristics, Vehicular Characteristics, Applications of Traffic Control Devices, Traffic signs, Road Marking.

**Module 2: Introduction to Road Safety**

**Unit-I:**

Accident Situation in India, International Comparison of Accident Data, Standard Definitions by IRC, Collection of Accident Data, Collision and Condition Diagrams.

**Module 3: Statistical Methods and Analysis of Accident Data**

**Unit-I:**

Methods in Analysis of accident Data, Regression Method, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons, Black Spot Identification & Investigations.

**Module 4: Road & its Effect on Accidents Unit-I:**

Factors Causing Accidents, Skidding, Factors Determining Skid Resistance, Pedestrian Safety, Measures to Increase Pedestrian Safety, Safety Improvement Strategies.

**Module 5: Accident Mitigation Measures**

**Unit-I**

Accident prevention by better planning, Accident prevention by better design of roads, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety.

**Text Books**

1. 'Transport planning and Traffic Engineering" by Dr. L. R. Kadiyali, Khanna Publications 9th Edition (2017).
2. 'Principles of Transportation Engineering" by Partha Chakroborty & Aminesh Das; Prentice Hall of India, 2nd edition (October 2017).

**Reference Books**

1. Fundamentals of Traffic Engineering, Richardo G Sigua Road Safety by NCHRP.

**E- Resources**

1. <https://nptel.ac.in/courses/105/101/105101087/>

**Course Outcomes**

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

1. Understand the Traffic characteristics
2. Analyze Collision and Condition Diagrams.

3. Describe Road & its Effect on Accidents
4. Understand the various Accident prevention measures.
5. Understand the statistical analysis of traffic flow variables.

**CO-PO/PSO Mapping Chart**  
**(3/2/1 indicates strength of correlation)**  
**3 – Strong; 2 – Medium; 1 - Weak**

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes *	
	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>CO1</b>	1	1	1	-	-	-	-	-	-	-	-	-	1	1
<b>CO2</b>	1	1	1	-	-	3	2	-	-	-	-	-	2	2
<b>CO3</b>	1	1	1	-	-	3	1	-	-	2	-	2	1	1
<b>CO4</b>	1	1	1	-	-	2	-	-	-	-	-	2	1	2
<b>CO5</b>	1	1	1	-	-	2	-	-	-	-	-	2	1	1
<b>Average</b>	1	1	1	-	-	2	0.6	-	-	0.4	-	1.2	1.2	1.4

<b>AY: 2022-23</b> Onwards	<b>J. B. INSTITUTE OF ENGINEERING AND TECHNOLOGY</b> (UGC Autonomous)	<b>B. Tech-CSE</b> <b>III Year- II</b> <b>Sem</b>			
Course Code: <b>L32OR</b>	<b>Introduction to Java Programming</b> <b>(Open Elective -III)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:**

Knowledge on Programming for Problem Solving

**Course Objectives:**

The students should be able to

1. Familiar with OOPs, constructors, and string handling functions
2. Understand inheritance and polymorphism.
3. Gain knowledge of with packages and interfaces
4. Understand the with exception handling and multithreading.
5. Know the applet programming, event handling and scripting.

**Module 1:**

Introduction: OOP concepts, history of Java, Java buzzwords, data types, variables, scope and lifetime of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java program.

Classes and Objects: concepts of classes, objects, constructors, methods, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion.

String handling: String, String Buffer, String Tokenize.

**Module 2:**

**Inheritance:** base class object, subclass, member access rules, super uses, using final with inheritance, method overriding, abstract classes

**Interfaces:** defining an interface, implementing interface, differences between classes and interfaces and extending interfaces.

**Packages:** Defining, creating and accessing a package, importing packages, access control, exploring package - java.io

**Module 3:**

**Exception handling:** concepts of exception handling, benefits of exception handling, exception hierarchy, checked and unchecked exceptions, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes.

**Module 4:**

**Multithreading:** differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups.

**Applets:** concepts of applets, differences between applets and applications, life cycle of applet, types of applets, creating applets, passing parameters to applets.

## Module 5:

**Event Handling:** events, event sources, event classes, event listeners, delegation event model, handling mouse and key board events, adapter classes. The AWT class hierarchy, user interface components-labels, buttons, canvas, scrollbars, text components, checkbox, checkbox groups, choices, lists

## Textbooks

1. Java The complete reference, 8th edition, Herbert Schildt, TMH.
2. Understanding OOP with Java, updated edition, T. Budd, Pears on education.

## Reference Books

1. An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John Wiley & sons.
2. An Introduction to OOP, second edition, T. Budd, Pearson education.
3. Introduction to Java programming 6th edition, Y. Daniel Liang, Pearson education.

## E - Resources:

1. <http://www.javasoft.com>
2. <http://www.w3schools.com>

## Course Outcomes

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

**CO1:** Use OOP concepts in problem solving.

**CO2:** Demonstrate Inheritance and Polymorphism

**CO3:** Create user defined Packages and Interfaces

**CO4:** Illustrate the concept of Exception handling and Multithreading.

**CO5:** Design GUI based applications using Applet Programming and Event Handling



<b>AY 2022-23 onwards</b>	<b>J. B. Institute of Engineering and Technology (UGC Autonomous)</b>	<b>B. Tech: AIML III Year II Sem</b>			
<b>Course Code: L320S</b>	<b>INTRODUCTION TO NEURAL NETWORKS (Open Elective III)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>
<b>Credits: 3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:**

1. Data Structures
2. Design and Analysis of Algorithms
3. Python Programming
4. Mathematics for Machine Learning

**Course objectives:**

**The student will:**

1. Become familiar with the fundamental concepts of Neural Networks and its applications.
2. Learn various learning strategies for solving real world problems.
3. Demonstrate various architectures of Artificial neural networks.
4. Summarise the limitations of the perceptron model
5. Understand the paradigms of associative memories.

**Module 1:**

**INTRODUCTION TO NEURAL NETWORKS**

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

**Module 2:**

**ESSENTIALS OF ARTIFICIAL NEURAL NETWORKS**

Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN Connectivity, Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules.

**Module 3:**

**SINGLE LAYER FEED FORWARD NETWORKS**

Introduction, Perceptron Models: Discrete, Continuous and Multi-Category Training Algorithms: Discrete and Continuous Perceptron Networks, Limitations of the Perceptron Model.

**Module 4:**

**MULTI- LAYER FEED FORWARD NETWORKS**

Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm Kolmogorov Theorem, Learning Difficulties, and Improvements.

## **Module 5:**

**ASSOCIATIVE MEMORIES:** Linear Association, Basic Concepts of recurrent Auto associative memory: retrieval algorithm, storage algorithm; By directional associative memory, Architecture, Association encoding & decoding, Stability.

**SELF ORGANIZING NETWORKS:** Unsupervised learning of clusters, winner-take-all learning, recall mode, Initialisation of weights, separability limitations

### **Text Books:**

1. Laurene Fausett, "Fundamentals of Neural Networks" , Pearson Education, 2004..
2. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003.
3. S.N.Sivanandam, S.Sumathi, S. N. Deepa "Introduction to Neural Networks using MATLAB 6.0", TATA Mc Graw Hill, 2006.

### **Reference Books:**

1. S. Rajasekharan and G. A. Vijayalakshmi pai, "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publication, 2004.
2. Timothy J. Ross, " Fuzzy Logic with Engineering Applications", Tata McGraw-Hill Inc. 2000

### **Course outcomes:**

#### **The student will be able to:**

1. Analyze Neural Networks and its applications.
2. Apply learning strategies for solving real world problems.
3. Implement various architectures of Artificial neural networks.
4. Categorize the merits of various perceptron models.
5. Construct the paradigms of associative memories.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech : AI&amp;DS III Year-II Sem</b>			
Course Code: <b>L320T</b>	<b>Open Elective-III HEALTH CARE DATA ANALYTICS</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Module I: Introduction to Health Care Data Analytics & Electronic Health Record**

**Unit I:** Introduction to Health care data sources and basic analytics, advanced data analytics, Applications and practical systems for health care, resources for health care data analytics,

**Unit II:** Electronics Health Records, Components of EHR, Coding System of EHR, Benefits of EHR- Barrier to Adopting EHR Challenges-Phenotyping Algorithms, Conclusion.

**Module II: Biomedical image modalities and Mining of Sensor Data in Health Care**

**Unit 1:** Biomedical image modalities, Object Detection, Image Segmentation, Image Registration, Feature Extraction, Conclusion and Feature work.

**Unit II:** Introduction Mining sensor data in medical informatics, scope and challenges,

Challenges in the Health care data analysis, Sensor Data Mining Applications, Non clinical Health Care Application, Summary and concluding remarks.

**Module III: Biomedical Signal Analysis and Genomic data analysis**

**Unit I:** -introduction types of biomedical signal analysis, ECG signal analysis, denoising of signals, multivariate bio medical signal analysis, cross correlation analysis.

**Unit II:** introduction genomic data generation, methods and standards for genomic data analysis, types of computational genomics studies towards personalized medicine, genetic and genomic study to the bed side of personalized medicine, concluding remarks.

**Module IV: Natural language processing and data mining for clinical text & Biomedical literature**

**Unit I:** Introduction to Natural language processing, Mining information for clinical text, Challenges of processing clinical reports, clinical applications, conclusions.

**Unit II:** Introduction terminology acquisition and management information extraction, text mining environments, applications integration with clinical text mining, conclusions.

**Module V: Social media and analytics for health care and Advanced data analytics for health care**

**Unit I:** Introduction to social media analysis for detection and trapping of infectious disease outbreaks, social media analysis for public health research and analysis of social media used in health care, conclusions.

**Unit II:** introduction basics statistical predication model, alternative, clinical predication model, survival models, evaluation and validation and conclusion.

**TEXT BOOKS**

1. Chandan K. Reddy and Charu C Aggarwal, "Healthcare data analytics", Taylor & Francis, 2020 Edition

**REFERENCE BOOKS**

1. Hui Yang and Eva K. Lee, "Healthcare Analytics: From Data to Knowledge to Healthcare Improvement, Wiley, 2016.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech ECE</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L320U</b>	<b>MATLAB PROGRAMING LANGUAGE</b> OE-III	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:**

**Course Objectives:**

The students will

1. To understand the basic principles of programming and of implementing mathematical concepts in MATLAB.
2. To write numerical algorithms with MATLAB Programming language.
3. To evaluate the computational results using graphical representations.
4. To gain knowledge about advanced MATLAB Programming methods.
5. To gain knowledge on Simulink used in MATLAB.

**Module 1: Introduction to MATLAB [10L]**

**Unit-I: [6L]**

Historical Background, Applications, Scope of MATLAB, Importance of MATLAB for Engineers, Features, MATLAB Windows (Editor, Work Space, Command History, Command Window).

**Unit-II: [4L]**

Operations with Variables, Naming and Checking Existence, Clearing Operations, Commands, Data types, Operators.

**Module 2: Data Flow in MATLAB [10L]**

**Unit-I: [10L]**

Vectors, Matrix Operations & Operators, Reshaping Matrices, Arrays, Colon Notations, Numbers, Strings, Functions, File Input-Output, Importing and Exporting of data.

**Module 3: MATLAB Programming [10L]**

**Unit-I:**

Conditional Statements, Loops, Writing Script Files, Error Correction, saving Files, Worked out Examples.

**Module 4: MATLAB Advanced [10L]**

**Unit-I: [10L]**

Plotting, Graphics, Creating Plot & Editing Plot, GUI (Graphical User Interface). Matlab-Algebra, Calculus, Differential, Integration, Polynomials, solving a system of linear equations.

**Module 5: SIMULINK [9L]**

**Unit-I: [9L]**

Introduction, Importance, Model Based Design, Tools, Mathematical Modeling, Converting Mathematical Model into Simulink Model, Running Simulink Models, Importing Exporting Data, Solver Configuration, Masking Block/Model.

## Text Books

1. Getting Started With Matlab: A Quick Introduction For Scientists And Engineers (English) by Rudra Pratap, OXFORD University Press.
2. MATLAB Programming by Y. Kirani Singh, B.B. Chaudhuri, PHI Publication.

## 3. Reference Books

1. MATLAB® Programming For Engineers, Fourth edition by Stephen J. Chapman.
2. Applied Numerical Methods Using MATLAB 1st Edition by Won Y. Yang Wenwu Cao, Tae-Sang Chung, John Morris.

## Course Outcomes

**CO1.** Translate mathematical methods to MATLAB code.

**CO2.** Generalize results and represent data visually.

**CO3.** Apply computer methods for solving a wide range of engineering problems.

**CO4.** Utilize computer skills to enhance learning and performance in other engineering and science courses.

**CO5.** acquire knowledge of Advanced Matlab programming methods and Simulink.

## 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	PS O1	PS O2
<b>CO1</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO2</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO3</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO4</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO5</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech ECM</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L320V</b>	<b>INTRODUCTION TO SENSORS AND ITS APPLICATIONS</b> <b>(Open Elective -III)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Nil

**Course Objectives:**

Students will learn to:

1. To understand the concepts of measurement technology.
2. To learn the different sensors used to measure various physical parameters.
3. To Acquire knowledge on Optical sensors.
4. To understand the concepts Acoustic sensors.
5. To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

**Module 1:**

**Unit-I: Introduction**

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers.

**Unit-II: Performance measures of sensors**

Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

**Module 2:**

**Unit-I: Motion, Proximity And Ranging Sensors**

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive

**Unit-II:**

LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

**Module 3:**

**Unit-I: Force, Magnetic And Heading Sensors**

Strain Gage, Load Cell, Magnetic Sensors–types, principle, requirement and advantages: Unit 2: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

**Module 4:**

**Unit-I: Optical, Pressure And Temperature Sensors**

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD.

**Unit-II:**

Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors, Film sensor, MEMS & Nano Sensors, LASER sensors.

## Module 5:

### Unit-I: Signal Conditioning And Daq Systems

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi-channel data acquisition

### Unit-II:

Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring

### Text Books

1. S Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill,2009.
2. Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th edition, Dhanpat Rai & Co, New Delhi,2013.

### Reference Books

1. Patranabis D, "Sensors and Transducers", 2nd Edition, PHI, New Delhi,2010.
2. 1. John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications,1999.
3. 2. Richard Zurawski, "Industrial Communication Technology Handbook" 2nd edition, CRC Press, 2015.

### E-Resources

1. <https://www.sciencelearn.org.nz/resources/1602-electricity-and-sensors>
2. <https://predictabledesigns.com/introduction-to-electronic-sensors/>

### Course Outcomes

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

**CO1.** Expertise in various calibration techniques and signal types for sensors.

**CO2.** Apply the various sensors in the Automotive and Mechatronics applications.

**CO3.** Study the basic principles of various smart sensors..

**CO4.** Apply Optical and Acoustic sensors in Home Appliances..

**CO5.** Implement the DAQ systems with different sensors for real time 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	PS O1	PS O2
<b>CO1</b>	2	3	2	-	-	-	-	-	-	-	-	-	-	-
<b>CO2</b>	2	2	-	2	-	-	-	-	-	-	-	-	-	-
<b>CO3</b>	3	2	-	3	-	-	-	-	-	-	-	-	-	-
<b>CO4</b>	3	1	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO5</b>	2	2	3	3	-	-	-	-	-	-	-	-	-	-
<b>Average</b>	2.4	2	2.5	2.67	-	-	-	-	-	-	-	-	-	-

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



<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech EEE</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L320X</b>	<b>Non-Conventional Energy Sources</b> <b>(OPEN ELECTIVE - III)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

### Course Objectives:

#### This course will enable students:

1. To elucidate the fundamentals of various energy sources and future energy requirement.
2. To impart a thorough knowledge about the application of solar energy.
3. To inculcate the students on feasibility and limitations of wind Energy Systems.
4. To analyse the principle and operation of Biomass energy.
5. To analyse the principle and operation of ocean energy and it's potential in india.

#### Module 1: Introduction [9L]

Introduction to energy Sources-Renewable and non-renewable energy sources –energy consumption as a measure of Nation's development – Strategy for meeting the future energy requirement – Global and national level energy scenarios –Prospects of renewable energy sources.

#### Module 2: Solar Energy [12L]

Fundamentals of Solar Energy, Solar Radiation on Earth's surface, Solar radiation geometry, Solar radiation measurements, Solar radiation data, Solar radiation on horizontal and tilted surfaces. Solar Thermal conversion: Flat plate collectors and concentrated collectors, collector efficiency. Solar applications: Heating, distillation, pumping, drying, cooking and solar electric power generation

#### Module 3: Wind Energy [10L]

Basic principle of wind energy conversion, site selection consideration, Betz Limit, Aerodynamics of wind turbine, basic components of wind energy conversion systems (WECS), types of WECS, applications of wind energy, safety system.

#### Module 4: Bio-Mass [9L]

Energy from Bio Mass: Various fuels, Conversion technologies, Aerobic digestion and anaerobic digestion, types of Bio-gas digesters, applications of bio-gas plants Factors affecting generation of bio gas, Community biogas plant, compare biomass and biogas.

#### Module 5: Geo-Thermal and Ocean Energy [10L]

Geothermal energy: Resources, methods of harnessing the energy, potential in India **Ocean energy:** Principle of ocean thermal energy conversion (OTEC), types: open cycle OTEC system, closed cycle and hybrid cycle, applications. Tidal and wave energy: Potential and conversion techniques.

## Text Books

1. "G. D. Rai", "Non-Conventional Energy sources", Khanna publishers, 2004
2. "John Twidell & Wier", "Renewable Energy Resources", CRC Press, 2009.

## Reference Books

1. "D. P. Kothari, Singal, Rakesh and Ranjan", "Renewable Energy sources and Emerging Technologies", PHI, 2009.
2. "F. C. Treble", "Generating Electricity from Sun", Pergamon Press, 1st Edition 1991
3. "C. S. Solanki", "Solar Photovoltaics - Fundamentals- Principles and Applications", PHI, 2009
4. "S. P. Sukhatme", "Solar Energy Principles and Application", TMH, 2009.
5. Agarwal, M.P., 'Future Sources of Electrical Power', S.Chand & Co. Ltd, New Delhi, 1999.

## E-Resources

1. <https://nptel.ac.in/courses/121106014>
2. <https://www.energy.gov/eere/geothermal/electricity-generation>
3. <https://beeindia.gov.in/sites/default/files/4Ch12.pdf>
4. <https://www.ireda.in/home>
5. <https://mnre.gov.in/wind/current-status/>
6. <https://mnre.gov.in/solar/current-status/>
7. <https://mnre.gov.in/bio-energy/current-status>

## Course Outcomes

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

- CO 1.** Understand the need of utilization of alternate energy resources & fundamentals of various non-conventional energy Systems.
- CO 2.** Analyze solar thermal and photovoltaic systems and related technologies for energy conversion.
- CO 3.** Understand Wind energy conversion and devices available for it.
- CO 4.** Understand Biomass conversion technologies, Geo thermal resources and energy conversion principles and technologies.
- CO 5.** Realize Power from oceans (thermal, wave, tidal) and conversion devices

## 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	PS O1	PS O2	
<b>CO1</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-	
<b>CO2</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-	
<b>CO3</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-	
<b>CO4</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-	
<b>CO5</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-	
<b>Average</b>	3	3	2	3	-	-	-	-	-	-	-	2	-	-	

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech IT</b> <b>III Year-II Sem</b>			
Course Code: <b>L320Y</b>	<b>Soft Computing</b> <b>(OPEN ELECTIVE - III)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

### **Unit I Soft Computing:**

Introduction to soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.

### **Unit II Artificial Intelligence:**

Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques.

### **Unit III Neural Network:**

Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, characteristic and applications of ANN.

### **Unit IV: Perceptron**

Perceptron training algorithm, Linear separability.

### **Unit V Genetic algorithm:**

Fundamental, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modelling.

### **Text Books:**

1. S.N. Sivanandam & S.N. Deepa, Principles of Soft Computing, Wiley Publications, 2nd Edition, 2011.
2. S, Rajasekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication, 1st Edition, 2009.

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

**CO 1.** Learn about soft computing techniques and their applications

**CO 2.** Analyze various neural network architectures

**CO 3.** Understand perceptrons.

**CO 4.** Define the fuzzy systems

**CO 5.** Analyze the genetic algorithms and their applications

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech: ME</b> <b>III Year – II</b> <b>Sem</b>			
Course Code: <b>L320Z</b>	<b>BASICS OF ROBOTICS</b> (Open Elective-III)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Engineering Physics, Engineering Mathematics

### Module 1

**Unit 1:** Introduction: Robotics-Introduction-classification with respect to geometrical configuration (Anatomy), Controlled system & chain type: Serial manipulator & Parallel Manipulator.

**Unit 2:** Components of Industrial robotics - precession of movement - resolution, accuracy & repeatability – Dynamic characteristics- speed of motion, load carrying capacity & speed of response

### Module 2

**Unit 1:** Grippers - End effectors: Mechanical gripper – Magnetic – Vacuum cup and other types of grippers.

**Unit2:** Industrial robots specifications. Selection based on the Application.

### Module 3:

**Unit 1:** Rotation Matrix, Homogenous Transformation Matrix, transformation matrix problems.

**Unit 2:** Kinematics-Manipulators Kinematics, D-H method of assignment of frames. Direct and Inverse Kinematics for industrial robots.

### Module 4:

**Unit 1:** Trajectory planning: Joint space scheme- Cubic polynomial fit- Obstacle avoidance in operation space-cubic polynomial fit with via point, blending scheme.

**Unit 2:** Types of motion: Slew motion – joint interpolated motion – straight line motion – problems.

### Module 5:

**Unit 1:** Sensors-Internal sensors: Position sensors & Velocity sensors, External sensors: Proximity sensors, Tactile Sensors, & Force or Torque sensors.

**Unit 2:** Programming of Robots and Vision System-Lead through programming methods- Teach pendent- overview of various textual programming languages like VAL etc.

### Text books

1. Industrial Robotics / Groover M P /McGraw Hill

2. Introduction to Robotics / John J. Craig/ Pearson

### Reference books

1. Theory of Applied Robotics / Jazar/Springer.H. Asada and J. J. E. Slotine, –Robot Analysis and Intelligencell, Wiley Inter-Science. 1986.

### E- Resources

1. <https://rb.gy/dw0rkv> <https://rb.gy/iayh9d>
2. <https://nptel.ac.in/courses/112/105/112105249/>
3. <https://nptel.ac.in/courses/112/101/112101098/>

### Course outcomes

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

**CO1:** Apply the basic components of robots

**CO2:** Differentiate types of robots and robot grippers.

**CO3:** Model forward and inverse kinematics of robot manipulators.

**CO4:** Analyze the path planning of the robot.

**CO5:** Program a robot to perform tasks in differential applications.

### CO-PO/PSO Mapping

Course Outcomes	Program Outcomes(POs)/Program Specific Outcomes(PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3	1	2	3	3	-	-	-	-	-	-	3	3	3
<b>CO2</b>	3	3	2	3	3	-	-	-	-	-	-	3	3	3
<b>CO3</b>	3	2	2	3	3	-	-	-	-	-	-	3	3	3
<b>CO4</b>	3	2	2	3	3	-	-	-	-	-	-	3	3	3
<b>CO5</b>	1	2	2	3	3	-	-	-	-	-	-	1	3	3
<b>Average</b>	2.6	2	2	3	3	-	-	-	-	-	-	2.6	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech -MIE</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L3201</b>	<b>BASIC MINING GEOLOGY</b> <b>(OPEN ELECTIVE – III)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Nil

### **Course Objectives**

This course will enable students to:

1. To introduce rock types and their physical properties
2. To acquaint with different structures occurring in rocks
3. To get idea about Ground water, and aquifers
4. To get idea about coal formation and its stages.
5. To know about minerals occurring in India.

### **Module 1**

Introduction, Definitions, Importance of geology in mining, Types of rocks, Physical properties of rocks.

### **Module 2**

Structural Geology: Definition, terminology, and Primary and secondary structures: Bedding, lineation, foliation, cleavage, Strike and dip. Definition of faults, folds and joints and their types, Unconformities, and its kinds.

### **Module 3**

Ground Water: Introduction, Hydrological Cycle, origin and occurrence of groundwater, water table. Aquifers: Types of aquifers, confined and unconfined aquifers, perched aquifers.

### **Module 4**

Coal: Stages of formation, composition, theories of formation of coal.

### **Module 5**

Occurrence and distribution of important metallic mineral deposits in India: Iron, Copper-Lead and Zinc–Manganese– Aluminum–Chromium. Occurrence and distribution of important non-metallic mineral deposits in India: Asbestos–kyanite–Sillimanite.

### **Textbooks**

1. Structural Geology – Billings, M.P. Prentice Hall.
2. Engineering geology –by Dr. Chennkeshavulu.

### **Reference Books**

1. A Textbook of Geology: Mukherjee P.K., The World Press Pvt. Limited Calcutta.

### **Course Outcomes**

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

- CO1** : Understand about rocks and their properties  
**CO2** : Learn about different structures occurring in rocks  
**CO3** : Understand about ground water, water table and aquifers  
**CO4** : Learn about coal and its formation theories  
**CO5** : Distinguish metallic and non-metallic minerals.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech -MBA</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L3202</b>	<b>Open Elective-III</b> <b>DIGITAL MARKETING</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Course Objective:**

To understand the importance of digital marketing and its applications

1. To understand the basics of Digital Marketing
2. To understand the Channels of Digital Marketing
3. To develop the capability to form Digital Marketing strategy
4. To enable the students to use new media such as Search Engine and Social Networking

**UNIT - I: Understanding Digital Marketing:** Concept, Components of Digital Marketing, Need and Scope of Digital Marketing, Benefits of Digital Marketing, Digital Marketing Platforms and Strategies, Comparison of Marketing and Digital Marketing, Digital Marketing Trends, Practical Exposure towards Social Media Marketing.

**UNIT - II: Channels of Digital Marketing:** Digital Marketing, Website Marketing, Search Engine Marketing, Online Advertising, Email Marketing, Blog Marketing, Social Media Marketing, Audio, Video and Interactive Marketing, Online Public Relations, Mobile Marketing, Migrating from Traditional Channels to Digital Channels, Affiliate Marketing.

**UNIT - II: Marketing in the Digital Era:** Segmentation – Importance of Audience Segmentation, How different segments use Digital Media – Organizational Characteristics, Purchasing Characteristics, Using Digital Media to Reach, Acquisition and Retention of new customers, Digital Media for Customer Loyalty.

**UNIT - III: Digital Marketing Plan:** Need of a Digital Marketing Plan, Elements of a Digital Marketing Plan– Marketing Plan, Executive Summary, Mission, Situational Analysis, Opportunities and Issues, Goals and Objectives, Marketing Strategy, Action Plan, Budget, Writing the Marketing Plan and Implementing the Plan.

**UNIT - IV: Search Engine Marketing and Online Advertising:** Importance of SEM, understanding Web Search – keywords, HTML tags, Inbound Links, Online Advertising vs. Traditional Advertising, Payment Methods of Online Advertising – CPM (Cost-per-Thousand) and CPC (Cost-per-click), Display Ads - choosing a Display Ad Format, Landing Page and its importance.

**UNIT - V: Social Media Marketing:** Understanding Social Media, Social Networking with Face book, LinkedIn, Blogging as a social medium, Micro blogging with Twitter, Social Sharing with YouTube, Social Media for Customer Reach, Acquisition and Retention.

Measurement of Digital Media: Analyzing Digital Media Performance, Analyzing Website Performance, Analyzing Advertising Performance.

**Course outcomes:**

Upon successfully completing the course, students should be able to:

1. Apply digital marketing in the globalized market
2. Define Channels of Digital Marketing
3. Design and develop Digital marketing plan
4. Understand Search engine marketing
5. Acquainted with Online Advertising

**Suggested Readings:**

1. Michael Miller, B2B Digital Marketing, 1e, Pearson, 2014.
2. Vandana Ahuja, Digital marketing, Oxford University Press 2015
3. Michael R Solomon, Tracy Tuten, Social Media Marketing, Pearson, 1e, 2015. Judy Strauss & Raymond Frost, E-Marketing, Pearson, 2016
4. Richard Gay, Alan Charles worth and Rita Esen, Online marketing – A customer led approach Oxford University Press 2007.
5. Arup Varma, Pawan S. Budhwar, Angelo S. De Nisi, Digital Marketing, Wiley, 2016.
6. David Bain – Digital Marketing in 2017



<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech -S&amp;H</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L3203</b>	<b>Open Elective-III</b> <b>Number Theory &amp; Cryptography</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:**

**Module –I Divisibility Theory And Canonical Decompositions[9L]**

Division algorithm – Base – b representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM.

**Module 2: Diophantine Equations And Congruence's [10L]**

Linear Diophantine equations – Congruence's – Linear Congruence's – Applications: Divisibility tests – Modular exponentiation-Chinese remainder theorem – 2 x 2 linear systems.

**Module 3: Classical theorems and Multiplicative functions [9L]**

Wilson's theorem – Fermat's little theorem – Euler's theorem – Euler's Phi functions

**Module 4: Classical Encryption Techniques [10L]**

Classical encryption techniques: Symmetric chipper model – Substitution techniques – Transposition techniques – Steganography.

**Module 5: Block chippers public key Encryption [ 10L ]**

Block chipper principles – block chipper modes and operations – advanced encryption standards (AES) – Public key cryptography – Principles of public key cryptosystem – The RSA algorithm – Elliptic curve arithmetic – Elliptic curve cryptosystem.

**Text Books**

1. Koblitz, N. "Course on Number Theory and Cryptography", Springer Verlag, 1986
2. Menezes, A, et.al. "Handbook of Applied Cryptography", CRC Press, 1996

**Reference Books**

1. Ivan Niven, Herbert S. Zukerman, Hugh L. Montgomery, "An Introduction to the Theory of Numbers".

## E-Resources

1. <https://people.maths.bris.ac.uk/~mazag/nt/lecture1.pdf>
2. <https://www.diva-portal.org/smash/get/diva2:530204/FULLTEXT01.pdf>
3. [https://en.wikipedia.org/wiki/Multiplicative\\_function](https://en.wikipedia.org/wiki/Multiplicative_function)
4. <https://www.slideshare.net/PrachiGulihar/elementary-cryptography>
5. [https://en.wikipedia.org/wiki/Public-key\\_cryptography](https://en.wikipedia.org/wiki/Public-key_cryptography)

## Course Outcomes

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

**CO1.** Ability to think and reason about abstract mathematics

**CO2.** Analyze the vulnerabilities in any computing system and hence be able to design a security solutions

**CO3.** Evaluate security mechanisms using rigorous approaches, including theoretical

**CO4.** Solve problems in elementary number theory

**CO5.** Apply elementary number theory to cryptography

## 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	PS O1	PS O2
<b>CO1</b>	3	2	3	3	-	-	-	-	-	-	-	2	-	-
<b>CO2</b>	3	2	3	3	-	-	-	-	-	-	-	2	-	-
<b>CO3</b>	3	2	3	3	-	-	-	-	-	-	-	2	-	-
<b>CO4</b>	3	2	3	3	-	-	-	-	-	-	-	2	-	-
<b>CO5</b>	3	2	3	3	-	-	-	-	-	-	-	2	-	-
<b>Average</b>	3	2	3	3	-	-	-	-	-	-	-	2	-	-

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech -S&amp;H</b> <b>III Year-II</b> <b>Sem</b>			
Course Code: <b>L3204</b>	<b>NDT and VACUUM TECHNOLOGY</b> <b>(Open Elective)</b>	L	T	P	D
Credits: <b>3</b>	(COMMON TO: All branches)	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Nil

### **Module- 1: Introduction to Non-destructive testing [8L]**

Introduction, Objectives of Non-destructive testing, Types of defects – Cracking, Spalling, Staining, Construction and Design defects, Honey combing, Dusting, Blistering, Rain damage.

### **Module -2: Methods of Non-destructive Testing [9L]**

Methods of Nondestructive Testing: Liquid penetration method, Dye penetration method, Ultrasonic Inspection method, Pulse Echo method, Radiographic testing Magnetic particle testing, Eddy current Testing.

### **Module- 3: Vacuum Technology and Flow Meters [9L]**

**Vacuum Technology:** Definition of vacuum, Degrees of vacuum and their ranges; Review of Kinetic theory of gases; Definitions of particle flux, mono layer formation time, pressure; Elementary gas transport phenomena; Knudsen's and Reynolds' numbers; Throughput, mass flow and conductance.

**Flow meters:** Molar flow, Mass flow.

### **Module- 4: Pressure gauges [8L]**

Pressure gauges: Classification, Direct and indirect gauges, Indirect gauges – Pirani gauge, Thermocouple gauge, Ionization gauge, hot cathode gauge, Penning gauge.

### **Module-5 : Vacuum Pumps [9L]**

Introduction, Pumping speed, Rotary vane pump, Turbo molecular pump, Diffusion pumps.

### **Text Books**

1. B K Pandey, S Chaturvedi, "Engineering Physics", Cengage learning, 1st Edition, 2014.
2. John. F. O'Hanlon, "A User's guide to Vacuum technology", Wiley, 3rd Edition, 2003.

### **Reference Books**

1. R Srinivasan, "Physics for Engineers", New Age international, 1st reprint, 2007.
2. R K Gaur and S L Gupta, "Engineering Physics", Dhanpat rai, Reprint, 2006.
3. Krishna Seshan, "Hand Book of Thin film deposition", Noyes, 2nd Edition, 2002.

### **E-Resources**

1. <http://www.enfm.net/catalog/catalog/enfm-usa.pdf>
2. <http://web.itu.edu.tr/~arana/ndt.pdf>
3. [http://www.issp.ac.ru/ebooks/books/open/Nondestructive\\_Testing\\_Methods](http://www.issp.ac.ru/ebooks/books/open/Nondestructive_Testing_Methods)

\_and\_New\_Applications.pdf

4. <http://nptel.ac.in/courses/114106035/35>

5. <http://nptel.ac.in/courses/112101004/37>

### **Course Outcomes**

After completion of this course the student is able to

1. Describe the Types of defects and analyze them.
2. The principles of NDT methods.
3. Analyze Vacuum technology and concepts of flow meters.
4. Apply the basic knowledge on pressure gauges.
5. Understand the concepts of different vacuum pumps.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech -S&amp;H</b> <b>IV Year-I Sem</b>			
Course Code: <b>L3205</b>	<b>Chemistry for Engineers</b> (COMMON TO: All branches)	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Nil

### **Module 1: Fibres and Rubbers [9]**

Fibres-classification-Characteristics of fibres-Preparation and applications of Nylon-6, 6 and Dacron-Fibre reinforced plastics(FRP)-Applications.  
Rubbers-Natural rubber and its vulcanization. Elastomers-Buna-S, Butyl rubber and Thiokol rubber.

### **Module 2: Polymers for Electronics[10]**

Polymer resists for integrated circuit fabrication, lithography and photolithography, Electron beam, X-ray and ion sensitive resists, Conducting polymers, types, properties and applications, electroluminescence, molecular basis of electrical conductivity, Photonic applications and non-linear optics, optical information Storage.

### **Module 3: Analysis and Testing of Polymers [8]**

Chemical analysis of Polymers: Spectroscopic methods – IR spectroscopy, Raman spectroscopy, NMR spectroscopy, Mass spectroscopy – X-Ray Diffraction analysis. Thermal analysis: Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC), Thermo Gravimetric Analysis (TGA).

### **Module 4: Surfactants and Lubricants[10]**

Methods of preparation, cleaning mechanism. Critical micelle concentration and its determination. Hydrophobic and hydrophilic interactions. Micelles and reverse micelles. Detergents. Fricohesity of surfactants. Lubricants-physical and chemical properties, types and mechanism of lubrication. Additives of lubricants and freezing points of lubricants.

### **Module 5: Metals and Alloys [9]**

Phase rule and applications to one, two and multi-component systems. Iron-carbon phase diagram. Types of alloys, carbon steel, alloy steel, alloys of Cu, Al, Pb.

### **Text Books**

1. A Textbook of Engineering Chemistry, by Shashi Chawla
2. Engineering Chemistry, by S. S. Dara

### **Reference Books**

1. Engineering Chemistry, by P. C Jain and M. Jain
2. Advanced Polymer Chemistry, by M. Chanda

## E-Resources

1. <https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/nanochemistry.html>
2. <https://www.sciencedirect.com/book/9780444519566/nanochemistry>
3. <https://www.researchgate.net/publication/320068992> Introduction to Nano-chemistry and Nano-materials
4. <https://www.kemi.dtu.dk/english/research/organic-inorganic-chemistry/nanochemistry>
5. <https://www.cambridge.org/core/books/engineering-chemistry/nanochemistry/D6DB35E32E530525DD927E68CED43197>

## Course Outcomes

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

1. Learn the different synthetic methods of the fibres and rubbers.
2. Know the electronic applications of polymers.
3. Acquire the knowledge on various instrumental methods of analysis.
4. Know the use of surfactants and lubricants.
5. Learn the use and applications of alloys.

<b>AY 2022-23 onwards</b>	<b>J. B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)</b>	<b>B. Tech S&amp;H III Year – II Sem</b>			
Course Code: <b>L3206</b>	<b>TECHNICAL COMMUNICATION SKILLS (COMMON TO ALL)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>
<b>Credits: 3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites: Nil**

**Objectives:**

1. Understand the role of language as a communication
2. Employ the role of presentation skills in public speaking
3. Know the importance of body language
4. Examine the role of group discussion for getting jobs
5. Understand the importance of interview skills for getting jobs

**Module -I Language as a Communication**

Introduction-definition-the process of communication-types of communication-barriers of communication; language and communication-properties of language.

**Module -II Presentation Skills**

Nature and importance of oral presentation-planning the presentation-preparing the presentation-organizing the presentation-rehearsing the presentation and checklist for making oral presentation

**Module -III Body Language**

Introduction-definition-eye contact- facial expressions-gesture and posture.

**Module -IV Group Discussion**

Nature of GD- Characteristics and Strategies of GD-Techniques for Individual Contribution-Group Interaction Strategies.

**Module -V Interview Skills**

The Interview Process-Characteristics of Interview-Pre-interview preparation Techniques-interview questions-FAQ- Projecting a Positive Image and Alternative Interview Format.

**References:**

- 1) Raman, Meenakshi and Sangeeta Sharma. Technical Communication-Principles and Practice. Third Edition, New Delhi: UP., 2015.
- 2) Rizvi, M Ashraf. Effective Technical-Communication. New Delhi: Tata McGraw-Hill., 2005.

**Course outcomes:**

1. Use the language skills in order to better communication
2. Learn the presentation skills and use them in conferences and seminars
3. Identify the role of presentation skills in expressing our feelings and emotions
4. Understand the role of group discussion for getting jobs
5. Know the importance of interview skills for getting jobs

### CO-PO/PSO Mapping

<b>CO-PO/PSO Mapping Chart</b> <b>(3/2/1 indicates strength of correlation)</b> <b>3 – Strong; 2 – Medium; 1 - Weak</b>														
<b>Course Outcome S (COs)</b>	<b>Program Outcomes (POs)</b>												<b>Program Specific Outcomes *</b>	
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	..	..	..	..	..	..	..	..	2	3	..	3	..	..
<b>CO2</b>	..	..	..	..	..	..	..	..	2	3	..	3	..	..
<b>CO3</b>	..	..	..	..	..	..	..	..	2	3	..	3	..	..
<b>CO4</b>	..	..	..	..	..	..	..	..	2	3	..	3	..	..
<b>CO5</b>	..	..	..	..	..	..	..	..	2	3	..	3	..	..
<b>Total</b>	..	..	..	..	..	..	..	..	2	3	..	3	..	..



# OPEN ELECTIVE-IV

AY: 2022-23 Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE IV Year-I Sem</b>			
Course Code: <b>L410A</b>	<b>ENVIRONMENTAL IMPACT ASSESSMENT (OE-IV)</b>	L	T	P	D
Credits: 3		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Environmental Science.

**Module 1:**

**Unit-1:** Initial Environmental examination –Factors affecting EIA – Need for Environmental Impact Assessment (EIA), Rapid and Comprehensive EIA, Environmental Impact statement (EIS)

– EIA capability and limitations – Legal provisions on EIA – stages of EIA.

**Module 2:**

**Unit-1:** Role of NEPA in EIA, CEQ, Environmental documents. EIA/ EIS& FONSI relationship, processing of EIA/EIS, Environmental attributes.

**Methodologies:** Criteria to be considered for the selection of EIA methodologies, Adhoc, overlays, Check lists – Matrices – Networks – Cost-benefit analysis with their advantages and limitations.

**Module 3:**

**Unit-1:** EIA guidelines for Development Projects, Prediction and Assessment – Assessment of Impact on land, water, air, and noise. Social and cultural activities and on flora and fauna – mathematical models – public participation, Forest act 1980, Wild life Protection Act-1972, The water (Prevention and control) Act-1974

**Module 4:**

**Unit-1: Environment management plan:**

Plan for mitigation of adverse impact on Environment – Options for mitigation of impact on water, air, land and on flora and fauna – Addressing the issues related to project affected people. Post project monitoring. ISO 9000, 14000 & 18000.

**Module 5:**

**Unit-1:**

EIA for Water resource developmental projects, Highway projects: Nuclear Power plant projects, Mining project (Coal, Iron ore), Thermal Power Plant, Infrastructure Construction Activities.

**Text Books**

1. "Environmental Impact Assessment" by S.R. Khandeshwar N.S. Raman, A.R. Gajbhiye, I kinternational house publishing, pvt ltd. 1st addition Sep 2019.
2. "Environmental Impact Assessment" by Barthwell, R. R. New Age International Publications. 3rd addition Oct 2017.

**Reference Books**

1. "Environmental Impact Analysis" by Jain R.K.-Van Nostrand Reinhold Co, H

K E Sinternationl publication, 3rd addition oct 2014.

2. "Environment Impact Assessment" by Anjaneyulu, B S Publication, 2nd addition Jan 2010

### Web Resources

1. <https://nptel.ac.in/courses/120/108/120108004/>

### Course Outcomes

On completion of the course, the students will be able to:

1. **Explain** the stages and need for environmental impact assessment.
2. **Discuss** different methodologies for environmental impact prediction and assessment.
3. **Evaluate** the environmental management plans.
4. **Solve** the problems associated with adverse impact on environment.
5. **Apply** the knowledge of EIA on different construction projects

<b>CO-PO/PSO Mapping Chart</b> <b>(3/2/1 indicates strength of correlation)</b> <b>3 – Strong; 2 – Medium; 1 - Weak</b>														
<b>Course Outcomes (COs)</b>	<b>Program Outcomes (POs)</b>												<b>Program Specific Outcomes</b>	
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	-	2	-	-	-	1	2	3	-	-	-	-	2	1
<b>CO2</b>	-	-	-	-	-	2	3	1	-	-	-	-	1	1
<b>CO3</b>	-	-	-	-	-	2	2	3	-	-	-	-	2	1
<b>CO4</b>	-	2	-	-	-	1	2	3	-	-	-	-	1	3
<b>CO5</b>	-	-	-	-	-	1	3	2	-	-	-	-	2	2
<b>Average</b>	-	0.8	-	-	-	1.4	2.4	2.4	-	-	-	-	1.6	1.6

<b>AY: 2022-23</b> Onwards	<b>J. B. INSTITUTE OF ENGINEERING AND TECHNOLOGY</b> (UGC Autonomous)	<b>B. Tech-CSE</b> <b>IV Year- I</b> <b>Sem</b>			
Course Code: <b>L410B</b>	<b>INTRODUCTION TO PYTHON PROGRAMMING</b> <b>(Open Elective -IV)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites: NIL**

**Course Objectives:**

The students should be able to

1. Acquire programming skills in core Python.
2. Apply the Python programming language operations, control structures
3. Develop the ability to use built-in data types
4. Develop the skill of creating functions, writing data to files
5. Acquire Object Oriented Skills in Python

**Module 1: Introduction**

**Unit-I: History**

Python Introduction, History of Python, Introduction to Python Interpreter and program execution, Python Installation Process in Windows and Linux, Introduction to anaconda.

**Unit-II: Variables**

Python IDE, python variable declaration, Keywords, Indents in Python, Python input/output operations.

**Module 2: Operators, Conditional Statements, Loops**

**Unit-I: Operators**

Arithmetic Operators, Comparison Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Ternary Operator, Operator precedence.

**Unit-II: Conditional Statements, Loops**

Conditional Statements (If, If-else, If-elif-else, Nested-if etc.) and loop control statements (for, while, Nested loops, Break, Continue, Pass statements)

**Module 3: Built-in Data types**

**Unit-I: Strings, Lists**

Strings Creating, initializing and accessing the elements; String operators, String functions and methods. Lists: Concept of mutable lists, creating, initializing and accessing the elements, traversing, appending, updating and deleting elements

**Unit-II: Tuple, Set, Dictionary**

Tuples creating, initializing and accessing the elements in a tuple. Concept of key-value pair, creating, initializing and accessing the elements in a dictionary, dictionary operations, Dictionary functions and methods.

## **Module 4: Functions and Files**

### **Unit-I: Functions**

Introduction to functions, Function definition and calling, Function parameters, Default argument function, Variable argument function, in built functions in python, Scope of variable in python.

### **Unit-II: Files**

Concept of Files, File opening in various modes, closing of a file. Reading from a file, writing onto a file, some important File handling functions.

## **Module 5: Object oriented Programming**

### **Unit-I: Programming types**

Programming types, Procedure-oriented programming, Object Oriented Programming.

### **Unit-II:**

Accessing Databases using Python.

## **Text Books**

1. Python for Everybody: Exploring Data in Python 3 by Charles Severance

## **Reference Books**

1. Programming in Python 3 - A complete Introduction to the Python Language Second Edition, Mark Summerfield, Addison-Wesley 2010
2. Object-Oriented Programming in Python, Michael H, Goldwasser, David Letscher, Pearson Prentice Hall, 2008.
3. Programming Python- 4 th Edition, Mark Lutz, O'Reilly, 2011.

## **E-Resources**

1. <https://www.youtube.com/watch?v=YYXdXT2l-Gg&list=PL-osiE80TeTskrapNbzxhwoFUiLCjGgY7>
2. <https://docs.python.org/3/tutorial/>
3. <https://www.programiz.com/python-programming>
4. <https://www.w3schools.com/python/>

## **Course Outcomes**

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

**CO1.** Choose the right data representation formats based on the requirements of the problem.

**CO2.** Identify tasks and write programs in python, to solve the task.

**CO3.** Use the comparisons and limitations of the various built-in data types and choose the right one.

**CO4.** Identify and write the functions, programs required for accessing files.

**CO5.** Demonstrates how to achieve reusability using inheritance, interfaces.

<b>AY 2022-23 onwards</b>	<b>J. B. Institute of Engineering and Technology (UGC Autonomous)</b>	<b>B. Tech: AI&amp;ML IV Year-I Sem</b>			
Course Code: <b>L410C</b>	<b>INTRODUCTION TO DEEP LEARNING (Open Elective IV)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>
<b>Credits: 3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:**

1. Probability Statistics, linear algebra. Machine learning .

**Course Objectives:**

**The Student will:**

1. Get introduced to various learning techniques of machine learning and understand differences between machine learning and deep learning
2. Understand and analyse optimization techniques and improvements in learning methods
3. Appreciate, understand and apply neural networks as tools for complete learning problems
4. Investigate and deploy/club multi-layer neural networks for learning related to images, text and speech sequences.
5. Appreciate, understand and implement Deep learning in real world practical problems

**Module 1:**

**Introduction to Deep Learning**

Introduction to Deep Learning, Brief History of Deep Learning, AI, Machine Learning and Deep Learning, Statistical Learning, Bayesian Learning, Decision Surfaces, Success stories of Deep Learning

**Module 2:**

**Linear Classifiers**

Linear Classifiers, Linear Machines with Hinge Loss, Optimization Techniques, Gradient Descent, Batch Optimization, Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam.

**Module 3:**

**Neural Network**

Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning, Unsupervised Learning with Deep Network, Autoencoders, Convolutional Neural Network, Building blocks of CNN, Transfer Learning, LSTM Networks.

**Module 4:**

**Deep Neural Net**

Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization, Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN

## **Module 5:**

### **Applications**

Detection & Segmentation problem definition, challenges, Evaluation, Datasets and Localization by regression, Detection as classification

Region proposals, RCNN and YOLO architectures, fully convolutional segmentations, Mask-RCNNs.

### **Text Books:**

1. Deep Learning- Ian Goodfellow, Yoshua Benjio, Aaron Courville, The MIT Press
2. Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.

### **Reference Books:**

1. Deep Learning: A Practitioner's Approach by Josh Patterson & Adam Gibson, O'Reilly Press
2. Python Deep Learning: Exploring deep learning techniques and neural network architectures with PyTorch, Keras, and TensorFlow, 2nd Edition by Ivan Vasilev, Pakt Publication.

### **E - Resources:**

1. <https://nptel.ac.in/courses/106/105/106105215/>
2. <https://www.slideshare.net/LuMa921/deep-learning-a-visual-introduction>
3. <https://yiqiaoyin.files.wordpress.com/2018/02/deep-learning-notes.pdf>

### **Course Outcomes:**

#### **The student will be able to:**

1. Identify tools of machine learning and deep learning, appropriate to any problems
2. Apply optimization techniques to improve the quality of various learning solutions.
3. Apply and investigate, neural network for complete learning problems.
4. Implement deep learning methods in the area of multidimensional and sequential inputs.
5. Investigate the scope of implementation of various deep learning techniques in any real world problem

<b>AY 2022-23 Onwards</b>	<b>J. B. Institute of Engineering and Technology (UGC Autonomous)</b>	<b>B. Tech: AI&amp;DS IV Year – I Sem</b>			
Course Code: <b>L410D</b>	<b>OPEN ELECTIVE – IV FUNDAMENTALS OF BIG DATA</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>
<b>Credits: 3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Course Objectives:**

1. The purpose of this course is to provide the students with the knowledge of Big data Analytics principles and techniques.
2. This course is also designed to give an exposure of the frontiers of Big data Analytics

**MODULE-I: Introduction to Big Data and Big Data Analytics**

**Unit 1:**

Introduction to Big Data: Big Data and its Importance, Four V's of Big Data, Structuring Big Data

**Unit 2:**

Drivers for Big Data, Introduction to Big Data Analytics, Classification of Analytics, Big Data Analytics applications

**MODULE- II: Big Data Technologies Unit 1:**

Big Data Technologies: Hadoop's Parallel World, Data discovery, Open source technology for Big Data Analytics, cloud and Big Data.

**Unit 2:**

Predictive Analytics, Mobile Business Intelligence and Big Data

**MODULE- III: Introduction to Hadoop and Map Reduce**

**Unit 1:**

Introduction Hadoop: Big Data, Apache Hadoop & Hadoop Eco System, Moving Data in and out of Hadoop.

**Unit 2:**

Map Reduce, understanding inputs and outputs of Map Reduce - Data Serialization.

**MODULE- IV:Hadoop Architecture & HDFS Architecture**

**Unit 1:**

Hadoop Architecture: Hadoop: RDBMS Vs Hadoop, Hadoop Overview, Hadoop distributors, HDFS, HDFS Daemons, Anatomy of File Write and Read., Name Node, Secondary Name Node, and DataNode.

**Unit 2:**

HDFS Architecture, Hadoop Configuration, Map Reduce Framework, Role of HBase in Big Data processing, HIVE, PIG.

**MODULE- V: Data Analytics & Social Media Analytics**

**Unit 1:**

Data Analytics with R Machine Learning: Introduction, Supervised Learning, Unsupervised Learning.

**Unit 2:**

Collaborative Filtering, Social Media Analytics, Mobile Analytics, Big Data Analytics with Big R



**TEXT BOOKS:**

1. Big Data Analytics, Seema Acharya, Subhasini Chellappan, Wiley 2015.
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Michael Minelli, Michehe Chambers, 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
3. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O'Reilly Media, 2012.
4. Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1st Edition, IBM Corporation, 2012.

**REFERENCE BOOKS:**

1. Big Data and Business Analytics, Jay Liebowitz, Auerbach Publications, CRC press (2013)
2. Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop, Tom Plunkett, Mark Hornick, McGraw-Hill/Osborne Media (2013), Oracle press.
3. Professional Hadoop Solutions, Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, Wiley, ISBN: 9788126551071, 2015.
4. Understanding Big data, Chris Eaton, Dirk deroos et al. McGraw Hill, 2012.
5. Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer, 2007.
6. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, 1st Edition, Wiley and SAS Business Series, 2012.

**Courses Outcomes:**

1. Ability to explain the foundations, definitions, and challenges of Big Data and various Analytical tools.
2. Ability to program using HADOOP and Map reduce, NOSQL
3. Ability to understand the importance of Big Data in social media and Mining.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech ECE</b> <b>IV Year-I Sem</b>			
Course Code: <b>L41OE</b>	<b>CONSUMER ELECTRONICS</b> <b>(OPEN ELECTIVE)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites: NIL**

**Module 1: [10L]**

**Unit-I: [6L]**

Audio Fundamentals and Devices: Basic characteristics of sound signal: level and loudness, pitch, frequency response, fidelity and linearity, Reverberation. Audio level metering, decibel level in acoustic measurement. Microphone: working principle, sensitivity, nature of response, directional characteristics.

**Unit-II: [4L]**

Types: carbon, condenser, crystal, electrets, tie- clip, wireless. Loudspeaker: working principle, characteristic impedance, watt capacity. Types: electrostatic, dynamic, permanent magnet, woofers, and tweeters. Sound recording: Optical recording, stereophony and multichannel sound, MP3 standard.

**Module 2: [8L]**

**Unit-I: [4L]** Audio systems: CD player, home theatre sound system, surround sound. Digital console: block diagram, working principle, applications.

**Unit-II: [4L]** FM tuner: concepts of digital tuning, ICs used in FM tuner TDA 7021T. PA address system: planning, speaker impedance matching, Characteristics, power amplifier, Specification.

**Module 3: [8L]**

**Unit-I: [4L]** Television Systems: Monochrome TV standards, scanning process, aspect ratio, persistence of vision and flicker, interlace scanning, picture resolution. Composite video signal: horizontal and vertical sync details, scanning sequence.

**Unit-II: [4L]** Colour TV standards, colour theory, hue, brightness, saturation, luminance and chrominance. Different types of TV camera. Transmission standards: PAL system, channel bandwidth

**Module 4: [10L]**

**Unit-I: [5L]** Television Receivers and Video Systems: PAL-D colour TV receiver, block diagram, Precision IN Line colour picture tube. Digital TVs: - LCD, LED, PLASMA, HDTV, 3-D TV, projection TV, DTH receiver.

**Unit-II: [5L]** Video interface: Composite, Component, Separate Video, Digital Video, SDI, HDMI

Multimedia Interface), Digital Video Interface. CD and DVD player: working principles, Interfaces.

**Module 5: [9L]**

**Unit-I: [5L]** Home / Office Appliances: FAX and Photocopier. Microwave Oven: types, single chip controllers, wiring and safety instructions, technical

specifications. Washing Machine: wiring diagram, electronic controller for washing machine, technical specifications, types of washing machine, fuzzy logic.

**Unit-II:[4L]** Air conditioner and Refrigerators: Components features, applications, and technical specification. Digital camera and cam coder: - pick up devices - picture processing - picture storage.

### Textbooks

4. Consumer Electronics, Bali S.P., Pearson Education India, 2010.
5. Audio video systems: principle practices & troubleshooting, Bali R and Bali S.P., Khanna Book Publishing Co. (P) Ltd., 2010 Delhi, India.

### Reference Books

3. Intellectual Property in Consumer Electronics, Software and Technology Startups, Springer Nature; 2014th edition (24 September 2013), ISBN-10:9781461479116.
4. Consumer Electronics, B.R. Gupta , V. Singhal, S.K. Kataria & Sons; 2013th edition.

### E-Resources

1. <https://www.allaboutcircuits.com/videos/category/consumer-electronics/>
2. <https://www.youtube.com/watch?v=IttXKAGl6zE>

### Course Outcomes

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

**CO1. Learn** how a Consumer Product is developed.

**CO2. Analyze** how to simulate and test that designs.

**CO3. Apply** in-depth study of systems and the use of those.

**CO4. Understand** concept of Audio Systems.

**CO5. Develop** Television Receivers & Video Systems.

### 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	PS O1	PS O2
<b>CO1</b>	-	-	2	2	3	-	-	-	-	-	-	-	2	-
<b>CO2</b>	2	2	-	-	-	-	-	-	-	-	-	-	2	-
<b>CO3</b>	3	2	-	-	-	-	-	-	-	-	-	-	2	-
<b>CO4</b>	-	-	-	-	-	-	-	-	-	-	-	-	2	-
<b>CO5</b>	2	-	3	3	-	-	-	-	-	-	-	-	2	-
<b>Average</b>	2.3	2	2.5	2.5	3	-	-	-	-	-	-	-	2	-

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech ECM</b> <b>IV Year-I Sem</b>			
Course Code: <b>L410F</b>	<b>INTRODUCTION TO EMBEDDED SYSTEMS</b> <b>(Open Elective-IV)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Nil

**Course Objectives:**

Students will learn to

1. Understand the basic concepts of embedded systems and 8051 microcontrollers.
2. Compare and contrast the basics of assembly programming language.
3. Identify the unique characteristics of real-time systems
4. Analyze the general structure of a real-time system and define the unique design problems and challenges of real-time systems.
5. Acquaint the embedded software development tools and various advanced architectures.

**Module 1:**

**Unit-I: Embedded Computing**

Introduction, complex systems and microprocessor, the embedded system design process, formalisms for system design, design examples

**Unit-II: The 8051 Architecture**

Introduction, 8051 micro controller hardware, input/output ports and circuits, external memory, counter and timers, serial data input/output, interrupts.

**Module 2:**

**Unit-I: Basic Assembly Language Programming Concepts**

The assembly language programming process, programming tools and techniques, programming the 8051.

**Unit-II:**

Data transfer and logical instructions, arithmetic operations, decimal arithmetic, jump and call instructions.

**Module 3:**

**Unit-I: Introduction to Real-Time Operating Systems**

Tasks and task states, tasks and data, semaphores, and shared data; message queues, mailboxes and pipes, timer functions, events, memory management, interrupt routines in an RTOS environment.

**Unit-II: Basic Design Using a Real-Time Operating System**

Principles, semaphores and queues, hard real-time scheduling considerations, saving memory and power, an example RTOS like uC-OS (open source).

**Module 4:**

**Unit-I: Embedded Software Development Tools**

Host and target machines, linker/locators for embedded software, getting embedded software into the target system

**Unit-II: Debugging Techniques**

Testing on host machine, using laboratory tools, an example system.

## Module 5:

### Unit-I: Introduction to advanced Architectures

ARM and SHARC, processor and memory organization and instruction level parallelism.

**Unit-II:** Networked embedded systems: bus protocols, I2C bus and CAN bus; internet-enabled systems, design example-elevator controller.

### Text Books

1. Wayne Wolf (2008), Computers as Components-principles of embedded computer system design, Elsevier, New Delhi, India.
2. Kenneth J. Ayala (2008), The 8051 Microcontroller, 3rd edition, Cengage Learning, India.

### Reference Books

1. David E. Simon (1999), An Embedded Software Primer, Pearson Education, India.
2. Jean J. Labrosse (2000), Embedding System Building Blocks, 2nd edition, CMP publishers, USA.
3. Raj Kamal (2004), Embedded Systems, Tata McGraw hill, India.

### E-Resources

1. <https://nptel.ac.in/courses/108/102/108102045/>
2. <https://www.edx.org/course/utaustinx/utaustinx-ut-6-02x-embedded-systems-4806>

### Course Outcomes

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

**CO1.** Program an embedded system.

**CO2.** Analyze Interfacing with keyboard, A/D & D/A conversions, serial data Communication, LCD and LED display.

**CO3.** Illustrate Tasks, Semaphores, Message queues, pipes, Timer functions.

**CO4.** Design embedded systems and real-time systems.

**CO5.** Compare and contrast ARM, SHARC, internet enabled systems.

### 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	PS O1	PS O2
<b>CO1</b>	2	1	2	-	-	-	-	-	1	-	2	2	2	-
<b>CO2</b>	2	2	2	-	-	-	-	-	2	-	2	2	3	1
<b>CO3</b>	2	2	-	-	-	-	-	-	2	-	-	2	3	1
<b>CO4</b>	1	3	-	-	-	-	-	-	2	-	-	2	3	1
<b>CO5</b>	2	1	-	-	-	-	-	-	2	-	2	2	2	1
<b>Average</b>	1.8	1.8	2	-	-	-	-	-	1.8	-	2	2	2.6	1

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech EEE</b> <b>IV Year-I Sem</b>			
Course Code: <b>L410G</b>	<b>SPECIAL ELECTRICAL MACHINES</b> <b>(OPEN ELECTIVE-IV)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Basic Electrical and Electronics Engineering

### **Module 1: PERMANENT MAGNET BRUSHLESS DC MOTORS [8L]**

Fundamentals of permanent magnets – types - principle of operation- magnetic circuit analysis - EMF and torque equations, Characteristics and control.

### **Module 2: PERMANENT MAGNET SYNCHRONOUS MOTORS [12L]**

Principle of operation – EMF and torque equations - Phasor diagram - Power controllers – performance characteristics – Digital controllers – Constructional features, operating principle and characteristics of synchronous reluctance motor.

### **Module 3: SWITCHED RELUCTANCE MOTORS [10L]**

Constructional features – Principle of operation - Torque prediction – performance Characteristics-Power controllers – Control of SRM drive – Sensor less operation of SRM – Applications.

### **Module 4: STEPPER MOTORS [10L]**

Constructional features –Principle of operation –Types – Torque equation – Linear and Nonlinear analysis – Characteristics – Drive circuits – Closed loop control – Applications.

### **Module 5: OTHER SPECIAL ELECTRICAL MACHINES [8L]**

Principle of operation and characteristics of Hysteresis motor – AC series motors – Linear inductionmotor – Applications.

### **Text Books**

1. T.J.E. Miller, Brushless magnet and Reluctance motor drives, Claredon press, London, 1989.
2. R.Krishnan, Switched Reluctance motor drives, CRC press, 2001.
3. T.Kenjo, Stepping motors and their microprocessor controls, Oxford University press, New Delhi, 2000.
4. K. Venkataratnam, Special Electrical Machines, Universities Press, 2014.

### **Reference Books**

1. T.Kenjo and S.Nagamori, Permanent magnet and Brushless DC motors, Clarendon press, London, 1988.
2. R.Krishnan, Electric motor drives, Prentice hall of India, 2002.
3. D.P.Kothari and I.J.Nagrath, Electric machines, Tata Mc Graw hill publishing company, New Delhi, Third Edition, 2004
4. Irving L.Kosow, Electric Machinery and Transformers, Pearson Education,

### E-Resources

1. <https://nptel.ac.in/courses/108/102/108102156/>
2. [https://www.academia.edu/9885014/SPECIAL\\_ELECTRICAL\\_MACHINES\\_NPT\\_EL\\_NOTES](https://www.academia.edu/9885014/SPECIAL_ELECTRICAL_MACHINES_NPT_EL_NOTES)
3. <https://easyengineering.net/ee6703-special-electrical-machines/>

### Course Outcomes

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

- CO 1.** Analyze given magnetic circuit and understand operation, characteristics and control of PMSM motor.
- CO 2.** Understand the construction, operation performance characteristics of PMSM and its power controllers.
- CO 3.** Understand the construction, operation and control of SRM drive and its power controllers.
- CO 4.** Understand the construction, operation, characteristics and control of stepper motor.
- CO 5.** Understand the operation & characteristics of other special electrical machines.

### 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	PS O1	PS O2
<b>CO1</b>	1	3	3	3	-	-	-	-	-	-	-	-	3	3
<b>CO2</b>	2	2	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO3</b>	2	2	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO4</b>	2	2	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO5</b>	2	2	-	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>	1.8	2.2	3	3	-	-	-	-	-	-	-	-	3	3

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech IT</b> <b>IV Year-I Sem</b>			
Course Code: <b>L41OG</b>	<b>Object Oriented Analysis and Design</b> <b>(OPEN ELECTIVE-IV)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

### **UNIT - I Introduction to UML:**

Importance of modeling, principles of modelling, object-oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle.

### **UNIT - II Basic Structural Modeling:**

Classes, Relationships, common Mechanisms, and diagrams. Advanced Structural Modeling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages.

### **UNIT - III Class & Object Diagrams:**

Terms, concepts, modeling techniques for Class & Object Diagrams.

### **UNIT - IV Basic Behavioral Modeling-I:**

Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams

### **UNIT - V Advanced Behavioral Modeling:**

Events and signals, state machines, processes and Threads, time and space, state chart diagrams. Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.

### **TEXT BOOK**

1. Grady Booch, James Rumbaugh, Ivar Jacobson : The Unified Modeling Language User Guide, Pearson Education.

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

**CO 1:** Select the basic elements of modeling such as Things, Relationships and Diagrams depending on the views of UML Architecture and SDLC.

**CO 2.** Apply basic and Advanced Structural Modeling Concepts for designing real time applications.

**CO 3.** Design Class and Object Diagrams that represent Static Aspects of a Software System.



**CO 4.** Analyze Dynamic Aspects of a Software System using Use Case, Interaction and Activity Diagrams.

**CO 5.** Apply techniques of State Chart Diagrams and Implementation Diagrams to model behavioral aspects and Runtime environment of Software Systems.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>IV Year-I Sem</b>			
Course Code: <b>L410I</b>	<b>BASICS OF MINE ENVIRONMENT</b> <b>(OPEN ELECTIVE – IV)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre- Requisites:** Nil

### Course Objectives

This course will enable students to:

1. To introduce about atmospheric, mine air & their limitations
2. To acquaint with spontaneous heating and explosions in coal mines
3. To get idea about sources of dust, and its control in mines
4. To get idea about miners' diseases & lighting in mines
5. To know about reclamation of mines, impact of mining on environment & sustainable mining

### Module 1

Atmosphere and mine air composition. Origin of gases, properties, limitations of gases in underground mines

### Module 2

Spontaneous Combustion: Factors, control measures.

Explosions: Causes of firedamp explosion, preventive measures against firedamp explosion.

### Module 3

Dust: Sources in underground and opencast mines, standards, and control measures.

### Module 4

Miner's diseases, Lighting standards in underground and opencast mines.

### Module 5

Reclamation, plantation of surface mines, Impact of mining on environment & sustainable mining.

### Textbooks

1. Elements of Mining Technology (VOL-2) – by D.J. Deshmukh.
2. Surface Mining – by S.K. Das.

### Reference Books

1. Mine Ventilation – by G.B. Mishra.

### Course Outcomes

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

- CO1** Learn about atmospheric and mine air  
**CO2** Learn about spontaneous combustion and explosion in coal mines  
**CO3** Understand about dust sources and its control in mines  
**CO4** Learn about miners' diseases, mine lighting, and its standards  
**CO5** Learn about reclamation of mines, impacts of mining on environment and sustainable mining

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech MBA</b> <b>IV Year-I Sem</b>			
Course Code: <b>L410J</b>	<b>RURAL MARKETING</b> <b>(OPEN ELECTIVE-IV)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Course Objective:** To understand the importance of Rural Marketing, Rural Environment, Problems in Rural Marketing in India and Strategies to be adopted by the corporate.

**UNIT-I:**

**Introduction:** Meaning - Evolution – Nature and Characteristics of Rural Market – Understanding the Indian Rural Economy –Rural Marketing Models – Rural Marketing Vs Urban Marketing – Parameters differentiating Urban & Rural Market - Differences in consumer behavior in Rural and Urban market.

**UNIT-II:**

**Rural Market Research:** Sources of Information- Factors influencing rural consumers during purchase of products – Rural consumer Life style – Approaches and Tools of Marketing Research - Rural Business Research- Evolution of Rural Marketing Research – Sources and methods of data collection , data collection approaches in rural areas, data collection tools for rural market. Limitation and challenges in rural marketing research, role of rural marketing consulting agencies

**UNIT-III:**

**Rural Marketing Mix:** Rural Marketing Mix – Additional Ps in Rural Marketing – 4As of Rural Marketing Mix – New Product Development for Rural Market – Rural Market Product Life Cycle – Objectives behind new product launch – New Product development process

**UNIT-IV:**

**Rural Market Brand & Channel Management:** Brand Loyalty in Rural Market – Regional Brands Vs National Brands – Channel Management – Indian Rural Retail Market – Rural Retail Channel Management – Strategies of Rural Retail Channel Management.

**UNIT-V:**

**Applications and Innovations:** Marketing of Consumer products, services, social marketing, agricultural marketing, rural industry products- Innovation for Rural Market – Marketing Strategies – e-Rural Marketing – Agricultural Co – operative Marketing – Rural Market Mapping – Corporate Social Responsibility – Organized Rural Marketing – IT for Rural Development – e-Governance for Rural India.

**TEXT BOOKS:**

1. C.S.G. Krishnamacharyulu, Lalitha Ramakrishnan, Rural Marketing: Text and Cases, Pearson Education, 2009.
2. Pradeep Kashyap, Rural Marketing, 3e Perason Education, 2016.

3. Balram Dogra & Karminder Ghuman, Rural Marketing, TMH, 2009.
4. Sanal Kumar Velayudhan, Rural Marketing, 2e Sage publications, 2012.
5. T P Gopaldaswamy, Rural Marketing, Environment, problems, and strategies, 3e Vikas Publications, 2016.

# OPEN ELECTIVE-V

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech CE</b> <b>IV Year – II</b> <b>Sem</b>			
Course Code: <b>L420A</b>	<b>ENERGY AUDIT &amp; GREEN BUILDINGS</b> <b>(Open Elective – V)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-requisite:** Green buildings

**Module 1:**

**Unit 1: Energy Scenarios:**

Energy Conservation-Energy Audit-Energy Consumption-Energy Security-Energy Strategy-Clean Development Mechanism.

**Unit 2: Types of Energy Audits and Energy-Audit Methodology:**

Definition of Energy Audit-Place of Audit-Energy- Audit Methodology-Financial Analysis- Sensitivity Analysis-Project Financing Options-Energy Monitoring and Training

**Module 2:**

**Unit 1: Environmental Audit:**

Environmental Audit; Introduction-Necessity-Norms. Types: Objectives-Bases types; Liabilities Audit-Management Audit-Activities Audit-Client drive and types; regulatory external audits- independent external audit-internal environmental audit -third party audit.

**Unit 2: Environmental Impact Assessment:**

Introduction-EIA regulations-Steps in Environmental impact assessment process benefits of EIA- limitations of EIA-Environmental Clearance for Civil Engineering Projects.

**Module 3:**

**Unit 1: Energy Sources:**

Renewable and Non-renewable sources of energy - Coal, Petroleum, Nuclear, Wind, Solar, Hydro, Geothermal sources, potential of these sources, hazards

**Unit 2: Energy Conservation:**

Introduction-Specific objectives-need of energy conservation-LEED India rating system and Energy Efficiency.

**Module 4:**

**Unit 1: Green Building:**

Introduction-Definition-Benefits-Principles; Planning concept of Green Building-Salient features of Green Building-Environmental Design-Strategies for Building Construction- Process; Improvement in Environmental Quality in Civil Structure. Materials; Bamboo, Rice Husk Ash, Concrete, Plastic Bricks-Reuse of waste materials- Plastic, Rubber, News Paper, Wood, Non- Toxic paint, Green roofing.

**Module 5:**

**Unit 1: Rating system for Green Building:**

Leadership in Energy and Environmental Design (LEED) Criteria-Indian Green Building Council (IGBC) Green Rating-Green Rating for Integrated Habitat Assessment (GRIHA) criteria-HVAC unit in Green Building-Certification

Programs (including GEM and ECBC Certifications).

**TEXT BOOKS:**

1. "Sustainable construction: Green Building design and delivery" by Kibert, C.J(John Wiley Hoboken, New Jersey).
2. "Non-Conventional Energy resources" by Chauhan, D S Sreevasthava, S K (New Age International Publishers, New Delhi).
3. "Alternative Building Materials and Technologies" by Jagadeesh, K S, Reddy Venkatta Rama, Nanjunda Rao K S (New Age International Publishers, New Delhi).
4. "Green Buildings" by Gevorkian (McGraw hill publication).

**REFERENCES:**

1. "Handbook of Green Building Design and Construction" by Sam Kubba (Butterworth-Heinemann).
2. Emerald Architecture: case studies in green buildings, The Magazine of Sustainable Design.
3. Energy Conservation Building Code 2017.

**E-Resources:**

1. <https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-ce06>
2. <https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ce40>

**Course outcomes:**

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

1. Differentiate and select best of various energy scenarios and energy auditing methodology
2. Identify various Renewable and Non-renewable sources of energy.
3. Justify others to use the waste materials efficiently and effectively.
4. Explain the application of design guidelines of Green Building considering the Energy Conservation Measures.
5. Discuss the building codes, relevant legislation governing the consumption of resources

<b>CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 – Weak</b>														
<b>Course Outcomes (COs)</b>	<b>Program Outcomes (POs)</b>												<b>Program Specific Outcomes*</b>	
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	1	2	1	1	-	1	2	-	-	-	-	-	1	1
<b>CO2</b>	1	2	1	1	-	2	2	-	-	-	-	-	1	-
<b>CO3</b>	2	1	2	1	-	1	2	-	-	-	-	-	-	1
<b>CO4</b>	1	1	1	1	-	2	2	-	-	-	-	-	1	1
<b>CO5</b>	-	1	1	1	-	1	2	-	-	-	-	-	1	-
<b>Average</b>	1	1.4	1.2	1	-	1.4	2	-	-	-	-	-	0.8	0.6

<b>AY: 2022-23</b> Onwards	<b>J. B. INSTITUTE OF ENGINEERING AND TECHNOLOGY</b> (UGC Autonomous)	<b>B. Tech-CSE</b> <b>IV Year- II</b> <b>Sem</b>			
Course Code: <b>L41OB</b>	<b>INTRODUCTION TO DESIGN THINKING</b> <b>(Open Elective -V)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites: NIL**

**Course Objectives:**

The students should be able to

1. Understand design thinking skills and customer needs.
2. Use Applied creativity, design thinking approach for idea generation.
3. Understand Design Research strategies, teamwork, and Service design.
4. Understand the Economics of Innovation
5. Understand Design thinking and innovations in various companies.

**Module 1:**

**Unit-I:**

Understand the critical design thinking skills needed to either improve an existing product or design a new product.

Identifying & Understanding Customer Needs, Innovation and Business Success

Learn to identify customer needs and draft customer needs statements as a first step towards user innovations.

**Unit-II:**

Design Thinking Approach for New Product Development, Product Specifications. Learn how to translate user needs into product specifications quantitatively, and how establishing product metrics can help to define those specifications. Learn the concepts that drive design thinking.

**Module 2:**

**Unit-I:**

Introduction to Synthesis, Applied Creativity, Design Thinking Approach for Idea Generation,

Learn to apply creativity, brainstorming, and concept generation process in designing needs solutions. Translate needs into product specifications, Choose the right development process. Present the final ideas, get real-time feedback.

**Unit-II:**

Introduction to Ideation and Prototyping Strategies, Prototyping Explore prototyping methods, strategies, and real-life examples where these have been applied to create a design that represents customer needs and product specifications. Submit the project ideas around user innovations.



### **Module 3:**

#### **Unit-I:**

Design Thinking Approach for Deciphering Needs, Introduction to Design Research Strategies, Design for Services, Team Work and Service Design Understand design of services, identify the potential for innovations within them, and learn how to apply product development frameworks to the service context.

#### **Unit-II:**

Design Thinking Approach for Concept Development, Product Architecture, Design Thinking Approach for Concept Evaluation, Analyse the economics of the innovation.

Learn to use the modular and integral product architectures in determining the building blocks of a product. Identify customer needs and user groups.

### **Module 4:**

#### **Unit-I:**

Analyse the economics of the innovation Learn to perform financial analysis of your project idea and decide if it is backed by a strong business rationale (Worth-It). Design for Environment, User Testing.

#### **Unit-II:**

Learn how to apply design for environment principles to a product life cycle. Product Development Processes, Design Thinking Approach for Obtaining User Feedback (What Works), Marketing of Innovation and Designing Business Models, learn to select and implement a product development process (staged, spiral, and agile) that's aligned to this project needs.

### **Module 5: Case Studies**

#### **Unit-I:**

Design Thinking and Innovation at Apple, IDEO Human Centred Service Design,

#### **Unit-II:**

Asia Miles Road to Stakeholder Centric Insight Driven Innovation. Present the final ideas, get real-time feedback.

### **Text Books**

1. Design Thinking: A Guide to Creative Problem Solving for Everyone, Andrew Pressman, Routledge Taylor & Francis eBooks, 2018.

### **Reference Books**

1. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, Tim Brown, HarperCollins Publishers, 2009.
2. The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems, Michael Lewrick, Wiley Publishers, 2017.

## E-Resources

1. [https://www.researchgate.net/publication/329310644\\_Handbook\\_of\\_Design\\_Thinking](https://www.researchgate.net/publication/329310644_Handbook_of_Design_Thinking)
2. <https://www.rcsc.gov.bt/wp-content/uploads/2017/07/dt-guide-book-master-copy.pdf>
3. [http://www.designthinkingbook.co.uk/DT\\_MJV\\_book.pdf](http://www.designthinkingbook.co.uk/DT_MJV_book.pdf)
4. [https://www.tutorialspoint.com/hi/design\\_thinking/design\\_thinking\\_tutorial.pdf](https://www.tutorialspoint.com/hi/design_thinking/design_thinking_tutorial.pdf)
5. <https://www.uni-due.de/imperia/md/content/innovationhub/designthinkingforlibraries.pdf>
6. <https://www.ibm.com/cloud/architecture/files/design-thinking-field-guide.pdf>
7. <https://thisisdesignthinking.net/on-design-thinking/design-thinking-resources/>

## Course Outcomes

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

**CO1:** Identify the Design Thinking skills and customer needs.

**CO2:** Apply creativity, design thinking approach for idea generation.

**CO3:** Identify Design Research strategies, teamwork, and Service design.

**CO4:** Analyse the economics of innovation.

**CO5:** Identify the Design thinking and innovations in various companies.

<b>AY 2022-23</b> onwards	<b>J. B. Institute of Engineering and Technology</b> <b>(UGC Autonomous)</b>	B.Tech: <b>AI&amp;ML</b> IV Year – II Sem			
Course Code: <b>L420C</b>	<b>INTRODUCTION TO GENERATIVE ADVERSARIAL NETWORKS</b> <b>(Open Elective V)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>
<b>Credits: 3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:**

1. Math: Linear Algebra, Calculus, Probability and Statistics
2. Data Structures
3. Machine Learning
4. Deep Learning

**Course objectives:**

**The student will:**

1. Understand the difference between generative and discriminative models.
2. Identify problems that GANs can solve.
3. Understand the roles of the generator and discriminator in a GAN system.
4. Understand the advantages and disadvantages of common GAN loss functions.
5. Identify possible solutions to common problems with GAN training.

**Module 1:**

**Introduction to GANs:-**

What are GANs?- How do GANs work?- GAN Training- Reaching Equilibrium- Applications of GANs

**Generative Modelling with encoders:-**

Introduction to Generative Modelling- Working of Auto Encoders at high level- Auto Encoders to GAN- Usage of Auto Encoders

**Module 2:**

**Convolutional Neural Networks:**

Introduction to CNN- Convolutional Filters- Parameter sharing- ConvNets Visualized.

**Deep GAN:**

Introduction to Deep GAN- Batch Normalization- Understanding Normalization- Computing Normalization.

**Module 3:**

**Evaluation:**

Evaluation Framework- Inception Score- Frechet Inception Distance

**Challenges in Training:**

Adding Network depth- Min-Max GAN- Non-Saturating GANs- When to Stop training?- Wasserstein GAN

**Module 4:**

**Semi Supervised GAN:**

What is Semi Supervised GAN?- Architecture- Training Process- Training Objectives- Implementation- Comparison to fully supervised Classifier

### **Conditional GAN:**

Motivation- CGAN Generator- CGAN Discriminator- Architecture- Implementation

### **Module 5:**

#### **Cycle GAN:**

Image to Image Translation- Cycle Consistency Loss- Adversarial Loss- Identity Loss- Architecture- Applications of Cycle GAN

#### **Applications of GAN:**

Image Generation- Training GANs for specific image generation tasks- Style Transfer- photo-to-painting and day-to-night style transfer- Data Augmentation- generating realistic synthetic data to enhance the performance and generalization of machine learning models.

#### **Text Books:**

1. GANs in Action, Deep learning with Generative Adversarial Networks, Jakub Langr, Vladimir Bok, Manning Publication
2. Generative Deep Learning by David Foster, O'Reilly Media, Inc.

#### **Reference Book:**

1. Learning Generative Adversarial Networks, Kuntal Ganguly, Packt Publishing
2. Generative Adversarial Networks Cookbook, Josh Kalin, Packt Publishing

#### **Course outcomes:**

##### **The student will be able to:**

1. Design generative and discriminative models.
2. Implement problems that GANs can solve.
3. Compare and contrast the roles of the generator and discriminator in a GAN system.
4. Inspect the challenges posed by common GAN loss functions.
5. Implement possible solutions to common problems with GAN training.

<b>AY 2022-23 onwards</b>	<b>J. B. Institute of Engineering and Technology (UGC Autonomous)</b>	<b>B.Tech: AI&amp;DS IV Year – II Sem</b>			
Course Code: <b>L420D</b>	<b>CLOUD COMPUTING (Open Elective V)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>D</b>
<b>Credits: 3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Module 1:**

Principles of Parallel and Distributed Computing, Introduction to cloud computing, Cloud computing Architecture, cloud concepts and technologies, cloud services and platforms, Cloud models, cloud as a service, cloud solutions, cloud offerings, introduction to Hadoop and Mapreduce.

**Module 2:**

Cloud Platforms in the Industry, Understanding Scientific Applications for Cloud Environments, cloud applications Healthcare and education, Scientific Applications, Business and Consumer Applications.

**Module 3:**

Virtualization, cloud virtualization technology, deep dive: cloud virtualization, migrating in to cloud computing.

Virtual Machines Provisioning and Virtual Machine Migration Services, On the Management of Virtual Machines for cloud Infrastructure, Comet cloud, T-Systems.

**Module 4:**

Enterprise cloud computing Paradigm, Federated cloud computing Architecture, SLA Management in Cloud Computing, Developing the cloud: cloud application Design.

**Module 5:**

Cloud management, Organizational Readiness and change management in the cloud age, Cloud Security, Data security in the cloud, Legal Issues in the Cloud , Achieving Production Readiness for the cloud Services.

**Text Books:**

1. Cloud Computing: Raj Kumar Buyya ,James Broberg, andrzej Goscinski, 2013 Wiley.
2. Cloud computing: Dr Kumar Saurab Wiley India 2011
3. Cloud Computing: Arshdeep Bahga, Vijay Madiseti, 2014, University Press.
4. Mastering Cloud Computing: Raj Kumar buyya, Christian Vecchiola,selvi-2013.

**E - Resources:**

1. <https://nptel.ac.in/courses/106/105/106105167/1>
2. <https://sjceodisha.in/wp-content/uploads/2019/09/CLOUD-COMPUTING-Principles-and-Paradigms.pdf>
3. <https://www.alljntuworld.in/download/cloud-computing-cc-materials-notes/>
4. <https://www.slideshare.net/jetraj17/cloud-computing-it703-unit-1-5>

**CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation)**

**3 – Strong; 2 – Medium; 1 - Weak**

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	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	2
<b>C02</b>	2	2	-	2	2	-	-	-	-	-	-	-	2	2
<b>C03</b>	2	2	2	-	2	-	-	-	-	-	-	-	-	2
<b>C04</b>	2	2	2	-	1	-	-	-	-	-	-	-	-	-
<b>C05</b>	2	-	-	-	-	-	-	-	-	-	-	-	2	2
<b>Average</b>	<b>2.0</b>	<b>2.0</b>	<b>2.0</b>	<b>2.0</b>	<b>1.7</b>	-	-	-	-	-	-	-	<b>2.0</b>	<b>2.0</b>

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech ECE</b> <b>IV Year-II</b> <b>Sem</b>			
Course Code: <b>L420E</b>	<b>Principles of Sensors and their Application</b> <b>(OE-05)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:**

**Course Objectives:**

1. Understand the fundamental principles of various sensors and their classifications.
2. Gain knowledge of signal conditioning and interfacing techniques for sensor integration.
3. Explore the applications of physical, chemical, and biological sensors in different domains.
4. Learn about smart sensors, IoT, and their integration in sensor networks.
5. Develop skills in sensor data processing, fusion, and application-specific algorithms.

**Module 1: Introduction to Sensors [8L]**

**Unit-I: Overview of Sensors [4L]**

Introduction to sensors: Definition, types, and classifications; Sensing principles: Mechanical, electrical, thermal, and optical; Sensor characteristics: Range, sensitivity, accuracy, resolution, and response time

**Unit-II: [4L]**

Sensor signal conditioning: Amplification, filtering, and linearization; Sensor interfacing: Analog and digital interfaces; Sensor calibration and compensation techniques

**Module 2: Physical Sensors [9L]**

**Unit-I: [5L]**

Temperature sensors: Thermocouples, RTDs, thermistors, and semiconductor temperature sensors; Pressure sensors: Piezoresistive, capacitive, and optical pressure sensors; Strain sensors: Resistive, capacitive, and piezoelectric strain gauges

**Unit-II: [4L]**

Accelerometers: Piezoresistive, piezoelectric, and capacitive accelerometers; Gyroscopes: Vibrating structure, fiber optic, and MEMS-based gyroscopes; Force and torque sensors: Load cells, strain gauge-based force sensors, and optical torque sensors.

**Module 3: Chemical and Biological Sensors [8L]**

**Unit-I: [4L]**

pH sensors: Glass electrode and ion-sensitive field-effect transistor (ISFET) sensors; Gas sensors: Electrochemical, semiconductor, and optical gas sensors; Biosensors: Enzyme-based, DNA-based, and immune sensors.

**Unit-II: [4L]**

Biosensors (continued): Lab-on-a-chip technology and bio-electrochemical sensors; Environmental sensors: CO<sub>2</sub> sensors, humidity sensors, and particulate matter sensors; Biomedical sensors: ECG, EEG, and pulse oximetry sensors.

**Module 4: Smart Sensors and Internet of Things (IoT)[10L]****Unit-I: [5L]**

Introduction to smart sensors: Features, architecture, and applications; Sensor networks: Wireless sensor networks, ad-hoc networks, and protocols; IoT and sensor integration: Data acquisition, processing, and communication.

**Unit-II: [5L]**

Energy harvesting for sensors: Solar, thermal, and vibration energy harvesting; Wearable sensors: Applications in healthcare, sports, and activity monitoring; Industrial IoT: Sensor applications in manufacturing, automation, and predictive maintenance

**Module 5: Name of the Module [9L]****Unit-I: [5L]**

Signal processing techniques for sensor data: Filtering, noise reduction, and feature extraction; Data fusion: Sensor fusion techniques and algorithms; Sensor arrays: Beamforming and spatial processing.

**Unit-II: [4L]**

Sensor-based localization and tracking: GPS, RFID, and computer vision-based methods; Sensor applications in robotics and automation; Emerging trends in sensor technology and applications.

**Text Books**

1. Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill, 2009.
2. Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

**Reference Books**

1. Sensors and Signal Conditioning by Ramon Pallas-Areny and John G. Webster
2. Principles of Measurement Systems by John P. Bentley
3. Sensors and Sensing Technology by V. Venkatesh and R. Srinivasan
4. Biosensors: Essentials by Min Wang



## E-Resources

1. NPTEL: Introduction to Sensors (<https://nptel.ac.in/courses/117/101/117101073/>)
2. Lecture Notes on Sensors and Transducers (<http://people.scs.carleton.ca/~soma/tech-notes/Sensors.pdf>)
3. Tutorialspoint: Sensors (<https://www.tutorialspoint.com/sensors/index.htm>)
4. NPTEL: Physical Sensors (<https://nptel.ac.in/courses/117/105/117105057/>)
5. Lecture Notes on Physical Sensors (<http://www-personal.umich.edu/~johannb/Pubs/Sensors-Chapter-Outline.pdf>)
6. Tutorialspoint: Physical Sensors ([https://www.tutorialspoint.com/physical\\_sensors/index.htm](https://www.tutorialspoint.com/physical_sensors/index.htm))
7. NPTEL: Chemical Sensors (<https://nptel.ac.in/courses/117/106/117106071/>)
8. Lecture Notes on Chemical Sensors (<http://www-personal.umich.edu/~johannb/Pubs/Sensors-Chapter-Outline.pdf>)
9. Tutorialspoint: Chemical Sensors ([https://www.tutorialspoint.com/chemical\\_sensors/index.htm](https://www.tutorialspoint.com/chemical_sensors/index.htm))
10. NPTEL: Smart Sensors (<https://nptel.ac.in/courses/117/107/117107044/>)
11. Lecture Notes on IoT and Smart Sensors (<https://www.iotforall.com/iot-resources/lecture-notes-internet-of-things/>)
12. Tutorialspoint: IoT ([https://www.tutorialspoint.com/internet\\_of\\_things/index.htm](https://www.tutorialspoint.com/internet_of_things/index.htm))
13. NPTEL: Sensor Data Processing (<https://nptel.ac.in/courses/117/103/117103042/>)
14. Lecture Notes on Sensor Data Processing (<http://www.dca.fee.unicamp.br/~miyagi/lectures/dsp-lecture-notes.pdf>)
15. Tutorialspoint: Signal Processing ([https://www.tutorialspoint.com/digital\\_signal\\_processing/index.htm](https://www.tutorialspoint.com/digital_signal_processing/index.htm))

## Course Outcomes

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

- CO1.** Identify and select appropriate sensors for specific applications based on their sensing principles and characteristics.
- CO2.** Design sensor interfaces and signal conditioning circuits to enhance the accuracy and reliability of sensor measurements.
- CO3.** Analyze and evaluate the performance of physical, chemical, and biological sensors in real-world scenarios.
- CO4.** Develop solutions using smart sensors, IoT, and sensor networks for monitoring and control applications.
- CO5.** Apply signal processing techniques to sensor data for feature extraction, localization, and tracking in diverse 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	PS O1	PS O2
<b>C01</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>C02</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>C03</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>C04</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>C05</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech ECM</b> <b>IV Year-II</b> <b>Sem</b>			
Course Code: <b>L420F</b>	<b>INTRODUCTION TO ELECTRONICS INSTRUMENTATION</b> <b>(Open Elective-V)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** Nil

**Course Objectives:**

Students will learn to

1. Get an understanding of various measurement systems functioning and metrics for performance analysis.
2. Understand the principle of operation, working of different electronic instruments viz. Signal generators, signal analyzers, recorders and measuring equipments.
3. Use various measurement techniques for measurement of different physical parameters using different classes of transducers.
4. Gain knowledge on parameters and functions of CRO.
5. Obtain knowledge on various transducers.

**Module 1:**

**Unit-I:**

Block Schematics of Measuring Systems, Performance characteristics, Static characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag; Measuring Instruments: DC Voltmeters, D'Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters.

**Unit-II:**

Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments. Electronic Voltmeters, Multimeters, AC,DC Meters, Digital Voltmeters: Ramp Type, Staircase Ramp, Dual Slope Integrating type, Successive Approximation Type, Autoranging, 3 1/2, 3 3/4 Digit Display, Pico ammeter, High Resistance Measurements, Low current Ammeter, Applications.

**Module 2:**

**Unit-I:**

Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary waveform Generator, Video Signal Generators, and Specifications.

**Unit-II:**

Signal Analyzers, AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillaors.

### **Module 3:**

#### **Unit-I:**

DC and AC Bridges: Wheat Stone Bridge, Kelvin Bridge, AC Bridges, Maxwell, Hay, Schering, Wien, Anderson Bridges.

#### **Unit-II:**

Resonance Bridge, Similar Angle Bridge, Wagner's ground connection, Twin T, Bridged T Networks, Detectors.

### **Module 4:**

#### **Unit-I:**

Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications, Specifications.

#### **Unit-II:**

Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs, Frequency Measurement, Period Measurement, Errors in time/Frequency Measurements, universal counters, Extension of range; Recorders: Strip chart, X-Y, oscillographic recorders.

### **Module 5:**

#### **Unit-I:**

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers.

#### **Unit-II:**

Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure - High Pressure, Vacuum level, Temperature - Measurements, Data Acquisition Systems.

### **Text Books**

1. Electronic Measurements and Instrumentations by K. Lal Kishore, Pearson Education - 2010.
2. Electronic instrumentation: H.S.Kalsi - TMH, 2nd Edition 2004.

### **Reference Books**

1. Electronic Instrumentation and Measurements - David A. Bell, Oxford Univ. Press, 1997.
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbins, W.D. Cooper: PHI, 5th Edition, 2003.
3. Electronic Measurements and Instrumentation: B. M. Oliver, J. M. Cage TMH Reprint.
4. Industrial Instrumentation: T. R. Padmanabham Spiriger 2009.

## Course Outcomes

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

**CO1.** List the various measurement techniques available and analyze the basic working of instruments used for measurement..

**CO2.** Compute the errors in measurements and their rectification

**CO3.** Analyse the working of AC and DC bridges.

**CO4.** Illustrate the basic principle and working of Oscilloscopes

**CO5.** Distinguish different types of transducers.

## 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	PS O1	PS O2
<b>CO1</b>	3	-	-	-	-	-	-	-	-	-	-	2	2	2
<b>CO2</b>	2	-	-	-	-	-	-	-	-	-	-	-	2	-
<b>CO3</b>	2	2	-	2	-	-	-	-	-	-	-	2	2	-
<b>CO4</b>	2	2	2	2	-	-	-	-	-	-	-	2	2	2
<b>CO5</b>	2	-	2	-	-	-	-	-	-	-	-	-	2	-
<b>Average</b>	2.2	2	2	2	-	-	-	-	-	-	-	2	2	2

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

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech EEE</b> <b>IV Year-II</b> <b>Sem</b>			
Course Code: <b>L420G</b>	<b>Instrumentation</b> <b>(Open Elective-V)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites: Electrical Measurements**

**Module 1: Characteristics of Measuring Instruments and Signal Representations**

**Unit 1 [6L]**

Measuring Systems, Performance Characteristics, – Static characteristics, Dynamic Characteristics; Errors in Measurement – Gross Errors, Systematic Errors, Statistical Analysis of Random Errors.

**Unit 2 [6L]**

Signal and their representation: Standard Test, periodic, aperiodic, modulated signal, sampled data, pulse modulation and pulse code modulation.

**Module 2: Oscilloscope and Digital Voltmeters**

**Unit 1 [6L]**

Cathode ray oscilloscope-Cathode ray tube-time base generator-horizontal and vertical amplifiers-CRO probes-applications of CRO-Measurement of phase and frequency-lissajous patterns-Sampling oscilloscope-analog and digital type.

**Unit 2 [6L]**

Digital voltmeters- Successive approximation, ramp, dual-Slope integration continuous balance type-Microprocessor based ramp type DVM digital frequency meter-digital phase angle meter.

**Module 3: Wave Analyzers and Spectrum Analyzers**

**Unit 1 [5L]**

Wave Analyses - Frequency selective analyzers, Heterodyne, Application of Wave analyzers- Harmonic Analyzers, Total Harmonic distortion.

**Unit 2 [5L]**

Spectrum analyzers, Basic spectrum analyzers, spectral displays, vector impedance meter, Q meter. Peak reading and RMS voltmeters.

**Module 4: Transducers**

**Unit 1 [6L]**

Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of resistor, inductor, LVDT and capacitor transducers; LVDT Applications.

**Unit 2 [6L]**

Strain gauge and its principle of operation, gauge factor, Thermostats, Thermocouples, Synchros, Piezo electric transducers, photovoltaic, photo conductive cells, photo diodes.

## Module 5: Measurement of Non-Electrical Quantities

### Unit 1 [5L]

Measurement of strain, Gauge Sensitivity, Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque.

### Unit 2 [5L]

Measurement of Temperature, Pressure, Vacuum, Flow, Liquid level.

### Text Books

1. A. K. Sawhney, "A course in Electrical and Electronics Measurements and Instrumentation", Dhanapath Rai and Sons., 10<sup>th</sup> Edition, 2007.
2. Transducers and Instrumentation by D.V.S Murthy, Prentice Hall of India.

### Reference Books

1. J.B. Gupta, "A course in Electronics and Electrical Measurements and Instrumentation", S. K. Kataria & Sons, 2009.
2. H.S. Kalsi, "Electronic Instrumentation", Tata McGraw Hill, 2004.
3. U. A. Bakshi, A. V. Bakshi "Electrical Measurements and Instrumentation", Technical Publications, 2009

### E-Resources

1. <https://nptel.ac.in/courses/108/105/108105153/>
2. <https://nptel.ac.in/courses/112/106/112106138/>
3. <https://nptel.ac.in/courses/112/107/112107242/>

### Course Outcomes

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

**CO1.** Compare the performance characteristics of Measuring Instruments.

**CO2.** Understand operating principles of CRO and Digital Voltmeters.

**CO3.** Understand operating principles of Wave Analyzer and Spectrum Analyzer.

**CO4.** Summarize the operation of various Transducers.

**CO5.** Measure Non-Electrical Quantities using Transducers.

### 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	PS O1	PS O2
<b>CO1</b>	2	-	2	2	-	-	3	-	-	-	-	-	2	-
<b>CO2</b>	3	-	1	3	-	-	2	-	-	-	-	-	3	-
<b>CO3</b>	3	-	3	2	-	-	2	-	-	-	-	-	3	-
<b>CO4</b>	2	-	3	2	-	-	1	-	-	-	-	-	3	-
<b>CO5</b>	1	-	2	3	-	-	2	-	-	-	-	-	2	-
<b>Average</b>	2.2	-	2.2	2.4	-	-	2	-	-	-	-	-	2.6	-

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





<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech IT</b> <b>IV Year-II</b> <b>Sem</b>			
Course Code: <b>L420H</b>	<b>Cyber Laws and Ethics</b> <b>(Open Elective-V)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Unit I: Information Technology & Cyber Crimes:**

Introduction, Glimpses, Definition and Scope, Nature and Extent, Know no Boundaries, Rapid Transmission and Accuracy, Diversity and Span of Victimization, Cyber World, Inadequacy of Law, Influence of Teenagers

**Unit II: Technology & Forms of Cyber Crimes:**

Influence of Technology on Criminality, Forms of Cyber Crimes.

**Unit III: Cyber Crimes and Global Response:**

Global Perspective, Country wise Legal Response, Country wise Analysis.

**Unit IV: Investigation in Cyber Crimes: Implications and Challenges:**

Introduction, Procedural Aspects, Issues, Complications and Challenges Concerning Cyber Crimes, Problems and Precautionary measures for Investigation.

**Unit V: Cyber Crimes: Discovery and Appreciation of Evidences:**

Introduction, Law of Evidence, Evidences in Cyber Crimes: Challenges and Implications, Computer Generated Evidence and their Admissibility, Judicial Interpretation of Computer related Evidence.

**Text Book:**

1. Dr Pramod Kr.Singh, "Laws on Cyber Crimes [Along with IT Act and Relevant Rules]" Book Enclave Jaipur India..

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

- CO 1.** Understand Cyber Space, Cyber Crime, Information Technology, Internet & Services.
- CO 2.** List and discuss various forms of Cyber Crimes
- CO 3.** Explain Computer and Cyber Crimes
- CO 4.** Understand Cyber Crime at Global and Indian Perspective.
- CO 5.** Describe the ways of precaution and prevention of Cyber Crime as well as Human Rights.

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech</b> <b>IV Year-II</b> <b>Sem</b>			
Course Code: <b>L420I</b>	<b>FUNDAMENTALS TO ROCK MECHANICS</b> <b>(OPEN ELECTIVE – V)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre Requisites:** Nil

### Course Objectives

This course will enable students to:

1. To introduce about concepts of stress and strain and failure criteria for rock and rock mass.
2. To acquaint with pre-mining stresses in rock and various methods of rock stress determination, its importance in mining applications.
3. To get idea about various engineering properties of rocks and soil; rock mass classification and soil classification methods
4. To get idea about instrumentation and monitoring systems used in surface and underground mine excavation stability.
5. To know about various ground improvement techniques and methods for safe mining operations

### Module 1

Basic concept of stress, strain and failure of rock, Analysis of stress, Analysis of strain, Constitutive relations, Parameters influencing strength/stress-strain behavior, Failure Criteria for Rock and Rock Mass Classical theories of rock failure: Coulomb's criterion, Mohr's criterion, Pre-mining state of Stress Stresses in rock mass, Factors influencing the in-situ state of stress, Estimating in situ stresses

### Module 2

Rock mass Classification and soil characterization, Overview of shear strength and compressibility of soil, Physico-mechanical properties of intact rock, Rock mass classification methods and their applications, Soil classification methods and their applications

### Module 3

Response of rock mass and soil to excavation, Response of rock mass to Excavations Underground, Induced stresses and displacements around single opening in rock mass, Ground support interaction analysis and reinforcement

of ground (rock mass and soil), selection and design of support systems.

#### **Module 4**

Slope Engineering: Slope failure and causes; Basic approaches to slope stability analysis and stabilisation, Monitoring of Excavation Stability: Purpose and nature of monitoring, Instrumentation and monitoring systems - Load; Stress and Deformation measuring, devices; Interpretation of monitoring data; Practical aspects of monitoring

#### **Module 5**

Ground improvement; grouting, fore polling, pre-reinforcement, shotcreteing and other methods

#### **Textbooks**

1. Introduction to Rock Mechanics, Goodman, RE.
2. Fundamental of Rock Mechanics by Jaeger, J.C. and Cook, NGW

#### **Reference Books**

1. Underground Excavation in Rock, Hoek, E and Brown, ET
2. Rock Mechanics for Underground Mining, Brady, BHG and Brown, ET

#### **Course Outcomes**

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

1. Learn about concepts of stress and strain and failure criteria for rock and rock mass.
2. Learn about pre-mining stresses in rock and various methods of rock stress determination, its importance in mining applications.
3. Understand various engineering properties of rocks and soil; rock mass classification and soil classification methods.
4. Learn about instrumentation and monitoring systems used in surface and underground mine excavation stability.
5. Learn about various ground improvement techniques and methods for safe mining operations

<b>AY: 2022-23</b> Onwards	<b>J. B. Institute of Engineering and Technology</b> (UGC Autonomous)	<b>B. Tech MBA</b> <b>IV Year-II</b> <b>Sem</b>			
Course Code: <b>L42OK</b>	<b>CUSTOMER RELATIONSHIP</b> <b>MANAGEMENT</b> <b>(Open Elective-V)</b>	L	T	P	D
Credits: <b>3</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Course Objective:** To understand the importance of Customer Relationship Management in Business.

**UNIT-I:**

**Introduction to CRM:** Concepts, Evolution, Need, understanding goals and objectives of CRM, Components of CRM, Benefits, CRM as a strategic marketing tool, CRM significance to the stakeholders, CRM Applications in Consumer and Business Markets, CRM Issues & Problems.

**UNIT-II:**

**Building Customer Relations:** Customer information Database – Customer Profile Analysis - Customer perception, Expectations analysis – Customer behaviour in relationship perspectives; individual and group customer’s - Customer life time value – Selection of Profitable customer segments - Customer Life Cycle, Business Networks and CRM.

**UNIT-III:**

**CRM Process:** Introduction and Objectives of a CRM Process; an Insight into CRM and e- CRMA/online CRM, The CRM cycle i.e. Assessment Phase; Planning Phase; The Executive Phase; Modules in CRM, 4C's (Elements) of CRM Process, CRM Process for Marketing Organization, CRM Value Chain, CRM Affiliation in Retailing Sector.

**UNIT-IV:**

**CRM Structures:** Elements of CRM – CRM Process – Strategies for Customer acquisition – Customer Retention and Development – Strategies for Customer Retention, Models of CRM – G- SPOT Model, KOEL’s Model, WebQual Audit Model, ONYX Model - CRM road map for business applications.

**UNIT-V:**

**CRM Planning and Implementation:** Strategic CRM planning process – Implementation issues – CRM Tools- Analytical CRM –Operational CRM – Call centre management – Role of CRM Managers, Trends in CRM- e-CRM Solutions –Features and advantages of e CRM, Functional Components of eCRM- Data Warehousing – Data mining for CRM – an introduction to CRM software packages.

**Course Outcome:** Students will be able to understand

1. need of CRM
2. building customer relations
3. CRM process
4. CRM structures
5. Planning and Implementation of CRM.

### **Suggested Readings:**

1. G. Shainesh, Jagdish, N.Sheth, Atul Parvatiyar, Customer Relationship Management: Emerging Concepts, Tools and Applications, Macmillan 2005.
2. Francis Buttle, Customer Relation Management: Concepts and Technologies, 2e, Routledge, 2013.
3. Ekta Rastogi, Customer Relation Management: Text and Cases, Excel Books, 2011.
4. Zikmund, Customer Relationship Management, Wiley 2012.
5. Paul Greenberg, CRM at the speed of light, 4e, TMH, 2009.
6. Lakshman Jha, Customer Relationship Management: A Strategic Approach, Global India PvtLtd, 2008.