B.TECH FOUR YEAR DEGREE COURSE

SR-21

ACADEMIC REGULATIONS,

COURSE STRUCTURE & SYLLABUS

(Applicable for the batches admitted from 2021-22)

SRINIVASA INSTITUTE OF ENGINEERING AND TECHNOLOGY
(UGC - Autonomous Institution**)**

Approved by AICTE & Permanently Affiliated to JNTUK, Kakinada
Accredited by NAAC with 'A' grade, Recognised by UGC under sections 2(f) & 12(B)
Cheyyeru (V), Amalapuram, East Godavari District – 533216
Andhra Pradesh, India

1. Preliminary Definitions and Nomenclatures

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of the instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Autonomy: Offers flexibility to an institute in all aspects of conducting its academic programs, it is granted by UGC for promoting excellence.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two semesters i.e., (one odd + one even).

AICTE: All India Council for Technical Education, New Delhi. A statutory body which offers approvals for technical institutions across India.

Autonomous Institute: Institute designated as autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University Kakinada, Kakinada) and State Government.

Backlog Course: A course is considered to be a backlog course if the student has obtained a failure grade (F) in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry, English etc., are considered to be foundational in nature.

Board of Studies (BoS): BoS is an authority as defined in UGC regulations, constituted separately for every department by the Head of the Department. They are responsible for curriculum design and updation of all the programs offered by the department.

Choice Based Credit System (CBCS): The credit-based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

CoE: Controller of Examinations

Continuous Internal Assessment (CIA): It is an examination conducted towards internal assessment.

Course: A course is a subject offered by a department for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives a weightage to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture hour per week.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Department: An academic entity that conducts relevant curricular and co-curricular activities and extra-curricular activities involving both teaching and non-teaching staff and other resources in the process of study for a degree.

Dropping of the Semester: A student, who doesn't want to register for any semester, can apply in writing in the prescribed format before commencement of that semester.

Core Courses: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective or Open Elective.

Professional Elective: It indicates a course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Massive Open Online Course (MOOC): MOOC courses inculcate the habit of self learning. MOOC courses would be additional choice in all the elective group courses.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 - point scale.

Pre-requisite: A course, the knowledge of which is required for registration into higher level course.

Programme: It may be under graduate (UG) like Bachelor of Technology (B.Tech.) and Post Graduate programme (PG) like Master of Technology (M. Tech)

Project work: It is a design or research-based work to be taken up by a student during his/her final year to achieve a particular aim. It is a credit-based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for any course, after completion of registration as a supplementary examination candidate.

Regulations: The regulations, common to all B.Tech. programmes offered by Institute are designated as "SR21 Academic Regulations" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 17 to 21 weeks of academic work equivalent to normally 90 working days. The odd Semester usually starts in the month of July and even semester in the month of December.

Semester End Examinations (SEE): It is an examination conducted for all the courses offered in a semester after completion of that semester class work.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means the Jawaharlal Nehru Technological University Kakinada, Kakinada.

2. Academic Regulations

For pursuing four-year undergraduate Bachelor Degree Programme of study in Engineering (B.Tech.) offered by **Srinivasa Institute of Engineering and Technology** under autonomous status (herein after referred to as **SIET**). These are applicable to B.Tech. regular four-year degree programme (for the batches admitted from the academic year 2021-22 & Lateral Entry batches admitted from the academic year 2022–23.

3. Choice Based Credit System

The Indian Higher Education Institutions (HEI's) are changing from the conventional course structure to Choice Based Credit System (CBCS) along with introduction to semester system at first year itself. The semester system helps in accelerating the teaching-learning process and enables vertical and horizontal mobility in learning.

The credit-based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice-based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach for learning.

Choice Based Credit System (CBCS) is a flexible system of learning and provides choice for students to select from the prescribed elective courses. A course defines learning objectives and learning outcomes and comprises of lectures / tutorials / laboratory work / field work / project work / comprehensive Examination /seminars/assignments/alternative assessment tools/presentations / self-study etc. or a combination of some of these. Under the CBCS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.

The CBCS permits students to:

- Choose electives from a wide range of elective courses offered by the departments.
- Undergo additional courses of interest.
- Adopt an interdisciplinary approach in learning.
- Make the best use of expertise of the available faculty.

4. Eligibility for Admission

Admission to the B. Tech programme shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government/University or on the basis of any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time. The total seats available as per the approved intake are grouped into two categories viz. category A and Category B with a ratio of 70:30 as per the state government guidelines vide G.O No.52.

- The admissions for category A and B seats shall be as per the guidelines of Andhra Pradesh State Council for Higher Education (APSCHE) in consonance with government reservation policy.
- Under Category A: 70% of the seats are filled through Andhra Pradesh Engineering Agriculture Pharmacy Common Entrance Test (APEAPCET) counseling.
- Under Category B: 30% seats are filled based on 10+2 merits in compliance with guidelines of APSCHE.

Admission eligibility-Under Lateral Entry Scheme Students with diploma qualification have an option of direct admission into II-year B. Tech. (Lateral entry scheme). Under this scheme 10% seats of sanctioned intake will be available in each course as supernumerary seats. Admission under this scheme will be conducted by Convener, Andhra Pradesh Engineering Common Entrance Test (APECET). The maximum period to complete B. Tech. under lateral entry scheme is six consecutive academic years from the date of joining.

5. Duration of Programme and Academic Calendar

The course duration for the award of the Degree in **Bachelor of Technology** will be four academic years, with two semesters in each year. However, if a student is unable to complete the course within 4 academic years, student can do so by giving more attempts but within 8(6 in case of lateral Entry) consecutive academic years from the date of admission.

For all the eight semesters a common academic calendar shall be followed in each semester by having an average of sixteen weeks of instruction, one week for the conduct of practical exams and with three weeks for theory examinations and evaluation. Dates to conduct mid and end semester examinations shall be notified in the academic calendar of every semester. The schedule for the conduct of all the curricular and co-curricular activities shall be notified in the planner.

6. Medium of Instructions

The medium of instruction shall be English for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course structure, in accordance with the prescribed syllabi.

7. Branches of Study

- Civil Engineering (CE)
- Electrical & Electronics Engineering (EEE)
- Mechanical Engineering (ME)
- Electronics & Communication Engineering (ECE)
- Computer Science & Engineering (CSE)
- Artificial Intelligence and Machine Learning (AI&ML)

8. Types of Courses

a) **Basic Science Course:** Basic Science courses are the courses based upon the content leads to enhancement of skill and knowledge as well as value based and are aimed at man making education. Skill subjects are those areas in which one needs to develop a set of skills to learn anything at all levels. They are basics to learning any subject.

b) **Professional Core Course:** Professional Core Course is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

c) **Professional Elective Course:** Professional Electives provide breadth of experience in respective branch and application areas. Professional Elective course is a course which can be chosen from a pool of courses. The objectives of the course are:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student's proficiency/skill.

An elective may be discipline centric (Professional Elective) focusing on those courses which add generic proficiency to the students or may be chosen from an unrelated discipline called as "Open Elective". There are four professional elective groups; students can choose not more than two courses from each group. Overall, students can opt for four professional elective courses which suit their project work in consultation with the faculty advisor/mentor. Nevertheless, one course from each of the two open electives is to be selected.

d) **Open elective course**: by other department students will have learning awareness and job-oriented benefits. Students require the opportunity to choose any open elective course from different departments to acquire knowledge in that field of course. Learning and employment benefits are not only through their own course subjects but also through open elective courses.

e) **Skill/job-oriented course:** The primary objective is to equip students with practical skills that are directly applicable to their jobs or desired careers enabling them to perform tasks more efficiently and effectively. Total 05 skill-oriented courses will be offered during III

to VII semesters. Among the five skill courses two courses shall focus on skill courses related to their domain, two courses shall focus on advanced skill or industry certified or job-oriented course and the remaining one shall be a soft skill course.

f) **Mandatory Course:** For mandatory courses like Induction Training, Environmental Sciences, Indian Constitution, Essence of Indian Traditional Knowledge, a student has to secure 25 marks out of 50 marks (50% of the marks allotted) in the end examination for passing the subject/course. For Mandatory courses "Completed" or "Not-Completed" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

No marks or letter grade shall be allotted for all mandatory/non-credit courses.

NCC / NSS Activities: NSS/NCC training is optional to the Undergraduate students. The activities shall be beyond class hours. The student participation shall be for a minimum period of 45 hours for certification in case of NSS.

9. Structure of the Program

Each academic year is divided into two semesters, (one odd + one even). Main Semesters are for regular class work. However, the following cases are exempted

- Students admitted on transfer from JNTUK Kakinada affiliated institutes, Universities and other institutes in the subjects in which they are required to earn credits so as to be on par with regular students as prescribed by concerned 'Board of Studies'.
- Each semester shall be of 21 weeks (Table 1) duration and this period includes time for registration of courses, course work, examination preparation and conduct of examinations.

Table 1: Academic Calendar

First Semester (21 weeks)	I Spell Instruction Period	8 weeks	19 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 week	
	Preparation and Practical Examinations	1 week	
	Semester End Examinations		2 weeks
Semester Break and Supplementary Examinations			2 weeks
Second Semester (21 weeks)	I Spell Instruction Period	8 weeks	19 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 week	
	Preparation & Practical Examinations	1 week	
	Semester End Examinations		2 weeks
Summer Vacation/Summer Internship			10 weeks

- Each semester shall have a minimum of 90 working days, out of which number of contact days for theory / practical are 70 and 20 days for conduct of examinations and preparation.
- The academic calendar shown in **Table 1** is declared at the beginning of the academic year.

10. Registration

Each student has to compulsorily register for course work at the beginning of each semester as per the schedule mentioned in the Academic Calendar. It is absolutely compulsory for the student to register for courses in time. The registration will be organized department wise under the supervision of the Head of the Department.

IN ABSENTIA registration will not be permitted under any circumstances.

At the time of registration, students should have cleared all the dues of Institute and Hostel in the previous semesters, paid the prescribed fee for the current semester and not been debarred from the institute for a specified period on disciplinary or any other ground.

11. Unique Course Identification Code

Every course of the B.Tech program will be placed in one of the four groups of courses as listed in the Table 2. The various courses and their two-letter codes are given below;

Table 2: Courses and their codes

S. No	Branch	Code
1	Civil Engineering	01
2	Electrical & Electronics Engineering	02
3	Mechanical Engineering	03
4	Electronics & Communication Engineering	04
5	Computer Science & Engineering	05
6	Artificial Intelligence & Machine Learning	61

12. Curriculum and Course Structure

The curriculum shall comprise Foundation/ Skill Courses, Core Courses, Elective Courses, Open Electives, Laboratory Courses, Technical Seminar, Communication Skills Practice, Soft Skills Practice, Professional Society Activities, Community Service Project, Summer Internship and Major Project. The list of elective courses may include subjects from allied disciplines also.

Contact Periods: Depending on the complexity and content of the course, the number of contact periods per week will be assigned. Each Theory and Laboratory course carries credits based on the number of hours/weeks as follows:

- Contact classes (Theory/Tutorial): 1credit per lecture hour per week.
- Laboratory Hours (Practical): 0.5 credit for1Practical hour per week.
- Summer Internship: 2credits
- Project Work and Full Semester Summer Internship (6 Months): 12Credits
- MOOCS: 2 Credits per course
- Comprehensive Viva Voce: 1Credit
- Mandatory Courses(MC):**Non-Credit**
- Induction Program: **Non-Credit**

Credit distribution for courses offered is shown in Table3.

Table 3: Credit distribution based on Contact Hours

S. No	Course	Hours	Credits
1	Theory Course (Core/Foundation/Elective)	3	3
2	Professional Core Courses	3	3
3	Professional Elective Courses	3	3
4	Open Elective Courses	3	3
5	Engineering Science courses (Engineering Graphics/Engineering Workshop)	1L+4P	3
6	Engineering Science courses	3	3
7	Laboratory Courses	3	1.5
8	MOOC Courses	0	2
9	Skill Oriented Course / Certification Course	1L+2P	2
10	Skill Advanced Course / Certification Course	1L+2P	2
11	Soft Skill Course / Certification Course	1L+2P	2
12	Summer Internship (8 Weeks)	-	1.5
13	Community Service Project	-	4
13	Seminar	-	1
14	Project Work with full Summer internship	-	10
15	Mandatory Courses	2	0
16	Minor Degree Courses	4	4

Course Structure

Every program of study shall be designed to have **36** theory courses, **5** Skill Oriented / Certification Courses, Summer Internship, Community Service Project, **5** Mandatory Courses and **17** laboratory courses. Every course of the B.Tech program will be placed in one of the 10 categories with minimum credits as listed in the **Table 4**. In addition, a student has to carry out a Project Work.

Table 4: Credit Distribution based on Category of Credits

S. No	Category	Subject Area and % of Credits	Average No. of Credits
1	Humanities and Social Sciences, including Management (HS)	HS (05% to 10%)	**10**
2	Basic Sciences including Mathematics, Physics and Chemistry (BSC)	BSC (10% to 15%)	**21**
3	Engineering Sciences, including Workshop, Drawing, Basics of Electrical / Electronics / Mechanical /Computer Engineering (ESC)	ESC (10% to 15%)	**24**
4	Professional – Core Courses, relevant to the chosen specialization/branch (PCC)	PCC (30% to 40%)	**51**
5	Professional Electives Courses, relevant to the chosen specialization/ branch (PEC)	PE (5% to 10%)	**15**
6	Open Electives Subjects / MOOCs, from other technical and/or emerging subject areas. (OEC)	OEC (5% to 10%)	**12**
7	Project Work through full Semester Summer Internship and Summer Internships / Seminar (PW)	PW (5% to 10%)	**17**
8	Skill Oriented Courses/Certification Courses project (SC)	SC (5% to 7%)	**10**
9	Mandatory Courses (Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge, Social Values and Professional Ethics) (MC)	MC (0%)	**0**
Total Credits			**160**

Table 5 : Semester wise distribution of Credits (for Four Years)

Year/Sem	No. of Theory Courses	No. of Lab Courses	Total Credits
B.Tech I Semester	2 Basic Science+ 1 Humanities and Social Science + 2 Engineering Science	1 Humanities and Social Science Lab + 1 Basic Science Lab + 1 Engineering Science Lab + Induction Training	**19.5**
B.Tech II Semester	2 Basic Science + 3 Engineering Sciences	2 Engineering Science Lab + 1 Basic Science Lab + Environmental Science	**19.5**
B.Tech III Semester	1 Basic Science + 4 Professional Core subjects	3 Professional Core Lab + Skill Oriented Course + Essence of Indian Traditional Knowledge	**21.5**
B.Tech IV Semester	1 Basic Science + 2 Professional Core + 1 Engineering Science / Professional Core (Interdisciplinary) + Humanities and Social Science	Engineering Science / Professional Core (Interdisciplinary) Lab + 2 Professional Core Lab + Skill Oriented Course+ Basics of Indian Constitution	**21.5**
B.Tech V Semester	3 Professional Core + 1 Open Elective/ Job Oriented Elective - I+ Professional Elective – I	2 Professional Core Lab + 1 Skill Advanced Course / Soft Skill Course + Community Service Project 2 Months after Second Year (To be Evaluated during V Semester) + Professional Ethics and Human Values	**24**
B.Tech VI Semester	3 Professional Core+ Professional Elective - II+ Open Elective/ Job Oriented Elective – II	3 Professional Core Lab + 1 Skill Advanced Course / Soft Skill Course +IPR & Patents	**21.5**
B.Tech VII Semester	3 Professional Elective- III,IV&V + Open Elective/ Job Oriented Elective –III, IV+ Humanities and Social Science Elective	Summer Internship 2 Months after Second Year (To be Evaluated during VII Semester) 1 Skill Advanced Course / Soft Skill Course.	**21.5**
B.Tech VIII Semester	Project Work with Full Summer Internship & Seminar		**11**
Total	6 Basic Science + 3 Humanities and Social Sciences + 5 Engineering Science+ 12 Professional Core + 1 Professional Interdisciplinary Core+ 5 Professional Electives + 4 Open Electives / Job Oriented Electives + Project Work	1 Humanities and Social Sciences Lab + 2 Basic Science Lab + 3 Engineering Science Lab + 1 Engineering Science / Professional Core(Interdisciplinary) Lab + 10 Professional Core Lab + 2 Professional Elective Lab + 2 Skill Oriented Course + 3 Skill Advanced Course / Soft Skill Course + Summer Internship + +Community Service Project + Mandatory Courses (Non-Credit)	**160**

Table 6: Semester wise distribution of Credits (for Three Years- Lateral Entry)

Year/Sem	No. of Theory Courses	No. of Lab Courses	Total Credits
B.Tech III Semester	1 Basic Science + 4 Professional Core subjects	3 Professional Core Lab + Skill Oriented Course + Essence of Indian Traditional Knowledge (MC)	21.5
B.Tech IV Semester	1 Basic Science + 2 Professional Core + 1 Engineering Science / Professional Core (Interdisciplinary) + Humanities and Social Science	Engineering Science / Professional Core (Interdisciplinary) Lab + 2 Professional Core Lab + Skill Oriented Course+ Basics of Indian Constitution (MC)	21.5
B.Tech V Semester	3 Professional Core + 1 Open Elective/ Job Oriented Elective - I+ Professional Elective – I	2Professional CoreLab+1 Skill Advanced Course / Soft Skill Course + Summer Internship 2 Months after Second Year (To be Evaluated during V Semester) + Professional Ethics and Human Values (MC)	21.5
B.Tech VI Semester	3 Professional Core+ Professional Elective - II+ Open Elective/ Job Oriented Elective – II	3 ProfessionalCoreLab+1 Skill Advanced Course / Soft Skill Course +IPR& Patents (MC)	24
B.Tech VII Semester	3 Professional Elective-III,IV&V + Open Elective/ Job Oriented Elective –III, IV+ Humanities and Social Science Elective	Industry Oriented Mini Project+ Comprehensive Viva Voce+ 1 Skill Advanced Course / Soft Skill Course.	21.5
B.Tech VIII Semester	Project Work with Full Summer Internship & Seminar		11
Total	2 Basic Science + 2 Humanities and Social Sciences + 12 Professional Core + 1 Professional Core (Interdisciplinary)+ 5 Professional Electives + 4 Open Electives / Job Oriented Electives + Project Work through Summer Internship (6 Months)	1 Engineering Science / Professional Core (Interdisciplinary) Lab + 10 Professional Core Lab + 2 Professional Elective Lab + 2 Skill Oriented Course + 3 Skill Advanced Course / Soft Skill Course + Summer Internship + Basics of Indian Constitution (MC) + Professional Ethics and Human Values (MC) + Essence of Indian Traditional Knowledge (MC) +IPR & Patents (MC)	121

Table 7: Course wise break-up for Regular Program (for Four Years)

Total Theory Courses - 36 (6 Basic Science + 3 Humanities and Social Sciences + 5 Engineering Science + 12 Professional Core + 1Professional Core (Interdisciplinary) + 5 Professional Electives + 4 Open Electives / Job Oriented Electives)	36 *.3credits each	108
Laboratory Courses - 17 (2 Basic Science Lab +1 Humanity Science Lab+ 3 Engineering Science Lab + 1 Engineering Science / Professional Core(Interdisciplinary) Lab + 10 Professional Core Lab	17 * 1.5 credits each	25.5
Summer Internship	1*1.5credit	1.5
Community Service Project	1 *4 credit	04
Seminar	1 * 1 credit	01
Skill Oriented Courses / Certification Courses-2	2 *.2credits each	04
Skill Advanced Courses / Soft Skill Courses / Certification Courses -3	3 *2 credit	06
Project Work	1 *10credits	10
Mandatory Courses	5 * 0 credits	0
Total Credits		**160**

Table 8: Course wise break-up (for Three years Lateral entry program)

Total Theory Courses - 26 (2 Basic Science +2 Humanities and Social Sciences + 12 Professional Core + 1 Professional Core (Interdisciplinary) + 5 Professional Electives + 4 Open Electives / Job Oriented Electives)	26 *3credits each	78
Laboratory Courses –11 (1 Engineering Science / Professional Core (Interdisciplinary) Lab + 10 Professional Core Lab)	11 * 1.5 credits each	16.5
Summer Internship	1 *1.5 credit	1.5
Community Service Project	1 *4 credit	04
Seminar	1 * 1 credit	01
Skill Oriented Courses / Certification Courses - 2	2 *2credits each	04
Skill Advanced Courses / Soft Skill Courses / Certification Courses – 3	3 *2 credit	06
Project Work	1 *10credits	10
Mandatory Course	4 * 0 credits	0
Total Credits		**121**

13. Evaluation Methodology (CIA and SEE)

The performance of a student in each semester shall be evaluated through Continuous Internal Assessment (CIA) and /or Semester End Examination (SEE) conducted semester wise.

Table 9: Evaluation Distribution of CIA and SEE

S.No	Type of Course	Total Marks	Continuous Internal Assessment (CIA)	Semester End Examination (SEE)
1	Theory	100	30	70
2	Laboratory	50	15	35
3	Summer Internship / Community Service Project	50	50	--
4	Skill Oriented Courses/ Skill Advanced Courses / Soft Skill Courses	100	30	70
5	MOOCs	100	--	100
6	Project Work	200	60	140
7	Mandatory Course	50	50	--

Theory Course (SEE)

The performance of a student in every theory course shall be evaluated for total of 100 marks each, of which the relative weightage for Continuous Internal Assessment and Semester End Examination shall be 30 marks and 70 marks respectively. The Semester End Examination (SEE) in each theory subject shall be conducted for 3 hours duration at the end of the semester for 70 marks.

- **Pattern of the Semester End Examination question paper is as follows:**

  The semester end examinations will be conducted by institute examination section for 70 marks with a duration of 3 hrs and consist of five questions carrying 14 marks each. Each of these questions is from one 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 questions will focus to test the objectiveness of the concept, analytical skill of the concept and the application skill of the concept.

A student has to secure not less than a minimum of 35% of marks (25 marks) exclusively at the Semester End Examinations in each of the theory subjects in which the candidate has appeared. However, the candidate shall have to secure a minimum of 40% of marks (40 marks) in both external (SEE) and internal (CIA) components put together to become eligible for passing in the subject.

Theory Course (CIA)

- For theory subjects, during a semester, there shall be two mid-term examinations for Continuous Internal Assessment (CIA). Each mid-term examination consists of
  - One objective examination (20 multiple choice questions) with a duration of 20 minutes for 10 marks
  - One descriptive examination with a duration of 90 minutes for 30 marks (3 full questions for 10 marks each) which will be reduced to 15 marks and
  - One assignment for 5 marks. Two assignment tests will be conducted before first and second mid examinations. First assignment test will be conducted after completion of first unit of syllabus. Six Questions may be announced in advance and on the day of test two questions will be given to each student randomly. The test may be conducted in the first period. Second assignment test will be conducted in the similar way after the completion of fourth unit's syllabus.
- All the mid exams shall be conducted from 50% of the syllabus.
- The total marks secured by the student in each mid-term examination are evaluated for 30 marks. Which consists of marks of objective examination (10 marks), descriptive examination (15 marks) and assignment (5 marks) shall be submitted to the Institute examination section within one week after completion of the mid-term examinations.
- Internal marks can be calculated with 80% weightage for better of the two mids and 20% weightage for other mid exam.

Example:

Mid-1 Marks=Marks secured in (objective examination-1+descriptive examination-1 + assignment-1)

Mid-2 Marks=Marks secured in (objective examination-2+descriptive examination-2 +assignment-2)

Final internal Marks = (Best of (Mid-1/Mid-2) marks x 0.8 + Least of (Mid- 1/Mid-2) marks x 0.2)

For example, If a student scores 23 marks and 24 marks in the first and second mid-term examinations respectively, then Weighted Average Marks = 24 x *0.8 + 23* x *0.2 = 23.8, rounded to 24 Marks.*

- With the above criteria, institute examination section shall be displayed in the

concerned college notice boards. If any discrepancy found, it shall be brought to the notice of institute examination section through proper channel within one week with all proofs. Discrepancies brought after the given deadline will not be entertained under any circumstances.

Laboratory Course

The performance of a student in every practical course shall be evaluated for total of 50 marks each, of which the relative weightage for Continuous Internal Assessment and Semester End Examination shall be 15 marks and 35 marks respectively.

External Evaluation for Laboratory Course:

- Procedure : 10Marks
- Experimental Work & Results : 15 Marks
- Viva-Voce : 10 Marks

A student has to secure not less than a minimum of 35% (12 marks) at the Semester End Examinations in each of the practical subjects in which the candidate had appeared. A candidate shall be declared to have passed in individual lab course if he secures a minimum of 40% aggregate marks (20 marks out of 50 marks in both Internal & External Examination marks put together).

Internal Evaluation for Laboratory Course:

For practical subjects there shall be a Continuous Internal Evaluation during the semester for 15 internal marks. Out of the15 marks for internal evaluation, day-to-day assessment in the laboratory shall be evaluated for 10 marks and internal practical examination shall be evaluated for 05 marks conducted by the laboratory teacher concerned.

Internal Evaluation for Design/ Drawing Courses:

For the subject having design and/or drawing, (such as engineering graphics, engineering drawing, machine drawing, production drawing and building drawing) the distribution of marks is for 30 Marks. Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2 hours each for 15 marks with weightage of 80% to better mid marks and 20% for the other. The subjective paper shall contain 3 either or type questions of equal weightage of 5 marks. There shall be no objective paper in mid semester examination. The sum of day-to-day evaluation and the mid semester marks will be the final sessional marks for the subject.

External Evaluation for Design/ Drawing Courses:

The Semester End Examination in Design / Drawing Course shall be conducted for 3 hours duration at the end of the semester for 70 marks. A student has to secure not less than a minimum of 35% of marks (25 marks) exclusively at the Semester End Examinations in each of the theory subjects in which the candidate has appeared. However, the candidate shall have to secure a minimum of 40% of marks (40 marks) in both external (SEE) and internal (CIA) components put together to become eligible for passing in the subject.

14. Internship

It is mandatory to complete ten months internship during the B.Tech. programme. These are divided in to two major categories, ie., two short term internships with a minimum of 6 weeks and a maximum of 8 weeks (two months) and another full-time summer internship with project work for six months during the final year second semester. One of the short-term internships is Community Service Project (CSP) and shall be completed during the summer break between II year and III year, it will be evaluated during the end examinations of III year I semester. The other short-term internship is a summer internship and shall be completed during the summer break between III year and IV year, it will be evaluated during the end examinations of IV year I semester. The full-time summer internship (6 months) shall be completed along with project work during final year final semester and it will be evaluated at the end of final semester.

Community Service Project

Community service project each of 8 weeks / 2 Months duration at the end of II B.Tech. (i.e., IV Semester) are Mandatory with 1.5 credits.

- Community Service Project is an experiential learning strategy that integrates meaningful community service with interaction, participation, learning and community development.
- Community Service Project involves students in community development and service
- Activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for

mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

Objective: Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships/Apprenticeships/On Job Training. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them.
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability.
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

- Every student should put in a minimum of **180 hours** for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. Of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc.
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
- The log book has to be countersigned by the concerned mentor/faculty in-charge.
- Evaluation to be done based on the active participation of the student and grade

could be awarded by the mentor/faculty member.

- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club etc.,
- Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Summer Internship/apprentice/on job training.

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward as far as possible in the near vicinity of the place of stay, so as to enable them to commute from their residence and return back by evening or so. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability.
- The Community Service Project is a twofold one; first the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers; rather, it could be another primary source of data.
- Second, based on the survey conducted the student/s could take up a social activity like–Agriculture, Health, Marketing and Cooperation, Animal Husbandry, Horticulture, Fisheries, Sericulture, Revenue and Survey, Natural Disaster Management, Irrigation, Law & Order, Excise and Prohibition, Mines and Geology, Energy, Internet, Electricity, Communications, Education Drinking Water etc.,

Suggested for CSP (but not limited to)

Water facilities and drinking water availability	Animals and species
Health and hygiene	Nutrition
Stress levels and coping mechanisms	Traditional health care methods
Health intervention programmes	Food habits
Horticulture Herbal plants	Air pollution
Botanical survey Zoological survey	Water pollution

Complimenting the community service project, the students may be involved to take up some awareness campaigns on social issues/special groups.

Programmes for School Children

1. Reading Skill Programme (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Programme on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Programme on Socially relevant themes.

Programmes for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Women's Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programmes on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days.

Programmes for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programmes

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programmes in consonance with the Govt. Departments like Agriculture, Health, Marketing and Cooperation, Animal Husbandry, Horticulture, Fisheries, Sericulture, Revenue and Survey, Natural Disaster Management, Irrigation, Law & Order, Excise and Prohibition, Mines and Geology, Energy, Natural Disaster Management, Irrigation

Role of Students

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also with the Governmental Departments. If the programme is rolled out, the District Administration could be roped in for the successful deployment of the programme.
- An in-house training and induction programme could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Time line for the Community Service Project Activity Duration: 8weeks

- Preliminary Survey (One Week)
- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

Community Awareness Campaigns (Two Weeks)

Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken in to consideration.

Community Immersion Programme (Four Weeks)

Along with the Community Awareness Programmes, the student batch can also work with any one of the governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics.

Community Exit Report (One Week)

During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks work to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher- mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University. Throughout the Community Service Project, a daily log-book need to be maintained by the student's batch, which should be countersigned by the governmental agency representative and the teacher mentor, who is required to periodically visit the students and guide them.

Evaluation of Community Service Project

Evaluation of the Community Service Project shall be through the departmental committee. A student will be required to submit a detailed project report to the concerned department and appear for an oral presentation before the departmental committee.

Day to day assessment log book – 20 Marks

- Project Report – 40 Marks
- Presentation and Viva-Voce – 40 Marks

A minimum of 50% of maximum marks shall be obtained to earn the corresponding credits.

Summer Internship

It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs in the area of concerned specialization of the UG programme. Students shall pursue this internship during summer vacation just before its offering as per course structure. The minimum duration of this course shall be at least 6 weeks and a maximum of 8 weeks (two months). The student shall register for the internship as per course structure before the summer break and commencement of next academic ie., final year.

A supervisor/mentor/advisor has to be allotted to guide the students for taking up the summer internship. The supervisor shall monitor the attendance and progress of the students while taking up the internship. Attendance requirements are as per the norms of the institution.

Evaluation of Summer Internship: After successful completion, students shall submit a summer internship technical report to the concerned department and appear for an oral presentation before the departmental committee consists of Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate from industry/skill development center shall be included in the report. The report and the oral presentation shall carry 40% and 60% weightage respectively. It shall be evaluated for 50 external marks at the end of the semester. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the Institution. The evaluation shall be carried during the end examinations of IV year I semester.

Skill Oriented / Skill Advanced / Soft Skill Courses

- For skill oriented/skill advanced /Soft skill Courses, one theory and 2 practical hours may be allotted or two theory hours may be adopted as per the decision of concerned BoS.
- From the five skill courses two shall be skill-oriented programs related to the domain and shall be completed in 2ndyear. The remaining 3 skill courses, one shall be necessarily a soft skill course and the remaining 2 skill-advanced courses can be in the same domain or Job oriented skills which can be interdisciplinary.

Evaluation Procedure: Evaluation of the Skill oriented / Skill advanced / Soft skills / Certificate course shall be through the departmental committee. A student will be registered for the courses being offered by the department or interdisciplinary. The evaluation shall be carried through Internal Examination - 30 Marks (CIA Mode) External Examination - 70 Marks (SEE Mode).

A student will be registered for the course being offered by industries / Professional bodies / APSSDC or any other accredited bodies. The Merit / Pass certificate obtained from the course are considered for **2** credits.

Massive Open Online Courses (MOOCs)

Meeting with the global requirements, to inculcate the habit of self learning and incompliance with UGC guidelines, MOOCs (Massive Open Online Courses) have been introduced as electives. The main intension to introduce MOOCs is to obtain enough exposure through online tutorials, self-learning at one's own pace, attempt quizzes, discuss with professors from various universities and finally to obtain certificate of completion for the course from the MOOCs providers

Regulations for MOOCs

- The respective departments shall give a list of courses from NPTEL or any other standard providers, whose credentials are endorsed by the HOD.
- Each department shall appoint Coordinators/Mentors and allot the students to them who shall be responsible to guide students in selecting on line courses and provide guidance for the registration, progress and completion of the same.
- A student shall choose an online course (relevant to his/her programme of study) from the given list of MOOCs providers, as endorsed by the teacher concerned, with the approval of the HOD.
- The details of MOOCs shall be displayed in Grade card of a student, provided student submits the proof of completion of it to the department concerned through the Coordinator/Mentor.
- Student can get certificate from SWAYAM/NPTEL or any other standard providers, whose credentials are endorsed by the HOD. The course work should not be less than **8** weeks.

Two credits will be awarded upon successful completion of each MOOC courses

having minimum of 8 weeks duration.

It is mandatory for the students who registered for minor degree along with major degree.

Project Work

Internal Evaluation for Project Work and Full Semester Summer Internship at Industry: The objective of Project Work and Full Summer Internship is to enable the student to take up investigative study in the broad field of his branch of Engineering/Interdisciplinary, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the department on an individual basis or three/four students in a group under the guidance of a supervisor/ guide. This is expected to provide a good initiation for the student(s) in R&D work. The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks).

External Evaluation for Project Work and Full Semester Summer Internship:

The project report shall be evaluated with an external examiner. At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the principal and is evaluated for 140 marks. A minimum of 50% of maximum marks shall be obtained to earn the corresponding credits. *The student project work shall not be evaluated if he/she fails to complete and submit the certificate of Full semester Summer Internship.*

Evaluation of Seminar

Participation of every student in seminar on Advanced Topic is mandatory during IV year. II semester for a credit of 1.The evaluation will be done for 50 marks by department level committee. Every student shall submit names of atleast four topics to deliver seminar talk. The department committee can allot any one of the topics submitted. Student shall prepare and submit a write up on the topic assigned. The student shall attend and deliver the seminar talk as per the schedule given by the department committee. The evaluation shall be done based on the write up submitted by the student

and the performance during seminar talk. A minimum of 50% of maximum marks (25 marks) shall be obtained to earn the corresponding credits.

Mandatory Courses

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 internal examination shall be conducted and evaluated for 50 Marks. The student shall be declared to have passed the mandatory courses only when Student secures **50% marks in the internal examination.** If the student fails, a re-examination shall be conducted for failed candidates in the Consecutive semester. The performance of the student shall be indicated in the grade sheets "**Completed (CP)" (or) "Not Completed (NCP) "**. The student should pass all the mandatory courses, for the award of B.Tech Degree.

15. Grading Procedure

Grades will be awarded to indicate the performance of students in each theory subject, laboratory / practical's, Skill oriented Course / Skill Advanced course / Soft Skill course, Summer Internships, Project Work and Full Semester Summer Internship in Industry (6 Months). Based on the percentage of marks obtained (Continuous Internal Assessment plus Semester End Examination, both taken together) a corresponding letter grade shall be given. 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 for theory & practical are mentioned in Table.11.

Table 11. Letter Grades

Range in which the % Marks in the subject fall	Letter Grade	Grade Points
Greater than or equal to 90%	A+ (Outstanding)	10
80 and less than 90%	A(Excellent)	9
70 and less than 80%	B (Very Good)	8
60 and less than 70%	C (Good)	7
50 and less than 60%	D (Fair)	6
40 and less than 50%	E (Pass)	5
<40	F (Fail)	0
Absent	AB	0

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

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

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

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

Credit points (CP) = Grade Point (GP) x credits …. For a course

A student passes the subject/ course only when GP 'E' grade or above

- A student to obtaining Grade F shall be considered as failed and will be required to reappear for that subject when the next supplementary examination offered.
- For Mandatory courses "Completed" or "Not Completed shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

Semester Grade Point Average (SGPA) / Cumulative Grade Point Average (CGPA)

- The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$\textbf{SGPA } (S_i) = \frac{\sum(C_i.G_i)}{\sum(C_i)}$$

Where, C_i is the number of credits of the i^{th} subject and G_i is the grade point scored by the student in the i^{th} course.

- The Cumulative Grade Point Average (CGPA) will be computed in the manner taking into account all the courses undergone by a student overall the semesters of a program, i.e.,

$$\textbf{CGPA} = \frac{\sum(C_i.S_i)}{\sum(C_i)}$$

Where, "S_i" is the SGPA of the ith semester and C_i is the total number of credits in that semester.

- Conversion of Grade Point Average to Percentage of Marks

Percentage of Marks = [CGPA – 0.75] x 10

Both SGPA and CGPA shall be rounded off to two decimal points and reported in the transcripts. While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

***Grade Point**:* It is a numerical weight allotted to each letter grade on a 10-point scale.

***Letter Grade**:* It is an index of the performance of students in a said course. Grades are denoted by letters A+, A, B, C, D and E.

16. Award of Class

After a student fulfilled the requirements and acquired the prescribed number of credits for the completion of the program He/She is eligible for the award of B.Tech. degree. Such eligible student shall be placed in one of the following four classes:

CGPA ≥ 7.75	CGPA ≥ 6.75 and < 7.75	CGPA ≥ 5.75 and < 6.75	CGPA ≥ 5.0 and < 5.75
First Class with Distinction (WITHOUT ANY SUPPLELEMENTRY APPEARANCE)	**First Class**	**Second Class**	**Pass Class**

17. Attendance Requirements and Detention Policy

A student is eligible to write the University examinations if he acquires a minimum of 40% in each subject and 75% of attendance in aggregate of all the subjects.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) may be granted by the College Academic Committee. However, this condonation concession is applicable only to any two semesters during the entire programme.

c) Shortage of Attendance below 65% in aggregate shall not be condoned.

d) A student who is short of attendance in a semester may seek re-admission into that

semester when offered within 4 weeks from the date of commencement of class work.

e) Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class.

f) A stipulated fee of Rs. 500/- in the concerned semester shall be payable towards condonation of shortage of attendance. Students availing condonation on medical ground shall produce a medical certificate issued by the competitive authority.

g) A student will be promoted to the next semester if he satisfies the (i) attendance requirement of the present semester and (ii) minimum required credits.

h) If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

i) For induction programme attendance shall be maintained as per AICTE norms.

j) For non-credit mandatory courses the students shall maintain the attendance similar to credit courses

18. Promotion Policies

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.8 for promotion to higher classes

a) A student shall be promoted from first year to second year if he fulfills the minimum attendance requirement as per University norm.

b) A student will be promoted from II to III year if he fulfills the academic requirement of 40% of credits up to either II year I-Semester or II year II-Semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester.

a) A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

19. Major Degree with a Minor

Students, who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering, may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme; student will

get Major degree of Mechanical Engineering with minor degree of Civil Engineering. Student can opt the Industry relevant tracks of any branch to obtain the Major degree with Minor, for example, a B.Tech. Mechanical Engineering student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

A student shall be permitted to register for Minors program at the beginning of 4thsemester provided that the student must have acquired 7.5 SGPA (Semester Grade point average) upto the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester, if a student fails to acquire 7.5 SGPA upto3rd semester or failed in any course, his registration for Minors program shall stand cancelled. An SGPA of 7.5 has to be maintained in the subsequent semesters without any backlog in order to keep the Minor registration active.

Minor degree will cumulatively require additional **20** credits in the specified area in addition to the credits essential for obtaining the undergraduate degree in Major discipline (i.e., 160 credits).

The BoS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance or demand, for example the minor tracks can be the fundamental or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, VLSI etc. The list of disciplines/ branches eligible to opt for an industry relevant minor specialization shall be clearly mentioned in the respective BOS.

Student must complete 4 courses each of 4 credits (for a total of 16 credits) by choosing out of six courses mentioned in the course structure of the department from which minor degree is seeking.

In addition to 16 credits from courses, students shall have to pursue atleast 2 courses for two credits each (total 4 credits) through MOOCS/NPTEL. The concerned BOS shall list the MOOCS/NPTEL courses to be pursued by the student. Attendance will not be monitored for this MOOCS course. A student has to acquire a certificate of MOOCS/NPTEL course from the agencies approved by the BOS in order to earn the required credits, and that should be evaluated by Department committee.

Student can opt the Industry relevant minor specializations as approved by the concerned departmental BoS or student can opt the courses from skill development corporation (APSSDC) or student can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline shall review such courses being offered by eligible

external agencies and prepare a fresh list every year incorporating latest skill based on industrial demand.

A committee should be formed at the level of department to evaluate the grades/ marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

If a student prefers to take test from an external agency, student must take a comprehensive viva-voce conducted at the department level and the marks assigned for the Viva-voce will be assigned to that course. However, if students wish to take the courses from the department, student should take examination conducted by the Department only. Also, if a student completes courses from external agency without taking test are also eligible to get minor degree after fulfilling all the formalities assigned by the departmental committee.

It is the responsibility of the student to acquire prerequisite knowledge of the minor program domain before taking the course. The BoS concerned shall prepare the list of subjects and prerequisites for each minor track.

If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or "Pass (P)" grade and also choose to omit the mention of the course as for the following:

- All the courses done under the dropped Minors will be shown in the transcript.
- None of the courses done under the dropped Minor will be shown in the transcript.

In case a student fails to meet the CGPA requirement for B.Tech Degree with Minor at any point after registration, student will be dropped from the list of students eligible for Degree with Minors and they will receive B. Tech Degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

20. Honors programme :

Students from same department are eligible for Honor program.

- A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired 7.5 SGPA upto the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester, if a student fails to acquire 7.5 SGPA up to 3rdsemester or failed in any course, his/her registration for Honors program shall stand cancelled.
- Students can select advanced subjects from their respective branch in which they are pursuing the degree. Example, If Mechanical Engineering student completes the selected advanced subjects from the same branch under this scheme, student will be awarded B.Tech. (Honors) in Mechanical Engineering.
- Student must complete 4 courses @ 4 credits from each pool and 2 MOOC/NPTEL courses @ 2 credits (Total 20 credits)
- The student who has registered for Honors shall choose one course from each pool. There shall be 4 pools with 5 courses each as mentioned in course structure of Honors program. The board of studies concerned will decide the courses under each pool for Honors programs.
- For Honors program, all the courses offered in each pool shall be domain specific courses and advanced courses.
- In addition to the 4 courses chosen, one from each pool, students shall have to pursue at least 2 courses through MOOCS/NPTEL. The concerned BoS shall list the MOOCS/NPTEL courses to be pursued by the student. Attendance will not be monitored for this MOOCS course. Student has to acquire a certificate of MOOCS/NPTEL course from the agencies approved by the BoS in order to earn 2 credits. BoS concerned shall prepare the list of advanced courses for each pool taking into consideration the core courses offered in the curriculum. If a course comes with a lab component, that component has to be cleared separately. The concerned BoS shall provide pre requisites to take the specific course by the student. It is the responsibility of the student to acquire/complete prerequisite before taking the course.
- If a student drops (or terminated) from the Honors program, they cannot convert the earned credits into free or core electives, they will remain extra. These

additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or "Pass" grade and also choose to omit the mention of the course as for the following:

- ❖ All the courses done under the dropped Honors will be shown in the transcript.
- ❖ None of the courses done under the dropped Honors will be shown in the transcript.

- In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, student will be dropped from the list of students eligible for Degree with Honors and they will receive B.Tech Degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

21. Graduation Requirements

The following academic requirements shall be met for the award of the B.Tech degree.

- Student shall register and acquire minimum attendance in all courses and secure 160 credits for regular program and 121 credits for lateral entry program.
- A student of a regular program, who fails to earn 160 credits within eight consecutive academic years from the year of their admission with a minimum CGPA of 4.0, is not eligible to get degree.
- A student of a lateral entry program, who fails to earn 121 credits within six consecutive academic years from the year of their admission with a minimum CGPA of 4.0, shall not get their degree and the admission stands cancelled.

22. Revaluation

A student, who seeks the re-evaluation of the answer script, is directed to apply for the photocopy of their semester examination answer paper(s) in the theory course(s), within 5 working days from the declaration of results in the prescribed format with prescribed fee to the Controller of Examinations through the Head of the department. The Controller of Examinations shall arrange for the revaluation and declare the results. If COE found the difference between the evaluation and reevaluation is more than 10 marks, then the COE shall arrange another evaluation. Revaluation is not permitted to the courses other than theory courses.

23. Termination from the Programme

The admission of a student to the program may be terminated and the student is asked to leave the institute in the following circumstances:

- The student fails to satisfy the requirements of the program within the stipulated maximum period for that program.
- A student shall not be permitted to study any semester more than three times during the entire Program of study.
- The student fails to satisfy the norms of discipline specified by the institute from time to time.

24. With-Holding of Results

If the candidate has any dues not paid to the institute or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld and student will not be allowed/ promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

25. Gap Year Concept

A candidate is normally not permitted to break the study. However, if a candidate intends to temporarily discontinue the program in the middle for valid reasons (such as accident or hospitalization due to prolonged ill-health) and to rejoin the program after the break from the commencement of the respective semester as and when it is offered, she/he shall apply to the principal in advance. Such application shall be submitted before the commencement of the semester and forwarded through the Head of the department along with relevant documents endorsed by his / her parent or guardian.

- The institute shall examine such type of applications, and if it finds the case to be genuine, it may permit the student to rejoin. Such permissions are accorded only to those who do not have any outstanding dues like tuition fee etc.
- The total period for completion of the program reckoned from the commencement of the semester to which the candidate was first admitted shall not exceed the maximum period of 8 years for regular and 6 years for lateral entry students. The maximum period includes the break period.

26. Conduct and Discipline

Students shall have a good conduct within and outside the premises of the Institute in a decent and dignified manner befitting the students of Srinivasa Institute of Engineering and Technology.

As per the order of the Honorable Supreme Court of India, ragging in any form is considered a criminal offence and is totally banned. Any form of ragging will be severely dealt with the following acts of omission and/or commission shall constitute gross violation

of the code of conduct and are liable to invoke disciplinary measures with regard to ragging.

Any sort of indiscipline activities which are mentioned below are not accepted in the campus.

- Lack of courtesy and decorum, indecent behavior anywhere within or outside the college campus.
- Damage of college property or Possession, consumption and distribution of Alcoholic drinks or any kind of narcotics to fellow students /citizens.
- Mutilation or unauthorized possession of library books.
- Noisy and unruly behavior, disturbing studies of fellow students.
- Hacking in computer systems (such as entering into other person's areas without prior permission, manipulation and/or damage of computer hardware and software or any other cyber crime etc.
- Usage of camera/cell phones in the campus.
- Plagiarism of any nature.

Commensurate with the severity of offense, the punishment may be reprimand, fine, expulsion from the institute/hostel, debarring from examination, disallowing the use of certain facilities of the Institute, rustication for a specified period or even outright expulsion from the Institute, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.

For an offence committed in the hostel, department or in class room and elsewhere, the chief Warden, the concern Head of the Department and the Principal respectively, shall have the authority to reprim and/or impose fine.

Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the principal for taking appropriate corrective action.

The Institute Level Standing Disciplinary Action Committee constituted by the academic council shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed. The Principal shall deal with any problem, which is not covered under these rules and regulations.

27. Grievance Redressal Committee

Grievance and Redressal Committee constituted by the Principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters. All the students must abide by the code and conduct rules prescribed by the college from time to time.

28. Transitory Regulations and Student Transfers

Required to do all the courses in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed such courses in the earlier semesters she/he was originally admitted into and substitute subjects are offered in place of them as decided by the Board of Studies. However, the decision of the University along with BoS members will be final.

Rejoining into I Year B.Tech I Semester: A student who is under Jawaharlal Nehru Technological University Kakinada (JNTUK) curriculum and detained due to shortage of attendance at the end of the first semester shall join the autonomous batch of first semester. Such students shall study all the courses prescribed for the batch in which the student joined and considered on par with regular candidates of Autonomous stream and will be governed by the autonomous regulations with the approval of JNTUK University.

Re joining into II Year B.Tech. II Semester: A student who is following JNTUK curriculum and detained due to shortage of attendance at the end of the first semester of second year shall join the autonomous batch of third semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with Lateral Entry regular candidates of Autonomous stream and will be governed by the autonomous regulations with the approval of JNTUK University. **Student Transfers:** Student transfers shall be as per the guide lines issued by the Government of Andhra Pradesh, JNTUK Kakinada and Institute from time to time.

29. Revision of Regulations and Curriculum

The Institute from time to time may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary and on approval by the Academic Council and the Governing Body shall come into force and shall be binding on the students, faculty, staff, all authorities of the Institute and others concerned.

30. Malpractices Rules

Disciplinary Action for Misconduct during Examinations

S.No	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
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 he is appearing but has not made use of (material shall include any marks on the body of the candidate 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 candidate orally or by any other body language methods or communicates through cell phones with any candidate 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 candidates 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 candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Controller of Examinations.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate 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 candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Controller of Exams/Additional Controller of Exams/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the COE 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 COE 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 Institute premises or engages in any other act which in the opinion of the officer on duty mounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	They shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and give up their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate 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 candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

8.	Possess 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 candidate 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 candidate is also debarred and gives up the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellationof the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjectsof that semester/year. The candidate is also debarred and gives up 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.
10.	Comes in a drunken condition	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate 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.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Director/Principal for further action towards suitable punishment.	


Ragging
Ragging is prohibited under the follwing Acts
Supreme Court in SLP No. 24295 of 2006 dt. 16-05-2007
High Court Judgement dt. 11-09-1997 in W.P.No. 26132/96
Act 26 of A.P. Legislative Assembly dt. 19-08-1997
Indian Parliament Notice dt. 26-07-2008
as per AICTE Notice dt. 01-07-2009
as per UGC Notice dt. 22-10-2009
Ragging within or outside any educational institution is Prohibited.
Ragging means doing an act which causes or is likely to cause Insult or Annoyance or Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student.
Imprisonment upto
Fine upto
Teasing Embarrassing and Humiliation
6 Months
+
Rs.1000/-
Assaulting or using criminal force or criminal intimidation
1 Year
+
Rs.2000/-
Wrongfully restraining or confining or causing hurt
2 Years
+
Rs.5000/-
Causing grievous hurt, kidnaping or rape or committing unnatural offence
5 Years
+
Rs.10,000/-
Causing death or abetting suicide
10 Years
+
Rs.50,000/-

DEPARTMENT OF MECHANICAL ENGINEERING
COURSE STRUCTURE – B.Tech 2021-2022

I B.Tech I Semester–Mechanical Engineering

S. No	Course Code	Course Title	Hours perWeek			Marks			Credits
			L	T	P	IM	EM	Total	
1	21B00101	Mathematics-I	4	1	0	30	70	100	3
2	21B00102	Engineering Chemistry	3	0	0	30	70	100	3
3	21H00101	Communicative English	3	0	0	30	70	100	3
4	21E03101	Engineering Drawing	1	0	3	30	70	100	3
5	21E03102	Material science& Engineering	3	1	0	30	70	100	3
6	21H00111	Communicative English Laboratory	0	0	3	15	35	50	1.5
7	21B00112	Engineering Chemistry Laboratory	0	0	3	15	35	50	1.5
8	21E03112	Material Science& Engineering Lab	0	0	3	15	35	50	1.5
		Total	**14**	**02**	**12**	**195**	**455**	**650**	**19.5**

I B.Tech II Semester–Mechanical Engineering

S. No	Course Code	Course Title	Hours Per Week			Marks			Credits
			L	T	P	IM	EM	Total	
1	21B00201	Mathematics-II	4	1	0	30	70	100	3
2	21B00202	Engineering Physics	3	0	0	30	70	100	3
3	21E03201	Thermodynamics	3	1	0	30	70	100	3
4	21E03202	Engineering Mechanics	3	1	0	30	70	100	3
5	21E05201	Programming in C	3	1	0	30	70	100	3
6	21E03211	Basic Engineering Workshop	0	0	3	15	35	50	1.5
7	21B00212	Engineering Physics Laboratory	0	0	3	15	35	50	1.5
8	21E05211	Programming in C Laboratory	0	0	3	15	35	50	1.5
9	21M00201	Environmental Science(Mandatory Course)	2	0	0	50	0	50	-
		Total	**18**	**04**	**09**	**245**	**455**	**700**	**19.5**

II B.Tech I Semester–Mechanical Engineering

S. No	Course Code	CourseTitle	Hours perWeek			Marks			Credits
			L	T	P	IM	EM	Total	
1	21B00301	Mathematics-III	4	1	0	30	70	100	3
2	21P03301	Mechanics of solids	3	1	0	30	70	100	3
3	21P03302	Kinematics of Machinery	3	1	0	30	70	100	3
4	21P03303	Fluid Mechanics and Fluid Machines	3	1	0	30	70	100	3
5	21P03304	Production Technology	3	0	0	30	70	100	3
6	21P03313	Fluid Mechanics and Fluid Machines LAB	0	0	3	15	35	50	1.5
7	21P03312	Mechanics of Materials LAB	0	0	3	15	35	50	1.5
8	21P03314	Production Technology LAB	0	0	3	15	35	50	1.5
9	21S03311	Computer Aided Machine Drawing	1	0	2	15	35	50	2
	Total		19	04	11	260	490	750	21.5

IIB.TechII Semester –Mechanical Engineering

S. No	Course Code	CourseTitle	Hours perWee k			Marks			Credits
			L	T	P	IM	EM	Total	
1	21B00401	Mathematics-IV	4	1	0	30	70	100	3
2	21P03401	Applied Thermodynamics	3	1	0	30	70	100	3
3	21P03402	Dynamics of Machinery	3	1	0	30	70	100	3
4	21E02401	Basic Electrical and Electronics Engineering	3	0	0	30	70	100	3
5	21H00401	Managerial Economics for Engineers	3	0	0	30	70	100	3
6	21E02411	Basic electrical and Electronics Engineering LAB	0	0	3	15	35	50	1.5
7	21P03411	Applied Thermodynamics LAB	0	0	3	15	35	50	1.5
8	21P03412	Theory of machines LAB	0	0	3	15	35	50	1.5
9	21S03411	Part Modeling& assembly Modeling using CAD	1	0	2	15	35	50	2
10	21M00401	Basics of Indian constitution (Mandatory Course)	2	0	0	50	00	50	-
	Total		19	03	11	260	490	750	21.5
Internship2MonthsduringSummerVacation									

III B.Tech I Semester – Mechanical Engineering

S.No	Course Code	Course Title	Hours per Week			Marks			Credits
			L	T	P	IM	EM	T	
1	21P03501	Machine Tools& Metrology	3	0	0	30	70	100	3
2	21P03502	Heat Transfer	3	1	0	30	70	100	3
3	21P03503	Design of Machine Elements -I	3	1	0	30	70	100	3
4	**Open Elective-I**		3	0	0	30	70	100	3
5	**Professional Elective – I**		3	0	0	30	70	100	3
	21L03501	Renewable Energy Sources							
	21L03502	Optimization Techniques							
	21L03503	Mechanics of Composite Materials							
6	21P03511	Machine Tools & Metrology Lab	0	0	3	15	35	50	1.5
7	21P03512	Heat Transfer Lab	0	0	3	15	35	50	1.5
8	21S03511	Employability Skills -I	1	0	2	15	35	50	2
9	21P03531	Community Service Project	0	0	0	100	0	100	1.5
10	21M00501	Professional Ethics and Human Values (Mandatory Course)	2	0	0	50	0	50	0
		TOTAL	**18**	**2**	**8**	**345**	**455**	**800**	**21.5**

III B.Tech II Semester – Mechanical Engineering

S.No	Course Code	Course Title	Hours per Week			Marks			Credits
			L	T	P	IM	EM	T	
1	21P03601	Artificial Intelligence & Machine Learning	3	0	0	30	70	100	3
2	21P03602	Finite Element Methods	3	1	0	30	70	100	3
3	21P03603	Design of Machine Elements –II	3	0	0	30	70	100	3
5	**Open Elective-II**		3	0	0	30	70	100	3
6	**Professional Elective – 2**		3	0	0	30	70	100	3
	21L03601	Refrigeration & Air-Conditioning							
	21L03602	Smart Manufacturing							
	21N03603	Production Planning and Control							
7	21P03611	Computer Aided Analysis Lab	0	0	3	15	35	50	1.5
8	21P03612	Instrumentation and Mechatronics Lab	0	0	3	15	35	50	1.5
10	21P03613	Computer Aided Manufacturing Lab	0	0	3	15	35	50	1.5
11	21S03611	Employ ability Skills –II	1	0	2	15	35	50	2
12	21M00601	Intellectual Property Rights& Patents (Mandatory Course)	2	0	0	50	0	0	50
Total			**18**	**0**	**12**	**210**	**490**	**700**	**21.5**

IV B.TechI Semester – Mechanical Engineering

S.No	Course Code	Course Title	Hours per Week			Marks			Credits
			L	T	P	IM	EM	T	
1	**Professional Elective-III**		3	0	0	30	70	100	3
	21L03701	Power Plant Engineering							
	21L03702	Flexible Manufacturing Systems							
	21L03703	Total Quality Management							
2	**Professional Elective-IV**		3	0	0	30	70	100	3
	21L03704	Design of Experiments							
	21L03705	Electric, Hybrid and Hydrogen Vehicles							
	21L03706	Computational Fluid Dynamics							
3	**Professional Elective-V**		3	0	0	30	70	100	3
	21L03707	Additive Manufacturing							
	21L03708	Advanced Machining Processes							
	21L03709	Product Lifecycle Management							
4	**Open Elective-III**		3	0	0	30	70	100	3
5	**Open Elective –IV**		3	0	0	30	70	100	3
6	**Humanities & social Sciences Elective**		3	0	0	30	70	100	3
	21H03701	Sociology&Elements of Indian History for Engineers							
	21H03702	Law for Engineers							
	21H03703	Business communication and presentation skills							
7	21P03721	**Summer Internship**	0	0	0	100	0	100	1.5
9	21S03701	Artificial Intelligence and Machine Learning Lab	1	0	2	30	70	100	2
		Total	**19**	**0**	**3**	**295**	**555**	**850**	**21.5**

IV B.TechII Semester – Mechanical Engineering

S.N O	Course Code	Course Title	Hours per Week			Marks			Credits
			L	T	P	IM	EM	T	
1	21P03831	Seminar	0	0	0	100	0	100	1
2	21M03821	Major Project	0	0	0	60	140	200	10
Total									**11**

OPEN ELECTIVE - I

S.No	Open Elective Course Title
1	Cyber security
2	Electrical measurements and instrumentation Basic of Civil Engineering
3	Principles of communication Operating systems
4	Air Pollution and Control

OPEN ELECTIVE - II

S.No	Open Elective Course Title
1	Machine learning
2	Basic of Civil Engineering
3	Fundamentals of electrical machines
4	IC applications

OPEN ELECTIVE - III

S.no	Open elective course title
1	Data Science Electronic measurements and instrumentation
2	Fundamentals of utilization of electrical energy
3	Green buildings
4	Fundamentals of microprocessors and micro controllers

OPEN ELECTIVE - IV

S.No	Open Elective Course Title
1	Operating systems
2	Fundamentals of power system engineering
3	Sustainability concepts in Civil Engineering
4	Electronic measurements and instrumentation

Minor Degree Program Courses

LIST OF MINOR COURSES OFFERD BY ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT

Fundamentals of signals and systems
Embedded systems and applications
Fundamentals of communication systems
Principles of electronic instrumentation
Fundamentals of digital signal processing
Digital system design

LIST OF MINOR COURSES OFFERD BY CIVIL ENGINEERING DEPARTMENT

Surveying & geomatics
Construction technology
Fundamentals of transportation Engineering
Basic soil mechanics
Environmental engineering and management
Smart Cities

LIST OF MINOR COURSES OFFERD BY COMPUTER SCIENCE AND ENGINEERING DEPARTMENT

Cloud Computing
Mobile Computing
Software Engineering
Data Base Management Systems
Fundamentals of Artificial Intelligence and Machine Learning
Cybersecurity Forensics

LIST OF MINOR COURSES OFFERD BY ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENT

Electrical Power Generation, Transmission & Economic Aspects
Electrical Safety Course
Principles Of Electric Power Conversion
Renewable Energy Sources
Electric Vehicles
Power Systems For Data Centres

I-B.TECH.-I SEMESTER SYLLABUS

MATHEMATICS –I
(Linear Algebra and Calculus)
(Common to All Branches)

I-B.Tech-I-Sem.	**L**	**T**	**P**	**C**
Subject Code: 21B00101	**4**	**1**	**0**	**3**

Pre Requisite: Nil

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

1. Develop the use of matrix algebra techniques that is needed by engineers for solving system of linear equations in practical applications.
2. Verify cayley – hamilton theorem and reduce quadratic forms to canonical form by orthogonal transformation
3. Test the convergence of an infinite series and verify mean value theorems for a continuous function
4. Apply the techniques of multi variable differential calculus to determine extrema and series expansions
5. Apply double integration techniques in evaluating areas bounded by region and triple integration techniques in evaluating volumes of solids

Unit-I: Solving Systems of Linear equations, Eigen values and Eigen vectors 12hours

Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous linear equations–Gauss Elimination method-Eigen values and Eigen vectors and problems on properties (without proofs) of Eigen values

Unit-II: Cayley–Hamilton Theorem and Quadratic Forms 12hours

Cayley-Hamilton theorem (without proof) – Applications – Finding the inverse and power of a matrix by Cayley-Hamilton theorem – Reduction to Diagonal form – Quadratic forms - rank, index, signature and nature of the quadratic forms–Reduction of quadratic form to canonical forms by orthogonal transformation.

Unit-III: Sequences, Series and Mean Value Theorems 12 hours

Sequences and Series: Convergence and divergence – Ratio test – Comparison test – Integral test – Cauchy's root test – Alternate series– Leibnitz's rule. Mean Value Theorems (without proofs): Rolle's Theorem–Lagrange's mean value theorem–Cauchy's mean value theorem–Taylor's and Maclaurin's theorems with remainders, Problems and applications on the above theorems.

Unit-IV: Partial Differentiation 12 hours

Introduction – Homogeneous function – Euler's theorem– Total derivative– Chain rule– Jacobian – Functional dependence –Taylor's and Mac Laurin's series expansion of functions of two variables. Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method of undetermined multiplier

Unit-V: Multiple Integrals 10 hours

Double and Triple integrals – Change of order of integration in double integrals – Change of variables to polar, cylindrical and spherical coordinates. Applications: Finding Area and Volume.

Textbooks:

1. **B.S.Grewal,** Higher Engineering Mathematics,44th Edition, Khanna Publishers.
2. **R.K.Jain & S.R.K.Iyengar** Advanced Engineering Mathematics, 5th Edition Narosa Publishing House

References:

1. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Pub., Reprint, 2008.
2. Higher Engineering Mathematics, Ramana B.V.,TMH,11th Reprint.
3. Calculus and Analytic Geometry by G.B.Thomasand R.L.Finney, 9th Edn, Pearson, Reprint, 200

ENGINEERING CHEMISTRY

I-B.Tech-I-Sem. **L T P C**
Subject Code: 21B00102 **3 0 0 3**
Pre Requisite: Nil

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

1. Categorize plastics, elastomers and composite materials according to industrial applications
2. Select appropriate materials for batteries and fuel cells
3. Illustrate various engineering materials and their preparation
4. Solve numerical problems of fuel technology
5. Select appropriate technique for water treatment.

Unit-I: Polymer Technology **08hours**

Polymerisation: Introduction, methods of polymerization (emulsion and suspension), mechanical properties. **Plastics:** Thermo plastics & Thermo setting plastics, Compounding of plastics, Compounding, fabrication (compression, injection, extrusion and Transfer), preparation, properties and applications (PVC, Bakelite and polycarbonates), recycling of e-plastic waste (waste to wealth).

Elastomers: Natural rubber, Processing of natural rubber, Compounding, Vulcanisation, preparation , properties and applications (Buna-S, Thiokol and Polyurethanes).

Composite materials: Fiber reinforced plastics, conducting polymers, biodegradable polymers with examples

Unit-II: Electro chemical Cells and Corrosion **10hours**

Galvanic cells, Single electrode potential, Concentration cells, electro chemical series and uses of series, standard hydrogen electrode, calomel electrode, Batteries: Dry cell, Li- ion battery, Lead- acid battery, Fuel cells: Construction and working of H2-O2, CH3OH-O2 **Corrosion:** Definition, theories of corrosion (chemical and electrochemical), galvanic corrosion, differential aeration corrosion, stress corrosion, pitting corrosion, galvanic series, factors influencing rate of corrosion, Corrosion control methods: proper designing and cathodic protection, cathodic coatings, anodic coatings, electro plating and electro-less plating, Paints (constituents and functions).

Unit-III: Chemistry of Engineering Materials **08hours**

Nano materials: Introduction – Carbon nanotubes and fullerenes -Sol-gel method, BET and TEM methods, Carbon nano tubes and fullerenes: Types, preparation, properties and applications

Green synthesis: Principles, 2 methods of synthesis with examples, **Cement:** Constituents, Manufacture of Portland cement, Chemistry of setting and hardening of cement, Deterioration of cement concrete. **Refractories:** Definition, classification, properties of refractories.

Unit-IV: Fuel Technology **10 hours**

Fuels: Introduction – Classification – Calorific value - HCV and LCV – Dulong's formula, Numerical problems, Coal: Proximate and ultimate analysis – Significance Petroleum: Refining – Cracking - synthetic petrol (Fischer Tropsch process)–Petrol knocking Diesel knocking - Octane and Cetane ratings – Anti-knocking agents, Gaseous fuels: Natural gas-LPG and CNG– Flue gas analysis by Orsat apparatus

Unit-V: Water Technology **10hours**

Hardness of water, determination of hardness by complexometric method, boiler troubles (priming and foaming, scale formation, boiler corrosion, causticembrittlement), internal treatments, softening of hard water (zeolite process, ion exchange process),municipal water treatment, potable water and its specifications, Disinfection of water- chlorination, break point chlorination-desalination (reverse osmosis and electrodialysis)

Text Books:

1. Engineering Chemistry by Jainand Jain; Dhanpat Rai Publicating Co.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015 edition

Reference Books:

1. Engineering Chemistry of Wiley India Pvt.Ltd., Vairamandothers, 2014 edition (second).
2. Engineering Chemistry by PrasanthRath, Cengage Learning, 2015 edition.
3. A text book of engineering Chemistry by S.S.Dara; S.Chand & Co Ltd., Latest Edition
4. Engineering Chemistry by M. Thirumala Chary; E. Laxminarayana, K. Shashikala Third Edition SCITECH

COMMUNICATIVE ENGLISH

I-B.Tech-I-Sem. **L T P C**
Subject Code: 21H00101 **3 0 0 3**
Pre Requisite: Nil

Course Out comes: At the end of the course, the student will be able to
1. Identify the context, topic, and pieces of specific information.
2. Apply the concepts of communication invarious channels to introduce one/other.
3. Bench mark with standards to comprehend effective communication.
4. Quantify expression by using adjectives, adverbs and antonyms.
5. Write technical/academic proposals through appropriate glossary of words

Unit-I: **10 hours**

Lesson-1: adrawerfull of happiness from "infotech english", maruthi publications
Lesson-2: deliverance by premchand from "the individual society", pearson publications. (Non- detailed)
Listening: Listening to short audio texts and identifying the topic. Listening to prose, prose and conversation.
Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests. Self introductions and introducing others.
Reading: Skimming text to get the main idea. Scanning to look for specific pieces of information. **Writing**: Paragraph writing (specifictopics) using suitable cohesive devices; linkers, sign posts and transition signals; mechanics of writing-punctuation, capital letters, Vocabulary: Technical vocabulary from across technical branches (20), grevocabulary (20) (antonyms and synonyms, Word applications) Verbal reasoning and sequencing of words. Grammar: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; Nouns: countable and uncountable; singular and plural basic sentence structures; simple question form-wh-questions; word order in sentences.

Unit-II: **10hours**

Sesson-1: Nehru's letter to his daughter Indiraon her birthday from "infotech english", maruthi publications.
Lesson-2: Bosom Friend by Hira Bansode from "The individual society", pearson publications. (Non- detailed)
Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts, both in speaking and writing.
Speaking: Discussion in pairs/small groups on specific topics followed by short structured talks. Functional English: Greetings and leave takings.
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in aparagraph together. Reading: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.
Writing: preparing posters, slides and presentation papers. Vocabulary: Technical vocabulary from across technical branches (20words). Grevocabulary analogies (20words) (antonyms and synonyms, Word applications) Grammar: Use of articles and zeroarticle; prepositions.

Unit-III: **08 hours**

Lesson-1: Stephen hawking-Positivity 'Benchmark' from "infotech english", maruthi publications.
Lesson-2: Shakespeare's Sister by Virginia Woolf from "The Individual Society", pearson publications. (Non-detailed)
Listening: Listening for global comprehension and summarizing what is listened to, both in speaking and writing.
Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed. Functional English : complaining and apologizing.
Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strate giestouse text clues for comprehension. Critical reading.

Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. Letter writing-types, format and principles of letter writing- mail etiquette, **writingcv's. Vocabulary**: Technical vocabulary from across technical branches (20 words). GRE Vocabulary (20words) (antonyms and synonyms, Word applications) Association, sequencing of words, Grammar: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

Unit-IV **10 hours**

Lesson-1: Liking a Tree, Unbowed: wangarimaathai-biography from"infotech English", Maruthi Publications

Lesson-2: Telephone Conversation-Wole Soyinka from "The Individual Society", pearson publications.(Non-detailed)

Listening: Making predictions while listening to conversations/transactional dialogues without video (only audio); listening to audio-visual texts.

Speaking: role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. Functional English: Permissions, Requesting, and inviting.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicative processor display complicated data.

Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. Writing sop, writing for media.

Vocabulary: Technical vocabulary from across technical branches (20words) gre vocabulary (20words) (Antonyms and Synonyms, Word applications) clozeen counters. Grammar: Quantifying expressions-adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

Unit-V: **08 hours**

Lesson-1: the chief software architect from "English encounters", maruthi publications

Lesson-2: stillirise by mayaangelou from "the individual society", Pearson

Lesson-3: G.D.Naidu 'trailblazers' by orient black swan pvt.Ltd. Publishers

Listening: Identifying key terms, under standing concepts and interpreting the concepts both in speaking and writing.

Speaking:Formal oral presentations on topics from academic contexts-without the use ofpptslides**.** Functional english: Suggesting/Opinion giving.

Reading: Reading for comprehension. Rapstrategy intensive reading and extensive reading techniques.

Writing: Writing academic proposals-writing research articles: format and style. Vocabulary: Technical vocabulary from across technical branches (20words) grevocabulary (20words) (Antonyms and Synonyms, Word applications) Coherence, matching emotions. Grammar: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Text Books:

1. Infotech english", maruthi publications. (Detailed)
2. "the individual society", pearson publications. (Non-detailed)

Reference books:

1. Text book English encounters", maruthi publications
2. Textbook: 'trailblazers' by orient blackswan pvt.Ltd. Publishers
3. Bailey, Stephen. *Academic writing: A hand book for international student*. Routledge, 2014.
4. Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinleyelt; 2nd edition, 2018.

ENGINEERING DRAWING

I-B.Tech-I-Sem. **L T P C**
Subject Code: 21E03101 **1 0 3 3**
Pre Requisite: Nil

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

1. Construct polygons, conics, cycloids and involutes
2. Draw the projections of points and lines
3. Draw the projections of planes and solids
4. Draw the projections of sections of solids and development of surfaces
5. Draw the isometric projections and conversion from pictorial views in to orthographic views and vice-versa

Unit-I: construction of polygons & Engineering Curves **10hours**

General: principles of Engineering Graphics and their significance, Usage of drawing instruments, lettering, **Polygons**: Construction of polygons – general method, inscribing and circumscribe polygons on circles. **Curves**: Parabola, Ellipse and Hyperbola by general methods only. Cycloids, involutes, tangents & normals for the curves.

Unit-II: orthographic projections of points & Lines **10 hours**

Orthographic projections: Reference plane, importance of reference lines, projections of points in various quadrants, Projections of lines: line parallel to both the planes, line parallel to one planeand inclined toother plane. Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces.

Unit-III: Projections of planes & Solids **10 hours**

Projections of planes: regular planes perpendicular/parallel to one reference plane and inclined to theother reference plane; inclined to both the reference planes. **Projections of Solids–**Prisms, Pyramids, Conesand Cylinders withth axis inclined to both the reference planes.

Unit-IV: sections of solids & its surface developments **10 hours**

Sections of solids: sections of prisms, Pyramids, cylinders and cones. True shapes of sections. (Limited to the cutting plane per pendicular to one of the principal plane). **Development of surfaces**: development of surfaces of right Regular Solids-Prism, Pyramid, cylinder and cone.

Unit-V: isometric views & Conversions **10 hours**

Principles of in some tric scales: Isometric views, Conventions, Isometric views of lines, Planes, simple and compound solids, orthographic projections: conversion of pictorial views in to orthographic views and vice-Versa. (Treatment is limited to simple models).

Text Books:

1. Engineering drawing by bhattn.D., charotar publishing house pvt ltd; charotar publishing house pvt ltd.
2. Engineering drawing by klnarayana, P.Kannaiah, 3rd edition, scitech publications

Reference books:

1. Dhanajayajolhe, Engineering Drawing, tatamcgraw-Hill, 2009.
2. Shahandrana, engineering drawing,2/e, pearsoneducation, 2009.
3. K.Venugopal, engineering drawingand Graphics,6/e, newage publishers, 2011.
4. K.C.John,engineering graphics,2/e,PHI,2013.

MATERIAL SCIENCE & ENGINEERING

	L	T	P	C
I-B.Tech-I-Sem.				
SubjectCode: 21B00102	**3**	**1**	**0**	**3**
PreRequisite: Nil				

Course Out comes: At the end of the course, the student will be able

1. Determine stability of phases in different alloy systems.
2. Assess the behavior of ferrous and non ferrous metals and alloys
3. Find the effect of heat treatment, addition of alloying elements on properties of ferrous metals.
4. Comprehend the properties and applications of composites and other advanced methods.
5. Apply and techniques for characterization

Unit-I: Classification and selection of materials **10 hours**

Crystal Geometry, Crystal Structure for Metallic Elements, Atomic Radius, Density of Crystal .Lattice Planes and Miller Indices , Inter-planar Spacings , Representation of Crystal Planes in a Cubic Unit Cell, Sketching the Plane from the given Miller Indices , Common Planes in a Simple Cubic Structure , Co-ordination Number ,Defects or Imperfections in Crystals, Point Imperfections , Line Defects or Dislocations, Surface and Grain Boundary Defects,. Volume Imperfections, Liquid Crystals, Anisotropy

Unit-II: Alloy systems phase diagrams & transformations **10 hours**

Alloy Systems: Solid Solution, The Families of Engineering Alloys, Hume-Rothery's Rules, Intermediate Phases or Intermediate Compounds (or Intermediate Solid Solutions),

Phase Diagrams: The Phase Rule or Gibb's Phase Rule or Condensed Phase Rule, Cooling Curves (Time-Temperature Curves), Construction of a Phase Diagram or Constitutional Diagram, The Lever Rule, Equilibrium Diagrams for Binary Alloys Forming Eutectic, Ceramic and Ternary phase Diagrams ,Applications of Phase Diagram. **Phase Transformations***:* The Kinetics of Solid State Reactions, Multiphase Transformations, Applications of Phase Transformations, Micro-constituents of Fe-C System, Allotropic forms of Iron ,Iron-carbon System . Iron-carbon equilibrium or Phase Diagram. Modified Iron-carbon Phase Diagram, Formation and Decomposition of Austenite , Types and Properties of Carbon-Steels, Isothermal Transformations-TTT Diagram, Transformation of Austenite upon Continuous Cooling, Transformation of Austenite to Marten site

Unit-III: Heat Treatment **10 hours**

Heat Treatment: Heat-Treatment Processes, Annealing, Annealing Operations, Mass Effect,. Principal Equipment for Heat Treatment, Major Defects in Metals or Alloys due to Faulty Heat Treatment , Surface Finish After Heat Treatment

Unit-IV: Engineering Materials **10 hours**

Ferrous Alloys: Types, Properties, applications of Steels & Castirons. **Non-ferrous alloys:** applications of Copper, Aluminium and its alloys, Superalloys, **Composite Materials:** classifications, Manufacturing Process ,some applications, **Powder Metallurgy:** Powder metallurgy process, preparation of powders, Applications **Nano Materials:** Introduction-nano scale properties advantages, disadvantages applications incomparison with bulk materials

Unit-V: Mechanical properties of materials and mechanical tests **10 hours**

Fundamental Mechanical Properties, Stress-Rupture Test, Factors affecting Mechanical Properties, Various types of Mechanical Tests, destructive and Non-Destructive Testing (NDT) and Fracture

Text Books:

1. Material Science,-S.L.Kakani, AmitKakani, NewAge Publishers,2006
2. Materia l Science and Metallurgy -Dr.V.D.Kodgire, Everest Publishers, 2008

Refercence Books:

1. Material Science and Metallurgy-V.Raghavan, Pearson Education/PHI, 5th Edition, 2004.
2. Introduction to Physical Metallurgy -Avner, McGraw Hill ,2nd Edition, 1997
3. Materials science and engineering an introduction, William D.collister, David G.Rethwich, "Looseleaf publications, 8th edition.

COMMUNICATIVE ENGLISH LABORATORY

	L	T	P	C
I-B.Tech-I-Sem.				
SubjectCode: 21H00111	**0**	**0**	**3**	**1.5**
PreRequisite: Nil				

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

1. Demons tratenuances of language through audio-visual experience and group activities.
2. Identify accent for intelligibility.
3. Demonstrate in conversation, jams and public speaking. Make use of the concepts to communicate confidently and competently in English language inall spheres.

LIST OF EXPERIMENTS

PRACTICE 1: Greeting, Introducing, and taking leave --- Pure Vowel

PRACTICE 2: Giving Information and Asking for Information –Diphthongs

PRACTICE 3: Inviting, Accepting and Declining Invitations –Consonants

PRACTICE 4: Commands, Instructions and Requests--Accent and Rhythm

PRACTICE5: Suggestions and Opinions--Intonation

ENGINEERING CHEMISTRY LABORATORY

	L	T	P	C
I-B.Tech-I-Sem.				
SubjectCode: 21H00111	**0**	**0**	**3**	**1.5**
PreRequisite: Nil				

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

1. Execute instrumental methods ofc hemical analysis and measuring
2. Demonstrate operating and testing of chemical instruments for determing chemical attributes
3. Demonstrate complexo metric and other techniques to determine the presence of ingredients

LIST OF EXPERIMENTS

(Any 10 experiments will be Conducted from the list given below)

1. Determination of HClusing standard Na_2CO_3 solution
2. Estimation of KMn O_4 by Oxalic acid.
3. Estimation of Ferrous Iron by $K_2Cr_2O_7$
4. Determination of total hardness of water by EDTA method
5. Determination of Alkalinity of water sample.
6. Determination of Chlorides presentin water sample.
7. Determination of pHof water and soil samples.
8. Conducto metrictitration of strong acid Vss trong base
9. Conducto metrictitration of strong acid Vs Weak base.
10. Potentio metrictitration of strong acid Vs strong base.
11. Potentio metrictitration of strong acid Vsweak base.
12. Preparation of Phenol for maldehyderesin.
13. Preparation of Urea formal dehyderesin.
14. Determination of Mg^{+2} presentin Antacid.
15. Determination of Zinc by complexometric method.

MATERIAL SCIENCE & ENGINEERING LABORATORY

	L	T	P	C
I-B.Tech-I-Sem.				
SubjectCode: 21E03112	**0**	**0**	**3**	**1.5**
PreRequisite: Nil				

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

1. Differentiate various microstructures off errous and non-ferrous metals and alloys.
2. Visualizegrains and grain boundaries.
3. Determine various parameters of characterization for powder metallurgy samples

LIST OF EXPERIMENTS

1. Metallographic sample preparation
2. Micro structure of puremetals–Iron,c opper an daluminum as per ASTM standards
3. Micro structure of low carbon steel, mild steel and high carbon micro structure of castirons.
4. Micro structure of non-ferrousalloys–aluminum, copper, titanium, nickel and the iralloys.
5. Hardenability of steels by Jominy End Quench Test.
6. Micro structure of heat treated steels.
7. Hardness of various un treated and treated steels.
8. Density, porosity, hardness & micro structure of an alloy prepared by powder metallurgy

I-B.TECH.-II SEMESTER SYLLABUS

MATHEMATICS-II
(Differential Equations and Numerical Methods)

	L	T	P	C
I-B.Tech-II-Sem.				
SubjectCode: 21B00201	**4**	**1**	**0**	**3**

PreRequisite: Nil

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

1. Solve the differential equations related to various engineering fields
2. Apply the concept of differential equations in l - C-R circuits and l-C circuits
3. Evaluate the approximate roots of polynomial and transcendental equations by different algorithms
4. Apply Newton's forward & backward interpolation for equal intervals and Lagrange's formulae for unequal intervals
5. Apply numerical integral techniques to different Engineering problems and apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations

Unit-I: Differential Equations of First Order and First Degree **12 hours**

Linear differential equations– Bernoulli's equations –Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling–Law of natural growth and decay– Orthogonaltrajectories

Unit- II: Linear Differential Equations of Higher Order **12 hours**

Homogeneous and Non-homogeneous differential equations of higher order with constant coefficients –with non-homogeneous term of the typee^{ax}, Sinax, Cosax, polynomial sinx, $e^{ax}V(x)$ and $x^mV(x)$–Method of Variation of parameters. Applications: L-C-R circuitsand L-C circuits

Unit-III: Iterative Methods **12 hours**

Introduction– Bisection method– Method of false position– Iteration method – Newton-Raphson method (One variable) for finding solutions of algebraic and transcendental equations– Gauss Jacobiand Gauss-Seidel methods for solving system of equations numerically.

Unit-IV: Inter polation and Numerical Differentiation **12hours**

Introduction–Errorsin polynomial interpolation–Finite differences–Forward differences–Backward differences –Central differences – Relations between operators – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's inter polation formula– Numerical differentiation using interpolating polynomial

Unit-V: Numerical Integration and Numerical Solution of Ordinary Differential Equations with Initial Conditions **10hours**

Numerical Integration by Trapezoidal rule– Simpson's 1/3rd and 3/8th rule - Numerical Solution of initial value problems by Taylor's series– Picard's method of successive approximations– Euler's method –Modified Euler's method–Runge-Kutta method(fourth order).

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics,44th Edition, Khanna Publishers.

2. R.K.Jainand S.R. K.Iyengar Advanced Engineering Mathematics, Fifth Edition Narosa Publishing House

Refercence Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics,10th Edition, Wiley & Sons, 2011
2. V.Ravindranath P&Vijayalaxmi, Mathematical Methods, Himalaya Publishing House.
3. B.V.Ramana, Higher Engineering Mathematics, 2007 Edition, TataMc.GrawHill Education.
4. Engineering Mathematics, Dr.T.K.V.Iyengar,S.Chand publications

ENGINEERING PHYSICS

I-B.Tech-II-Sem. **L T P C**
SubjectCode: 21B00202 **3 0 0 3**
PreRequisite: Nil

Course Outcomes: At the end of the course, the student will be able to
1. Illustrate optical interference and diffraction and polarization.
2. Apply laser mechanism and fiber optics for the communications systems.
3. Determine the crystal structures
4. Use xray diffraction technique for material studies.
5. Make use of dielectrical and magnetic materials in engineering applications.

Unit-I: Wave Optics **11 hours**

Interference: Principle of superposition – Interference of light - Interference in thin films (Reflection Geometry) & applications - Colors in thin films- Newton's Rings- Determination of wavelength and refractive index. **Diffraction:** Introduction-Fresnel and Fraunhofer diffraction-Fraunhofer diffraction due to single slit, double slit- N-slits (Qualitative)–Diffraction Grating- Dispersive power and resolving power of Grating (Qualitative). **Polarization:** Introduction-Types of polarization
- Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

Unit-II Laser and Fiber Optics **08hours**

Lasers: Introduction – Characteristics of laser – Spontaneous and Stimulated emissions of radiation–Einstein's co efficients–Population inversion–Lasingaction-Pumping mechanisms – Ruby laser – He-Ne laser - Applications of lasers. **Fiber optics:** Introduction – Principle of optical fiber- Acceptance Angle - Numerical Aperture -Classification of optical fibers based on refractive index profile and modes – Propagation of electro magnetic wave through optical fibers –Applications.

Unit-III: Crystallography and X-ray Diffraction **08hours**

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattice – crystal systems (3D) – co ordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes. **X-ray diffraction:** Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods.

Unit-IV: Acoustics and Ultrasonics **08 hours**

Acoustics: Introduction requirements of acoustically good hall Reverberation Reverberation time - Sabine's formula (Derivation using growth and decay method) – Absorption co efficient and its determination Factors affecting acoustics of buildings and their remedial measures. **Ultrasonics:** Introduction - Properties - Production by magnet ostriction and piezoelectric methods Detection - Acoustic grating - Non Destructive Testing pulse echo system through transmission and reflection modes-Applications.

Unit-V: Dielectric and Magnetic Materials **08hours**

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibilityand Dielectric constant - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) – Lorentzinternal field-Clausius-Mossottiequation-Piezoel ectricity. **Magnetic Materials:** Introduction - Magnetic dipole moment- Magnetization-Magnetic susceptibility and permeability –Origin of permanent magnetic moment - Classificationo magnetic materials: Dia, para, Ferro, anti ferro&Ferri magnetic materials- Domain concept for Ferromagnetism & Domainwalls (Qualitative)- Hysteresis-soft and hard magnetic materials-Engineering applications.

Text Books:

1. Engineering Physics – Dr.M.N. Avadhanulu & Dr.P.G. Kshirsagar, S. Chandand Company
2. Engineering Physics by P.K.Palanisamy SciTech publications.

Refercence Books:

1. Fundamentals of Physics–Halliday, Resnick and Walker, John Wiley & Sons
2. Engineering Physics –M.R.Srinivasan, NewAge Publications
3. Engineering physics–D.K.Battacharyaand Poonam Tandon, Oxford University press
4. Ch.Srinivas, Ch.Seshubabu, Engineering Physics, Cengage learning publications

THERMO DYNAMICS

I-B.Tech-II-Sem. **L T P C**
SubjectCode: 21E03201 **3 1 0 3**
PreRequisite: Nil

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

1. Explain various thermo dynamic systems and processes
2. Apply the basic laws of thermo dynamics
3. Evaluate the performance of energy conversion devices
4. Determine property values during any process by using concepts of amixture of gases
5. Analyze the thermodynamic cycles and evaluate performance parameters

Unit-I: First Law of Thermo dynamics **10 hours**

Introduction: Basic Concepts: Macroscopic and micro scopic view points, definitions of thermo dynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermo dynamics and Temperature measurement. Joule's experiment - first lawofthermodynamics, corollaries-perpetualmotionmachinesoffirstkind,firstlaw
Applied to non-flowand flowprocess-limitations offirst law of thermo dynamics.

Unit-II: Second Law of Thermo dynamics **08 hours**

Kelvin - Planck statement and Clausius statement and their equivalence, corollaries - perpetual motion machines of second kind - reversibility and irreversibility, cause of irreversibility, Carnot cycle, heat engine, heat pump and refrigerator, Carnot theorem, Carnot efficiency.

Unit-III: Entropy, Availability and Irreversibility **08 hours**

Clausius inequality- Concept of Entropy- entropy equation for different processes and systems. Definition of exergy and anergy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes and irreversibility. Maxwell relations, TdS equations differencein heat capacities, ratio of heat capacities. TD relations, RealGas equations.

Unit-IV: Properties of Steam and use of Steam Tables **08hours**

Pure Substances, P-V-T surfaces, T-s and h-s diagram, Mollier chart, dryness fraction, property tables, analys is of steam undergoing various thermodynamic processes using Mollier chart–steam calorimetry. Energy equation, Clausius-Clapeyron equation and JouleThompson co efficient

Unit-V: Airstandard cycle **10hours**

Otto, Diesel and dual cycles, P-V and T -S diagrams - description and efficiencies, meaneffective pressures. Brayton Cycle - Comparison of Otto, Diesel and dual cycles, Comparison of Brayton and Otto Cycles.

Text Books:
1.P.K.Nag, Engineering Thermodynamics, 5/e, TataMc GrawHill, 2013.
2.Yunus A.Cengel, Michaela A.Boles, Thermodynamics, 7/e, TataMcGrawHill, 2011.

Refercence Books:
1. B.Jonesand G.A.Hawkins, Introduction toThermodynamics,2/e, JohnWiley&Sons, 2012.
2. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics,3/e,Wiley, 2015

ENGINEERING MECHANICS

I-B.Tech-II-Sem. **L T P C**
Subject Code: 21E03202 **3 1 0 3**
Pre Requisite:

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

1. Determine result antofforcesactingona body through mechanics concepts
2. Solve problem of bodies subjected to friction.
3. Find the location of centroid and calculate moment of in ertia of a given section.
4. Solve the kinetics and kinematics of a body under going various types of body motions
5. Solve problems using work energy equations for translation, and rotation conditions

Unit-I: Forces and Equilibrium **10 hours**

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

Unit-II: Analysis of Perfect Frames and Friction **08 hours**

Analysis of perfect frames (Analytical Method)– Types of Frame – Assumptions for forces inmembers of a perfect frame, Method of joints, Method of sections, Force table, Cantilever Trusses, Structures with one end hinged and other freely supported on rollers carrying horizontal, inclined loads. **Friction:** Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;

Unit-III: Centre of Gravity and Moment of Inertia **10 hours**

Centre of Gravity & Centroid: determination of centre of gravity, Centroid for Plane geometrical figures, regular solids, composite areas, simple solids, areas & Volumes centroid methods. **Moment of Inertia:** Area moment of Inertia, Radius of gyration, Parallel axis and per pendicularaxis the orems, Moment of Inertia of Laminae of Different Shapes.

Mass Moment of Inertia: mass moment of inertia of Rectangular plate, Circular Plate, Right circular cone.

Unit-IV: Kinematics **08 hours**

Review of particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear ,angular); Impact (Direct and oblique).

Unit-V: Kinetics of Rigid Bodies **10hours**

Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation inplane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work Energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

Text Books:

1. ShamesandRao(2006), Engineering Mechanics, Pearson Education
2. ReddyVijayKumarK. And J.SureshKumar (2010) Publisher

Refercence Books:

1. TimoshenkoS.PandYoungD.H., "Engineering Mechanics", McGrawHill International Edition, 1983.
2. AndrewPytel, JaanKiusalaas, "Engineering Mechanics", Cengage Learning, 2014.
3. BeerF.P&JohnstonE.RJr.Vector, "Mechanics for Engineers", TMH, 2004..
4. TayalA.K., "Engineering Mechanics–Statics & Dynamics", Umesh Publications, 2011

PROGRAMMING INC

I-B.Tech-II-Sem. **L T P C**
Subject Code: 21E05101 **3 1 0 3**
Pre Requisite:

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

1. Write algorithms and to draw flow charts for solving problems.
2. Use different operators, data types and write programs that use two-way/multi way selection.
3. Select the best loop construct for a given problem.
4. Make use of Arrays in solving complex problems.
5. Solve problems using concept of structures, unions and FileI/O operations

Unit-I: **10 hours**

Introduction to Computers: Computer Systems, Computer software and hardware, Computing Environments, Computer Languages. **Introduction to the C Language:** Algorithm and Flow chart, Structure of C Program, Creating and running programs, Identifiers, Types, Variables, Constants, Input / Output, Operators (Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associatively, Expression Evaluation, Type conversions.

Unit-II: **10hours**

Control Structures: Selection Statements (making decisions) – Two Way Selection (if-else), Multi way Selection (nested if and switch) statements, Repetition statements (loops)-while, for, do-while statements, Loop examples, Jump statements related to looping – break, continue, go to. Simple C Program examples.

Unit-III: **10hours**

Arrays: Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multi dimensional Arrays, Example Programs **Strings:** String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String, Example Programs.

Unit-IV: **10hours**

Functions: Designing, Structured Programs, Functionin C, User Defined Functions, Inter Function Communication, Standard Functions, Storage Classes, Scope and lifetime, Passing Array to Functions, Command Line Arguments and Recursion.
Pointers: Concept of pointer, declaring and initializing pointer variables, pointer expressions and address arithmetic, null pointers, generic pointers, pointers as function arguments, pointers and arrays,pointer and strings,pointer to pointer, dynamic memory allocation, dangling pointer.

Unit-V: **10hours**
Structures &Union: The Type Definition (Type def), Enumerated Types, Structure, Unions, and Example Programs. **Data Files:** Introduction to Files, Using files In C, Reading from Text Files, Writing toText files, Random Access File.
Text Books:
1. Programming for Problem Solving, Behrouz A.Forouzan, Richard F.Gilberg, CENGAGE.
2. Programming in C,ReemaThareja, and OXFORD University press.
Refercence Books:
1. Computer Fundamentals and Programming, Sumithabha Das, McGrawHill.
2. Programming in C,AshokN.Kamthane, AmitKamthane, and Pearson.
3. C Programming–Balaguruswamy, McGrawHill

BASIC ENGINEERING WORKSHOP

	L	T	P	C
I-B.Tech-II-Sem.				
Subject Code: 21E03211	**0**	**0**	**3**	**1.5**
Pre Requisite:				

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

1. Prepare required models using various engineering trades
2. Apply safety norms while handling the workshop equipment
3. Install and make use of operating ystems and MSoffice tools, configure firewalls and troubleshoot network connections

LIST OF EXPERIMENTS

1. Carpentry
   a. T-Lap Joint
   b. Cross Lap Joint
   c. Dovetail Joint
   d. Mortise and Tenon Joint

2. Fitting
   a. VeeFit
   b. Square Fit
   c. HalfRound Fit
   d. Dovetail Fit

3. Black Smithy
   a. Roundrod to Square
   b. S-Hook
   c. Round Rod to Flat Ring
   d. Round Rod to Square headed bolt

4. House Wiring
   a. Parallel/Series Connection of three bulbs
   b. Stair Case wiring
   c. Florescent Lamp Fitting
   d. Measurement of Earth Resistance

5. Tin Smithy
   a. Taper Tray
   b. Square Box without lid
   c. Open Scoop
   d. Funnel

6. IT Workshop. Assembly & Disassembly of Computer 2. OS & other software installation

ENGINEERING PHYSICS LABORATORY

	L	T	P	C
I-B.Tech-II-Sem.				
Subject Code :21B00212	**0**	**0**	**3**	**1.5**

Pre Requisite:

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

1. Demonstrate diffraction techniques, straingauge methods for material investigations
2. Apply magnetism and optics for determining various physical characteristics.
3. Apply the techniques of physical instruments for thickness evaluation, laws of string and other parameters.

LIST OF EXPERIMENTS

(Any 10 experiments will be conducted from the list given below)

1. Laser: Determination of wave length using diffraction grating.
2. Young's modulus of given material by Straingauge method.
3. Study of variation of magnetic field along the axis of a current carrying circular coil by Stewart & Gee's method.
4. Determination of ultra sonic velocity in given liquid (Acousticgrating).
5. Determination of dielectric constant using charging and discharging method.
6. Study the variation of Bversus Hbymagnetizing the magnetic material (B-Hcurve).
7. Estimation of Planck's constant using photo electric effect.
8. Rigidity modul us of material of a wire-dynamic method(Torsionalpendulum).
9. Determination of numerical aperture and accept anceangle of an optical fiber.
10. Determination of thick ness of thin object by wedge method.
11. Determination of radius of curvature of given planoconvexlens by Newton's rings.
12. Determination of wave lengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
13. Determination of dispersive power of the prism.
14. Sono meter: Verification of laws of string..
15. Determination of Moment of Inertia of a Fly Wheel.

PROGRAMMINGINC LABORATORY

I-B.Tech-II-Sem. **L T P C**

Subject Code :21E05211

Pre Requisite:

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

1. illustrate various concepts of C language and generate programs
2. draw flow charts and write algorithms.
3. design and develop solving skills through C.

LIST OF EXPERIMENTS

Exercise-1 Basics I

a) Write a simple program using print f (), scan f ()

b) C Program to Perform Adding, Subtraction, Multiplication and Division of two numbers

Exercise-2 Basics II

a) Write a C Program to Simulate 3 Laws at Motion (v=u+at, s=ut+1/2at 2,v2-u 2=2as)

b) Write a C Program to convert Celsius to Fahrenheit and viceversa

Exercise-3 Control Flow -I

a) Write a C Program to Find Whether the Given Year is a LeapYear or not.

b) Write a C Program to Add Digits & Multiplication of a number

Exercise-4 Control Flow -II

a) i) Write a C Program to Find Whether the Given Number is Prime Number or Not

ii) Write a C Program to Find Whether the Given Number is Arm strong Number or not

b) Write a C program to print Floyd Triangle

Exercise-5 Control Flow -III

a) Write a C Program to print Pascal Triangle

b) Write a C Program to make a simple Calculator to Add, Subtract, Multiply or Divide Using Switch-case statement.

Exercise –6 Arrays

a) Write a program in C for multiplication of two square Matrices.

b) Write a program in C to find transpose of a given matrix.

Exercise –7 Functions

a) Write a C Program demonstrating of parameter passing in Functions and returning values.

b) Write a C Program illustrating Fibonacci, Factorial with Recursion without Recursion

Exercise –8 Functions

a) Write a program in C to add numbers using call by reference.

b) Write a program in C to swapel ements using call by reference

Exercise –9 Arrays and Pointers

a) Write a C Program to Access Elements of an Array Using Pointer

b) Write a C Program to find the sum of numbers with arrays and pointers.

Exercise –10 Strings

a) Implementation of string manipulation operations with library function.

i) copy ii)concatenate iii)length iv)compare

b) Implementation of string manipulation operations without library function.

i) copy ii)concatenate iii)length iv)compare

Exercise–11 Structures

a) Write a C program to find

b) sum of neements entered by user.Toper form this program,

Allocate memory dynamically using malloc () function

c) Write a C program to find sum of n elements entered by user. Toper form this program, allocate Memory dynamically using call function

Exercise-12 Files

a) Write a C programming code to open a file and to print it contents on screen.

b) Write a C program to copy files.

ENVIRONMENTAL SCIENCE

I-B.Tech-II-Sem. **L T P C**
Subject Code: 21E05101 **2 0 0 0**
Pre Requisite:

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

1. Articulate the inter connected and interdisciplinary nature of environmental studies.
2. Demonstrate an integrative approach to environmental issues with a focus on sustainability.
3. Use critical thinking, problem-solving, and the methodological approaches of the social sciences, natural sciences, and humanities in environmental problem solving.
4. Adopt sustainability as a practice in life, society and industry through rain water harvesting, watershed management, ozonelayer depletionand waste landreclamation.
5. Out line the effect of value education and welfare programmes.

Unit-I: Multi disciplinary Nature of Environmental Studies **08 hours**

Multi disciplinary nature of Environmental Studies – Definition, Scope and Importance – Need for Public Awareness. Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies –Timber extraction – Mining, dams and other effects on forest and tribal people– Water resources –Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams –benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.–Energy resources:

Unit-II: Ecosystems & Biodiversity and Its Conservation **12 hours**
Ecosystems: Concep to faneco system–Structure and function of aneco system–Producers, consumers and decomposers–Energy flow in the ecosystem–Ecological succession–Food chains, food webs and ecological pyramids–Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grass land eco system, Desert eco system Aquatic eco systems (ponds, streams, lakes, rivers, oceans, estuaries) Bio diversity And Its Conservation: Introduction, Definition: genetic, species and eco system diversity – Bio-geographical classification of India–Value of bio diversity: consumptive use, Productive use, social, ethical, aesthetic and option values–Bio diversity at global, National and local levels–India asa mega-diversity nation–Hot-sports of bio diversity–Threats to bio diversity: habitat loss, poaching of wildlife, man-wildlife conflicts–Endangered and endemics pecies of India–Conservation of bio diversity: In-situand Ex-situconservation of bio diversity. resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.
Land resources: Land as a resource, land degradation.

Unit-III: Environmental Pollution & Solid Waste Management **10 hours**

Environmental Pollution: Definition, Cause, effects and control measures of: a. Air Pollution. b. Water pollutionc. Soilpollutiond. Marinepollutione. Noisepollutionf. Thermalpollutiong. Nuclearhazards **Solid Waste Management:** Causes, effects andcontrol measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and lands lides.

Unit-IV: Social Issues and the Environment **10 hours**

Social Issues and the Environment: From Unsustainable to Sustainable development–Urban problems related to energy – Water conservation, rain water harvesting, water shed management –Resettlement and rehabilitation of people; its problems and concerns. Case studies–

Environmental ethics: Issues and possible solutions–Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies–Waste land reclamation.–Consumer is m and waste products.–Environment Protection Act.–Air (Prevention and Control of Pollution) Act.–Water (Prevention and control of Pollution) Act–Wildlife Protection Act–Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness

Unit-V: Human Population and The Environment **08 hours**

Human Population nd The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education–HIV/AIDS–Women and Child Welfare–Role of information Technology in Environment and human health– Case studies.

Field Work:Visit to a local areato document environment al assets River/forest grass land/hill/mountain–Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds–river, hillslopes, etc..

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, "Environmental Studies", Pearsoneducation.

Refercence Books:

1. Deeksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science", Cengage Publications.
2. M.AnjiReddy, "Textbook of Environmental Sciences and Technology", BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
J. Glynn Henry and Gary W. Heinke, "Environmental Sciences and Engineering", Prenticehall of India Private limited
4. G.R.Chatwal, "A Text Book of Environmental Studies" Himalaya Publishing House 6. Gilbert M.Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.

I-B.TECH.-I SEMESTER SYLLABUS

MATHEMATICS –III
(Integral Transforms, Vector Calculus and PDE)

	L	T	P	C
II-B.Tech-I-Sem.				
SubjectCode: 21B00301	**4**	**1**	**0**	**3**
Pre Requisite: Nil				

Course Out comes: At the end of the course, the student will be able to
1. Apply the La place transform for solving ordinary differential equations
2. find the Fourier series of periodic signals and apply integral expressions for the forward and in verse fouriertrans form to a range of non-periodic wave forms
3. interpret different operators such as gradient, curl and divergence and estimate the work done against a field, circulation and flux using vector calculus
4. Solve the first order partial differential equations related to various engineering fields.
5. Identify the methods for solving higher order partial differential equations in different physical processes.

Unit-I: Laplace Transforms **12 hours**

Laplace transforms–Definition and Laplace transforms of some certain functions–Shifting the orems – Transforms of derivatives and integrals – Unit step function –Multiplied by t and Divided by t – Dirac's delta function– Periodic function– Inverse Laplace transforms– Partial fractions–Convolution the orem (without proof). Applications: Solving ordinary differential equations (initial value problems) using Laplacetransforms

Unit-II: Fourierseries and Fourier Transforms **12hours**

Fourier Series: Introduction– Periodic functions – Fourier series of periodic functions – Dirichlet's conditions – Even and odd functions –Change of interval– Half-range sine and cosine series. – Fourier Transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals – Sine and cosine transforms–inverse transforms–Finite Fourier transforms

Unit-III: Vector calculus **12 hours**

Vector Differentiation: Gradient– Directional derivative – Divergence– Curl– Scalar Potential
Vector Integration: Line integral – Work done – Area– Surface and volume integrals – Vector integral the orems: ProblemsonGreens, Stokesand Gauss Divergence the orems (without proof).

Unit-IV: Partial Differential Equations of First Order **10 hours**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions offirst order linear (Lagrange) equation and non linear (standard types) equations.

Unit-V: Second order Partial Differential Equations and Applications **12 hours**

Second order PDE: Solutions of linear partial differential equations with constant coefficients–-homogeneous-terms of the type e^{ax+by}, $\sin(ax+by)$, $\cos(ax+by)$, $x^m y^n$
Applications of PDE: Method of separation of Variables–Solution of one dimensional Wave, Heat and two-dimensional heate quation (Cartesianform).

Text books:

1. **B.S.Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **R.K.Jain & S.R.K.Iyengar** Advanced Engineering Mathematics, 5th Edition Narosa Publishing House

References:

1. ErwinKreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley&Sons, 2011
2. Engineering Mathematics, Dr.T.K.V.Iyengar, S.Chand publications
3. B.V.Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc.GrawHill Education.
4. N.P.Bali&ManishGoyal, Engineering Mathematics, Lakshmi Publications.

MECHANICS OF SOLIDS

II-B.Tech-I-Sem. **L T P C**
Subject Code: 21P03301 **3 1 0 3**
Pre Requisite: Engineering Mechanics

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

1. Evaluate stresses and strains
2. Draw the SF and BM diagrams for various beams under different loading conditions
3. Determine the resistance and deformation in machine members subjected to torsional loads.
4. Analyze and design thin, thick cylinders.
5. Analyze various of stresses incurved bars.

Unit-I: Analysis of Stresses and Strain **10 hours**

Simple Stresses & amp; Strains: Elasticity and plasticity – Types of stresses & amp; strains– Hooke's law–stress–strain diagram for mild steel–Working stress–Factor of safety–Lateral strain, Poisson's ratio & amp; volume tricstrain–Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy– Resilience – Gradual, sudden, impact and shock loadings. Principal stresses-Mohr's circle of stresses

Unit-II: Bending Monements and Shear Force Diagrams **10 hours**

Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and over hanging beams subjected to point loads, u.d.l., uniformly varying loads and combination of these loads – Point of contraflexure– Relation between S.F., B.M and rate of loading at a section of a beam.

Unit-III: Flexural Stresses **10 hours**

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/I =f/y = E/R Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections–Design of simple beam sections.
Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

Unit-IV: Torsion and Springs **08 hours**

Torsion formulation stresses and deformation in circular and hollows shafts–Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

Unit-V: Thin and Thick Cylinders **10 hours**

Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders – Riveted boilershells–Thinsphericalshells. Wire wound thin cylinders. Lame's equation–cylinders subjected to inside & outside pressures –compound cylinders

Textbooks:

1. Mechanics of Material–J.M.Gereand S.P. Timoshenko–CBS publisher
2. Strengthofmaterials by B.C.Punmia-lakshmi publications pvt.Ltd, NewDelhi

References:

1. Strength of Materials–R. K.Rajput–S. Chand & Company
2. Strength of Materials -ByJindal, Umesh Publications.
3. Strength of Materials by S.Ramamruthamand R.Narayanan, Dhanpat Rai Publishing Company.

KINEMATICS OF MACHINERY

II-B.Tech-I-Sem. **L T P C**
Subject Code: 21P03302 **3 1 0 3**
Pre Requisite: Engineering Mechanics

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

1. Solve various mechanical engineering problems related strain energy
2. Apply basic principles of mechanisms in mechanical engineering
3. Assess various concepts of various mechanisms
4. Examine the velocity and acceleration diagram for a given mechanism
5. Utilize analytical, mathematical and graphical aspects of kinematics of Machines for effective sign.

Unit-I: Mechanisms and Machines **10 hours**

Elements or Links–Classification–Rigid Link, flexible and fluid link. Types of kine matic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Mechanisms and machines – classification of mechanisms and machines – kinematic chain – inversion of mechanisms– inversions of quadric cycle chain, single and double slider crank chain. Mobility of mechanisms

Unit-II: Steering and Straight Line Motion Mechanisms **10 hours**

Straight Line Motion Mechanisms - Exact and approximate, copied and generated types – Peaucellier, Hart, Scott Russel, Grasshopper, Watt, Tchebicheff and Robert Mechanisms. Pantograph. Steering Mechanisms: Conditions for correct steering–Davis Steering gear, Ackermanns steering gear. Hooke's Joint (Universal coupling)-Single and double Hooke's joint—applications–Simple problems.

Unit-III: Kinematics **10hours**

Velocity and Acceleration Diagrams- Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method –Slider crank mechanism, four bar mechanism. Acceleration diagrams for simple mechanisms, determination of Coriolis component of acceleration, Klein's construction: Analysis of slider crank mechanism for displacement, velocity and acceleration of slider using analytical method. Instantaneous Centre Method: Instantaneous centre of rotation, centrode and axode – relative motion between two bodies – Three centers in-line the orem – Locating instantaneous canters for simple mechanisms and determination of angular velocity of points and links

Unit-IV: Gears and Gear Trains **10 hours**

GEARS: Higher pairs, toothed gears–types–law of gearing, condition for constant velocity Ratio for transmission of motion, Forms of tooth-cycloidal and involute profiles.Velocity of sliding– phenomena of interference–Methods to avoid interference-Condition for minimum number of teeth, expressionsforarcofcontactandpathofcontact. Introduction to Helical, Beveland Wormgears.

GEARTRAINS: Introduction–Types of gears–Simple, Compound, Reverted and Epicyclic gear trains, Train value – Methods offinding train value or velocity ratio– Tabular column method for Epicyclic gear trains. Torque in epicyclic gear trains. Differential gear of an automobile – Simple problems

Unit-V: Cams & Followers **08hours**

Cams: Definitions of camand follower–uses–Types of followers and cams–Terminology. Types of follower motion-Uniform velocity, Simple harmonic motion, Cycloidal, uniform Acceleration and retardation, Maximum velocity and maximum acceleration duringout ward and returnstrokes. Drawing of camprofiles.

Analysis of Motion Of Followers: Tangentcam with roller follower–circulararc (Convex) cam with flat faced and roller follower

Text books:

1. Theory of Machines and Mechanisms-S.S.Rattan, TataMcGrawHill Publishers.
2. Theory of Machines R.SKhurmi & J.KGupta, SChand Publishers.

References:

1. Theory of Machines by ThomasBevan/CBS
2. Theory of Machines SadhuSinghPearsonsEdn
3. Mechanism and Machine Theory/JSRao and RVDukkipati/New Age

FLUID MECHANICS AND FLUID MACHINES

	L	T	P	C
II-B.Tech-I-Sem.				
Subject Code: 21P03303	**3**	**1**	**0**	**3**

Pre Requisite: Engineering Physics

Course Out comes: At the end of the course, the student will be able

to 1. Illustrate basic terms used influid mechanics
2. Apply the principles offluid statics, kinematics and dynamics
3. Determine flow characteristics and estimate various losses inflow through channels
4. Determine characteristics for uniform and non-uniform flows in open channels.
5. Design different types of turbines, centrifugal and multi stage pumps.

Unit-I: Introduction to Fluid Statics **10 hours**

Distinction between a fluid and a solid - characteristics of fluids - Fluid Pressure: Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, UTube Differential Manometer. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability off loating bodies

Unit-II: Fluid Kinematics and Dynamics **10 hours**

Classification of fluid flow - Stream line, path line, streak line and stream tube; stream function, velocity potential function. Introduction to Reynolds transport the orem. One, two and three- dimensional continuity equations in Cartesian coordinates. Fluid Dynamics: Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: Venturimeter, orifice meter and Pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Definitions of Reynolds Number, Froude Number, Weber Number and Euler Number.

Unit-III: Analysis of Pipe Flow **10hours**

Energy losses in pipelines; Darcy – Weisbach equation; Minor losses in pipelines; Hydraulic GradeLine and Total Energy Line; Concept of equivalent length – Pipes in Parallel and Series. LaminarFlow-Laminar flowthrough: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity. Reynolds experiment, Transition from laminar to turbulent flow. Resistance to flow of fluid in smooth and rough pipes-Moody's diagram –Introduction to boundary layer theory.

Unit-IV: Impact of Jets & Hydraulic Turbines **08 hours**

Impact of Jets- Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes - velocity triangles at inlet and outlet - Work done and efficiency - Hydraulic Turbines: Classification of turbines; Pelton wheel. Francis turbine - efficiency - Draft tube: theory - characteristic curves of hydraulic turbines.

Unit-V: Pumps **10 hours**

Thin seamless cylindrical shells – Derivation of formula for longitudinal and circum ferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume ofthin cylinders – Riveted boiler shells–Thin spherical shells. Wire wound thin cylinders. Lame's equation–cylinders subjected to inside & outside pressures –compound cylinders

Textbooks:

1. Fluid Mechanics, Fundementals and Applications by Y.A. Cengel, J.M.Cimbala, 6thEdn,McGrawHill
2. K. Subrahmanya, "Theory and Applications of Fluid Mechanics", Tata

References:

1.R.K.Bansal, Atext of "Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P) Ltd., New Delhi.
2.P.M.Modi and S.M.Seth, "Hydraulics and Fluid Mechanics", Standard Book House Banga Sharma, "Hydraulic Machines", Khanna Publishers

PRODUCTION TECHNOLOGY

	L	T	P	C
II-B.Tech-I-Sem.				
Subject Code: 21P03304	**3**	**0**	**0**	**3**
Pre Requisite:				

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

1. Demonstrate different metal casting processes and gating systems.
2. Classify working of various welding processes.
3. Evaluate the forces and power requirements in rolling process.
4. Apply the principles of various forging operations.
5. Out line the manufacturing methods of plastics, ceramics and powder metallurgy.

Unit-I:Casting Process **10 hours**

Introduction: Importance and selection of manufacturing processes. Introduction to casting process, process steps; pattern and design of gating system; Solidification of casting: Concept, solidification of pure metal and alloy; Special casting processes: Shell casting, investment
casting, diecasting, centrifugal casting, casting defects and remedies.

Unit-II: Metal Forming and Forging **10 hours**

Introduction, Nature of plastic deformation, hot and cold working of metals, mechanics of metal forming; **Rolling**: Principle, types of rolling mill and products, roll passes, forces in rolling and power requirements; **Extrusion**: Basic extrusion process and its characteristics, hot extrusion and cold extrusion, wire drawing, tube drawing. Principles of forging, tools and dies. Types: Smith forging, drop forging, forging hammers, rotary forging and forging defects. **Sheet metal forming**: Mechanics of sheet metal working, blanking, piercing, bending, stamping

Unit-III: Metal Joining Processes **10 hours**

Welding : Classification of welding processes, types of welded joints and their characteristics, Gaswelding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arcwelding, V-I characteristics, Manual metal arc welding, Sub mergedarc welding, TIG &
MIG welding. Electro–slag welding. Resistance welding, Friction welding, Frictionstir welding, Forge welding, Explosive welding; Thermit welding, Plasma Arc welding, Laser welding, electronbeam welding, Soldering & Brazing. Heat affected zones in welding; pre & Post heating, Weldability of metals, welding defects– causes and remedies–destructive and non destructive testing of welds. welding, Forge welding, Explosive welding; Thermit welding, Plasma Arc welding, Laser welding, electron beam welding, Soldering & Brazing. Heat affected zones in welding; pre & post heating, Weldability of metals, welding defects– causes and remedies–destructive and non destructive testing of welds

Unit-IV: Plastic Processing, Ceramics and Powder Metallurgy **08 hours**

Plastics: Types, properties and their applications, processing of plastics, extrusion of plastics, transfer molding and compression molding, injection molding, thermo forming, rotational molding, and blow molding. **Ceramics**: Classification of ceramic materials, properties and their application, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing. **Powder Metallurgy**: Principle, manufacture of powders, steps involved.

Unit-V: Un conventional Machining Processes **10 hours**

Principle and Processes Parameters of Electrical discharge machining (EDM), Electro-Chemical Machining (ECM), Laser Beam Machining (LBM), Plasma Arc Machining (PAM), Electron Beam Machining, Abrasive Jet Machining (AJM), Water Jet Machining (WJM), and Ultra sonic Machining (UM)

Textbooks:

1. RaoP.N., Manufacturing Technology –Volume I,5/e, McGraw-Hill Education, 2018.
2. Kalpakjain S and Schmid S.R., Manufacturing Engineering and Technology, 7/e, Pearson, 2018.

References:

1. Introduction to Physical Metallurgy by Sidney H.Avner Millek P. Groover,
2. Fundamentals of Modern Manufacturing: Materials, Processes and Systems, 4/e, John Wiley and Sons Inc, 2010,Sharma P.C.,
3. A Textbook of Production Technology,8/e,S Chand Publishing, 2014.

FLUID MECHANICS AND FLUID MACHINES LAB

	L	T	P	C
II-B.Tech-I-Sem.				
SubjectCode:21P03313	**0**	**0**	**3**	**1.5**
PreRequisite:				

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

1 Demonstrate the classical experiments In fluid mechanics and hydraulic machinery.

2 correlate various flow measuring devices such as Venturimeter, orifice meter and notches

.3.discuss the performance characteristics of turbines and pumps.

LIST OF EXPERIMENTS

1. Verification of Bernoulli'sequation.
2. Calibration of Venturimeter.
3. Calibration of Orifice meter
4. DeterminationofCoefficientofdischargeforasmallorificebyconstantheadmethod.
5. Calibration of contracted Rectangular Notch.
6. Calibration of contracted Triangular Notch.
7. Determination of loss of headina sudden contraction.
8. Determination of loss of headina sudden Expansion.
9. Performance test on Impulse turbines
10. Performance test on reaction turbines(FrancisandKaplanTurbines)
11. Impact of jet
12. Performance test on centrifugal pumps.

MECHANICS OF SOLIDS LAB

	L	T	P	C
II-B.Tech-I-Sem.				
Subject Code:21P03312	**0**	**0**	**3**	**1.5**
PreRequisite:				

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

1 Demonstrate the classical experiments in fluid mechanics and hydraulic machinery.

2 correlate various flow measuring devices such as Venturimeter, orifice meter and notches

.3.discuss the performance characteristics of turbines and pumps.

LIST OF EXPERIMENTS

(Any10 experiments will be conducted from the list given below)

1. Tensiontest.
2. Bending test on(Steel/Wood)Cantilever beam.
3. Bending test on simplysupported beam.
4. Torsion test.
5. Vickers HardnessTest
6. Rockwell HardnessTest
7. Brinell HardnessTest
8. Compression test on Open coiled springs
9. Tension test on Closely coiled springs
10. Compression test on wood/concrete
11. Izod Impact test on metals
12. Charpy Impact test on metals
13. Shear test on metals
14. Direct ShearTestonTimberSpecimen
15. Continuousbeam–deflectiontest.

PRODUCTION TECHNOLOGY LAB

	L	T	P	C
II-B.Tech-I-Sem.				
Subject Code:21P0331	**0**	**0**	**3**	**1.5**

PreRequisite:

CourseOutcomes: At the end of the course,the student will be ableto

1 Demonstrate the classical experiments in fluid mechanics and hydraulic machinery.

2 correlate various flow measuring devices such as Venturi meter, orifice meter and notches

.3.discuss the performance characteristics of turbines and pumps.

LIST OF EXPERIMENTS

(Any10 experiments will beconducted from the list given below)

1. **Design and making of pattern**
   - Single piece pattern
   - Split pattern

   Sand properties testing
   - Sieve analysis(dry sand)
   - Clay content test
   - Moisture content test
   - Strength test(Compression test&Shear test)
   - Permeability test
2. **Mould preparation**
   - Straight pipe
   - Bent pipe
   - Dumble
   - Gear blank
   - Gascutting andwelding
3. **Manual metal Arc welding**
   - Lapjoint
   - Buttjoin
4. **Injection Molding**
5. **Blow Molding**
6. **Simple models using sheet metal operations**
7. **Study of deepdrawing and extrusion operations**
8. **Study of Basicpowder compactionand sintering**
9. **Study of TIG/MIG Welding**
10. **Study of Resistance Spot Welding**
11. **Study of Brazing and soldering**
12. **Study of Plastic Moulding Process**

COMPUTER AIDED MACHINE DRAWING

	L	T	P	C
II-B.Tech-I-Sem.				
Subject Code:21P03301	**0**	**0**	**3**	**1.5**
PreRequisite:				

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

1. Prepare engineering drawings with dimensions and bill of material during design and development.
2. Develop assembly drawings using part drawings of machine components.
3. Represent Conventional representation of materials,common machine elements and parts

LIST OF EXPERIMENTS

PART-A

Drawing of Machine Elements and simple parts

1. Selection of Views, additional views for Machine elements and parts
2. Popular forms of Screwthreads, bolts,nuts, studbolts, tapbolts, setscrews.
3. Keys,cotter joints, knucklejoint, Hook'sjoint
4. Riveted joints for plates
5. Shaft couplings.
6. Journal,pivot and collar and foot step bearings.

PART-B

II. Assembly Drawings:

Drawings of assembled views for the part drawings

1. Engine parts–Gear pump,Fuel pump,petrol Engine connecting rod,piston,stuffing box and eccentric assembly.
2. Other Machine Parts- Screws Jack, MachineSwivelVice,Plummerblock, Tailstock and ToolPost

II-B.TECH.-II SEMESTER SYLLABUS

MATHEMATICS – IV
(Complex Variables and Statistical Methods)

	L	T	P	C
II-B.Tech-II-Sem.				
Subject Code:21B00401	**4**	**1**	**0**	**3**
PreRequisite:Nil				

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

1. Apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic
2. find the differentiation and integration of complex functions used in engineering problems and make useof the Cauchyresidue theoremto evaluate certainintegrals
3. apply discrete and continuous probability distributions to determine the mean and variance of asampling distribution of means
4. design the components of a classical hypothesis test for large samples
5. develop the use of small sample tests needed by engineers for practical applications

Unit-II:Functions of a Complex Variable and Complex Integration **12 hours**

Introduction – Continuity – Differentiability – Analyticity –Cauchy-Riemann equations in Cartesianand polar coordinates – Harmonic and conjugate harmonic functions – Milne –Thompson method.Complex integration: Lineintegral–Cauchy'sintegraltheorem–Cauchy-Goursat theorem- Cauchy's integral formula – Generalized integral formula (all without proofs) and problems on above theorems

Unit-II:Series Expansions and ResidueTheorem **12 hours**

Radius ofconvergence–Expansionin Taylor'sseries, Maclaurin's series and Laurent series.Types of Singularities:Isolated–Essential –Poleoforderm–Residues –Residue theorem(without proof). Evaluation of real integral of the types $\int_{-\infty}^{\infty} f(x)dx$ and $\int_{c}^{c+2\pi} f(\text{Cos}\theta,\text{Sin}\theta)d\theta$.

Unit-III:Random Variables, Distributions and Sampling Theory **12 hours**

Random variables–Discrete and Continuous random variables–Distribution function–Mathematical Expectation and Variance – Binomial, Poisson and Normal distributions.SamplingTheory:Introduction– Population and samples– Sampling distribution of Means andVariance(definitiononly)–Central limit theorem(without proof)

Unit-IV:Estimation and Test of Hypothesis(Large Samples) **10 hours**

Point and Interval estimations–Maximum error of estimate–Confidence interval–Test of Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors –Lvel of significance –One-tail and two-tail tests–Z-Tests concerning one proportion and two proportions–Z-Test concerning one mean and two means(Large samples)

Unit-V:Tests of Hypothesis (Small Samples) **10hours**

Hypothesis concerning one mean and two means (Small Samples) using *t* -Test – ests concerning difference of two variances (Small samples) using F-test–χ^2-test for goodness of fit and independence of attributes

Text Books:

1. W.BrownandR.V.Churchill,ComplexVariables and Applications, 9th edition Mc-GrawHill,2013.
2. Miller and Freund's, Probability and Statistics for Engineers,Pearson,7th edition,2008

Reference Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers,44th Edition,2017.
2. S.C.Gupta andV.K.Kapoor,Fundamentals of Mathematical Statistics,11th edition,Sultan Chand&Sons Publications,2012.
3. Jayl.Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition,Cengage.
4. Sheldon, M.Ross, Introduction to probability and statistics Engineers and the Scientists,4th Edition,Academic Foundation,2011

APPLIED THERMODYNAMICS

	L	T	P	C
II-B.Tech-II-Sem.				
Subject Code:21P03401	**3**	**1**	**0**	**3**

PreRequisite:Thermodynamics

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

1. Derive actual cycle from fuel-air cycle and air-standard cycles.
2. Explain working principle and various components of IC engine.
3. Analyze the performance of an IC engine based on various parameters.
4. Explain working principle and various components of IC engine.
5. Determine the efficiency of gas turbines.

Unit-I:Air Standard Cycles **12 hours**

Air standard Cycles:Otto,diesel and dual cycles,its comparison, Brayton cycle Thermodynamic Vapour cycles: Rankine cycle, Regenerative cycle and Reheat cycles, efficiency problems.

Unit-II:IC Engines **12hours**

I.C.Engines:Classification- Working principles, Valve and Port Timing Diagrams,-Engine systems-Fuel,Carburettor,Fuel Injection System, Ignition,Cooling and Lubrication, principles of super charging and turbo charging

Unit-III:Measurement,Testing and Performance **08 hours**

Measurement,Testing and Performance:Parameters of performance-measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brakepower–Determination of frictional losses and indicated power–Performance test–Heat balance sheet.

Unit-IV:Steam Boilers and Steam Turbines **10 hours**

Boilers-classification-water tube, fire tube boilers, boiler accessories and mountings, boiler efficiency problems.
Steam turbines:classification,impulse and reaction turbines:velocity compounding,velocity triangles for moving blades, power produced byimpulse and reaction turbines

Unit-V:Tests of Hypothesis(Small Samples) **10hours**

GAS TURBINES: Simple gas turbine plant – ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating –closed cycle type gas turbines.
JETPROPULSION:Principle of operation–classification of jet propulsive engines–working principles with schematic diagrams and representationon T-s diagram-

Text Books:
1. Thermal Engineering,MaheshVRathore,Tata McGraw Hill 2017
2. M.L.Mathurand F.S.Mehta,Thermal Engineering,Jain brothers, 2014

ReferenceBooks:
1. GanesanV,Internal Combustion Engines,Tata McGraw Hill, 2017.
2. Nag P.K, Engineering Thermodynamics, 4/e,Tata McGraw-Hill,2008.
3. Refrigeration and AirConditioning, C.P.Arora &Damokumanda war

DYNAMICS OF MACHINERY

II-B.Tech-II-Sem. **L T P C**
Subject Code:21P03402 **3 1 0 3**
Pre Requisite:Kinematics of Machinery

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

1. Determine gyroscopic couple and its effect
2. Analyze brakes, and describe dynamometers
3. Calculate equili brium speed for governors
4. Analyze balancing of shafts with rotating and/ or reciprocating masses
5. Calculate the natural frequencies in longitudinal,transverse and torsional vibrations

Unit-I:Gyroscopes **10 hours**

Gyroscopes: Angular velocity,angular acceleration,gyroscopic couple,gyroscopic effect on aeroplanes, ships, stability of four-wheel and two- wheel automobiles, rigid disc at an angle fixed to a rotating shaft.

Unit-II: Brakes and Dynamometers **12 hours**

Brakes: Types of brakes – Block brake, band brake, disc brake, band and block brake, internal expanding shoe brake, effect of brake.
Dynamometers:Prony, ropebrake,belt transmission,epicyclic train, Bevis-Gibson torsion dynamometers.

Unit-III:Governors **10 hours**

Governors: Types of governors, principles of inertia and centrifugal governors- Watt, Porter, Proell, Hartnell, Hartung. Sensitiveness, hunting, isochronism, stability, power, effort, controlling force of a Governor.

Unit-IV:Balancining of Masses **10 hours**

Balancing: Static and dynamic balancing of rotating masses, force balancing of four bar linkage, Primary and Secondary balancing of reciprocating engine, balancing of inline four stroke engines (2,4,6 cylinders),V-engines,thre ecylinder radial engines,direct and reverse crank method, introduction to field balancing.

Unit-V:Vibrations **10 hours**

Free Vibrations: Definition, types, basic features, degrees of freedom, free undamped longitudinal vibration–equilibrium method, energy method, Rayleigh's method, displacement,velocity, acceleration,effect of mass of spring; damped vibration, logarithmic decrement; torsional vibrations – Single and two rotor systems

Text Books:
1.S.S. Rattan, Theory of Machines, Tata McGrawHill, NewDelhi.

Reference Books:
1. Thomas Bevan, The Theory of Machines: A textbook for Engineering students,Pearson,NewDelhi
2. Norton RC,Kinematics and Dynamics of Machinery,Tata Mc Graw Hill Education Pvt.Ltd,
3. Sadhu Singh.Theory of machines: kinematics and dynamics,,Pearson Education India.

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

	L	T	P	C
II-B.Tech-II-Sem.				
SubjectCode:21E02401	**3**	**0**	**0**	**3**
PreRequisite:				

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

1. Analyze various electrical network configurations.
2. Calculate efficiency of DC machines through Swinburne's and Braketests.
3. analyze performance of single-phase transformer and working of 3-phase alternator and 3-phase induction motors.
4. Analyze operation of halfwave, full wave bridge rectifiers and OP-AMPs.
5. Apply transistors concepts to solve numerical problems on feed back amplifiers

Unit-I:Electrical Circuits **10 hours**

Basic definitions– types of network elements –Ohm's Law –Kirchhoff's Laws– inductive networks–capacitive networks– series–parallel circuits– star-delta and delta-star-transformations.-Numerical Problems.

Unit-II: DC Machines **10 hours**

Principle of operation of DC generator – EMF equation – types of DC machines – torque equation Characteristics of DC motors – applications – three point starter – speed control methods of DC motor –Swinburne's Test- Braketest on DC shunt motor-Numerical problems.

Unit-III:AC Machines **10 hours**

Transformers: Principle of operation and construction of single phase transformers – EMF equation – Losses– OC &SC tests–efficiency and regulation-Numerical Problems.
AC Rotating Machines: principle of operation of 3-Phase induction motor, squirrel cage, slip ring motors – slip-torque characteristics – efficiency – applications- Numerical Problems. Principle of operation and construction of alternators–types of alternators Regulation of alternator by synchronous impedance method –principle of operation of synchronous motor

Unit-IV:Rectifiers and Linear ICs **10 hours**

PN junction diodes – diode applications (half wave & full wave bridge rectifiers). Characteristics of Operation Amplifiers (OP-AMP) – application of OP-AMPs (inverting, non-inverting, integrator and differentiator) Numerical Problems

Unit-V:Transistors **10 hours**

PNP and NPN junction transistors, transistor as an amplifier– frequency response of CE, CB, CC amplifiers. Basic concepts of feed back amplifier- Numerical problems.

Text Books:
1. Electrical Technology by Surinder PalBali, Pearson Publications.
2. Electronic Devices and Circuits by R.L.Boylestad and Louis Nashelsky, 9thedition,PEI/PHI

ReferenceBooks:
1. Electrical Circuit Theory and Technology by JohnBird, Routledge Taylor& FrancisGroup.
2. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah,TMHPublications.

MANAGERIAL ECONOMICS FOR ENGINEERS

	L	T	P	C
II-B.Tech-II-Sem.				
SubjectCode:21H00401	**3**	**0**	**0**	**3**
PreRequisite:				

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

1. Apply managerial Economic concepts for decision making
2. Perform cost analysis in Production
3. Apply managemen the ories in Markets&Firms
4. Outline the principles of industrial& business organizations,its financial management
5. Illustrate the importance of capital & capital Budgeting in decision Making

Unit-I:Introduction to Managerial Economics and Demand Analysis **10 hours**

Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Typesof Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting,Concept of Supply and Law of Supply.

Unit-II: Theory of production and cost analysis **10 hours**

Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choiceof least cost factor combination-Concepts of Returns to scale and Economies of scale- Differentcost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Totalcosts –Cost –Volume Profit analysis-Determination of Breakeven point (problems)- Managerial significance and limitations of Break evenpoint.

Unit-III: Introduction to Markets, Managerial Theories of the Firm &Pricing Policies **10hours**

Market structures:Types of competition, Features of Perfect Competition,Mono poly and Monopolistic Competition. Price-Output Determination under Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly Managerial theories of the firm-Marris and Williamson's models. Pricing Policies: Methods of Pricing-Marginal Cost Pricing, Limit Pricing, Market Skimming Pricing,Penetration Pricing, Bundling Pricing,and Peak Load Pricing.Internet Pricing Models: Flat rate pricing, Usage sensitive pricing, Transaction based pricing, Priority pricing, charging on the basis of social cost,Precedence model, Smart market mechanism model.

Unit-IV:Types of Industrial Organization &Introduction to Business Cycles **10 hours**

Characteristic features of Industrial organization, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, State/Public Enterprises and their types. Changing business environment inpost-liberalizations cenario. Financial Management**:**Functions of financial management, simple and compound interest, Methods of evaluating alternatives Depreciation: commonmethods.

Unit-V:Capital and Capital Budgeting **08 hours**

Meaning of capital budgeting, Need for capital budgeting – Capital budgeting decisions (Examples ofcapital budgeting) - Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR), IRR and Net Present Value Method (simple problems)

Text Books:

1. Managerial Economics and Financial Analysis,byJ.V.PrabhakarRao, Maruthi Publications,2011
2. Managerial Economics and Financial Analysis,byN.AppaRao.&P.VijayaKumar,Cengage Publications,NewDelhi,2011

Reference Books:

1. Managerial Economics and Financial Analysis,by ARAryasri,TMH2011
2. Managerial Economics by Sumadamodaran,Oxford2011
3. Mangerial Economice and Financial Analysis by S.A.Siddiqui&A.S.Siddiqui, New Age International Publishers,2011.

BASICELECTRICAL AND ELECTRONICS ENGINEERING LAB

	L	T	P	C
II-B.Tech-II-Sem.				
SubjectCode:21E02411	**0**	**0**	**3**	**1.5**

Pre Requisite:

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

1. Compute the efficiency of DC shunt machine without actual loading of the machine.
2. Estimate the efficiency and regulation at different load conditions and powerfactors for single phase transformer with OC and sCtests.
3. Analyze the performance characteristics,to determine efficiency of DC shunt motor,3-Phase induction motor.

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LIST OF EXPERIMENTS

Section A:Electrical Engineering:
The following experiments are required to be conducted ascompulsory experiments:

1. Swinburne's test on D.C. Shunt machine (predetermination of efficiency of a given D.C. shunt machine working asmotorand generator).
2. OC and SC tests on single phase transformer (predetermination of efficiency and regulation at given power factors).
3. Brake test on3-phase Induction motor(determination of performance characteristics)
4. Regulation of alternator by Synchronous impedance method.
5. Speed control of D.C.Shunt motorby
6. ArmatureVoltage control b)Field flux control method
7. Braketeston D.C.Shunt Motor.

Section B: Electronics Engineering:
The following experiments are required to be conducted as compulsory experiments:

1. PN junction diode characteristics a) Forward bias b) Reverse bias (Cut in voltage and resistance calculations)
2. Transistor CEcharacteristics (input and output)
3. Half wave rectifier with and without filters.
4. Full wave rectifier with and with outfilters.
5. CEamplifiers.
6. OP-amp applications(inverting ,noninverting,integrator and differentiator)

APPLIED THERMODYNAMICS LAB

	L	T	P	C
II-B.Tech-II-Sem.				
SubjectCode: 21P03411	**0**	**0**	**3**	**1.5**
PreRequisite:				

CourseOutcomes: At the end of the course,the student will be ableto

1. Explain different working cycles of engines
2. Describe various types of combustion chambers in IC engines
3. Illustrate the working of refrigeration and air conditioning systems

LIST OF EXPERIMENTS

1. Demonstration of diesel and petrol engines by cut models
2. Valve timing diagram of 4 – stroke diesel engine
3. Port timing diagram of 4 – stroke diesel engine
4. Performance of 2- stroke single cylinder petrol engine
5. Morse test on multi cylinder petrol engine
6. Performance of 4 – stroke single cylinder diesel engine
7. Assembly and disassembly of diesel and petrol engines
8. Performances of two stage reciprocating air compressor
9. Performances of refrigeration system
10. Performances of Air conditioning system

THEORY OF MACHINESLAB

	L	T	P	C
II-B.Tech-II-Sem.				
SubjectCode:21P03412	**0**	**0**	**3**	**1.5**

PreRequisite:

CourseOutcomes: At the end of the course,the student will be ableto

1. Examine the motion of amotorized gyroscope when the coupleis applied along its spinaxis.
2. Find the frequency of un-damped and damped free vibration of an equivalent spring mass system.
3. find the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.

LIST OF EXPERIMENTS
(A Minimum of 10 experiments to beconducted)

1. To determine whirling speed of shaft theoretically and experimentally.
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
3. To analyze the motion of amotorized gyroscope when the couple is applied along its spin axis
4. To determine the frequency of undamped freevibration of an equivalent spring mass system.
5. To determine the frequency of damped force vibration of a spring mass system
6. To study the static and dynamic balancing using rigid blocks.
7. Tofind the moment of inertia of a flywheel
8. To plot follower displacement vs camrotation for various Cam Follower systems.
9. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism /Four bar mechanism
10. To find coefficient of friction between belt and pulley.
11. To study simple and compound screw jack and determine the mechanical advantage, velocity ratio and efficiency
12. To study various types of gears- Spur, Helical,Worm and Bevel Gears

PART MODELING &ASSEMBLY MODELING USINGCAD

	L	T	P	C
II-B.Tech-II-Sem.				
SubjectCode:21S03411	**0**	**0**	**3**	**1.5**

Pre Requisite:

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

1. Create surface and assembly models.
2. Develop 3D models using bottom up approach,top down approach
3. Create exploded views of complex assembly models

CAD software:Concept of Parametric Modeling, Feature Based Modeling,User Interface, Mouse operations, File types and Management, drawing profiles.

Sketcher: Profile tool bar ,operation (corner,chamfer,re-limitations, transformations, project 3D element),constraints, types of constraints, workbench.
Sketch tools,tools (Sketch solving status,sketch analysis,output feature),visualization toolbar, user selection filter.

Part Modeling : Material Addition and Removal (Pad, Pocket, Shaft, Groove), Sketch and PositionedSketch, Types of Fillets, Types of Chamfer, Types of Hole. Pattern (Rectangular, Circular, User) ,Thread/Tap,Datum Features (Plane, Axes,Points),Simple Draft.
Boolean Operations (Add ,remove ,Intersect),Transformation (Translation,Mirror,Scaling)

Assembly Modeling:
Types of assembly approach,Types of Constrains and DOF,placement of components in the Assembly, Manipulating Components, BOTTOM UP Approach, TOP down APPROACH Generationof various Parts/assemblies: like Screw Jack, Oldham's Coupling, and Foot step bearing, Couplings, knuckle and cotter joints, Crankshaft, Connecting Rod, Piston and Cylinder. Use CATIA, Creo or any CAD packages.

B.TECH.-I SEMESTER SYLLABUS

MACHINE TOOLS & METROLOGY

	L	T	P	C
III-B.Tech-I-Sem.				
Subject Code :21P03501	**3**	**0**	**0**	**3**

Pre Requisite: Nil

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

1. explain cutting tool geometry; analyze mechanism of chip formation and forces in orthogonal cutting
2. illustrate operations of lathe, drilling, and boring machines
3. make use of the operations of milling and grinding machines
4. analyze the limits and tolerances for engineering components
5. test surface roughness of part and tool alignment of various machines

Unit-I **10 hours**

Metal cutting: Introduction, elements of cutting process – Geometry of single point tools. Chip formation and types of chips. Engine lathe – 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 **9 hours**

Drilling and Boring Machines: Principles of working, specifications, types, operations performed; twist drill. Types of Boring machines and applications. Shaping, slotting and planing machines –Principles of working – machining time calculations.

Unit-III **10 hours**

Milling Machines – Principles of working – Types of milling machines – Geometry of milling cutters methods of indexing.
Grinding – theory of grinding – classification of grinding machines. Types of abrasives, bonds. Selection of a grinding wheel. Lapping, honing and broaching machines, comparison and Constructional features, machining time calculations

Unit-IV **10 hours**

Limits, Fits And Tolerances- Unilateral and bilateral tolerance system, hole and shaft basis system. Inter changeability and selective assembly. Limit Gauges: Taylor's principle, Design of GO and NO GO gauges Measurement of angles, Bevel protractor, and Sine bar. Measurement of flat surfaces, straight edges, surface plates, optical flat and auto collimator.

Unit-V **9 hours**

Surface Roughness Measurement: Roughness, Waviness. CLA, RMS, Rz Values. Methods of measurement of surface finish, Talysurf. Screw thread measurement, Gear measurement; Machine Tool Alignment Tests on lathe, milling and drilling machines.

Textbooks:

1. Machine Tool Practices, Kibbe, Johne. Neely, T. White, Rolando O. Meyer, Pearson.
2. Fundamentals of Metal Machining and Machine Tools, Geoffrey Boothroyd, TMH.

References:

1. Principles of Machine Tools, Bhattacharyya A and Sen.G.C, New Central Book Agency.
2. Fundamentals of Dimensional Metrology, Connie Dotson, Thomson.

HEAT TRANSFER

III-B.Tech-I-Sem. **L T P C**
Subject Code :21P03502 **3 1 0 3**
Pre Requisite: Nil

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

1. identify different modes of heat transfer and compute one dimensional steady state heat transfer
2. solve transient heat conduction problems for simple geometries
3. analyze forced and natural convective heat transfer
4. design heat exchangers using LMTD and NTU methods
5. explain the principles of boiling and radiation

Unit-I **10 hours**

Introduction: Modes and mechanisms of heat transfer: Basic laws of heat transfer – simple general discussion about applications of heat transfer.**Conduction Heat transfer:**Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates.Simplification and forms of the field equation-steady, unsteady and periodic heat transfer-initial and boundary conditions.**One dimensional Steady state conduction Heat transfer:** Homogeneous slabs, hollow cylinders and sphere- composite systems-overall heat transfer coefficient-Electrical analogy-Critical radius of insulation.

Unit-II **9 hours**

One Dimensional Transient Conduction Heat Transfer: Variable Thermal conductivity-systems with heat sources or Heat generation-extended surfaces (fins) heat transfer – long fin, fin with insulated tip and short fin, application to error measurement of temperature.**One Dimensional Transient Conduction Heat Transfer:** Systems with negligible internal resistance-significance of Biot and Fourier numbers-infinite bodies-chart solutions of transient conduction systems.

Unit-III **10 hours**

Convective Heat Transfer: Classification of system 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 and method, application for developing semi – empirical non – dimensional correlation for convection heat transfer – significance of non-dimensional numbers – concepts of continuity, Momentum and energy equations-Integral method as approximate method.
Internal Flows: Concepts about hydrodynamic and thermal entry lengths – Division of internal flow - use of empirical relations for horizontal pipe flow and annulus flow.

Unit-IV **10 hours**

Free convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate use of empirical relations for vertical plates and pipes.
Heat Exchangers: Classification of heat exchanger – overall heat transfer coefficient and fouling factor – concepts of LMTD and NTU methods –problems using LMTD and NTU methods.
Forced convection: External flows - concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer – Flat plates and cylinders.

Unit-V **9 hours**

Heat Transfer with phase change: Boiling: - Pool boiling – Regimes- calculations on nucleate boiling, critical heat flux and film boiling.

Radiation 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 greybodies- radiation shields- electrical analogy for radiation networks.

Textbooks:

1. Fundamentals of Engineering Heat and MassTransfer,R.C.Sachdeva, New Age International Publisher.
2. Heat Transfer, P. K. Nag,TMH.

References:

1. Fundamentals of Heat and Mass Transfer – Cengel and Ghajar - TMH.
2. Heat and mass transfer –Heat and mass transfer – R K Rajput- S. Chand & Company.
3. Heat and mass transfer – D S Kumar- S K Kataria& Sons.

DESIGN OF MACHINE ELEMENTS -I

	L	T	P	C
III-B.Tech-I-Sem.				
Subject Code :21P03503	**3**	**1**	**0**	**3**

Pre Requisite: Nil

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

1. explain the design procedure and select materials for specific application
2. evaluate the strength, stiffness and fatigue of machine elements
3. design riveted, welded and boltedjoints
4. design keys, cotters, knuckle joints
5. design shafts and couplings

Unit- I: Design for Static Strength **10 hours**

Introduction: General considerations in the design - Engineering Materials and their properties - selection - Manufacturing consideration in design.**Design for Static Strength:** Simple stresses - Combined stresses - Torsional and Bending stresses - Impact stresses - Stress strain relation - Theories of failure - Factor of safety - Design for strength and rigidity - preferred numbers.

Unit- II: Design for Fatigue Strength **9 hours**

Stress concentration–Theoretical stress Concentration factor –Fatigue stress concentration factor- Notch Sensitivity. Design for fluctuating stresses – S-N Diagram - Endurance limit – Estimation of Endurance strength – Gerber's curve – Goodman Method– Soderberg Method.

Unit- III: Riveted, Welded and Bolted Joints **10 hours**

Riveted joints- methods of failure of riveted joints - strength equations - efficiency of riveted joints, eccentrically loaded riveted joints.**Welded joints**-Design of fillet welds-axial loads-circular fillet welds under bending, torsion. Welded joints under eccentric loading
Bolted joints – Types of Bolts - Design of bolts with pre-stresses – Design of Bolted joints under eccentric loading – bolts of uniform strength

Unit- IV: Keys, Cotters and Knuckle Joints **9 hours**

Types of keys - Design of keys - stresses in keys-cottered joints - spigot and socket, sleeve and cotter, jib and cotter joints, Knuckle joints.

Unit- V: Shafts and Shaft Couplings **10 hours**

Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code.
Shaft Couplings: Rigid couplings – Muff, Split muff and Flange coupling, Flexible coupling– Bushed-Pin Coupling.

Textbooks:

1. Design of Machine Elements, V.B. Bhandari,TMH.
2. Machine Design, Jindal, Pearson.

References:

1. Design of Machine Elements, V. M. Faires, Macmillan.
2. Design of Machine Elements-I,Annaiah, M.H, New Age.
3. Mechanical Engineering Design, Richard G. Budyanas and J. Keith Nisbett,Shygley.

CYBER SECURITY
(OpenElective - I)

III-B.Tech-I-Sem.	**L**	**T**	**P**	**C**
Subject Code :	**3**	**1**	**0**	**3**

Pre Requisite: Nil

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

1. Illustrate the broad set of technical, social & political aspects of Cyber Security and security management methods to maintain security protection
2. appreciate the vulnerabilities and threats posed by criminals, terrorist and nation states to national infrastructure
3. illustrate the nature of secure software development and operating systems
4. demonstrate the role security management plays in cyber security
5. defense and legal and social issues at play in developing solutions

Unit - I: **9 hours**

Introduction: Introduction to Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, AccessControl, and Cryptography, Authentication, AccessControl, Cryptography Programs and Programming: Unintentional (Nonmalicious) Programming Oversights, Malicious Code—Malware, Counter measures.

Unit – II **8 hours**

Web Security: User Side, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks.

Operating Systems Security: Security in Operating Systems, Security in the Design of Operating Systems, Rootkit.

Unit - III: **10 hours**

Network Security: Network Concepts, Threats to Network Communications, Wireless Network Security,Denial of Service, Distributed Denial-of-Service Strategic Defenses: Security Counter measures Cryptography in Network Security, Firewalls, Intrusion Detection and Prevention Systems, Network Management.

Cloud Computing and Security: Cloud Computing Concepts, Moving to the Cloud, Cloud Security Tools and Techniques, Cloud Identity Management, Securing IaaS.

Unit - IV: **10 hours**

Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, Email Security, Privacy Impacts of Emerging Technologies, Where the Field Is Headed.

Management and Incidents: Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis, Dealing with Disaster.

Unit - V: **10 hours**

Legal Issues and Ethics: Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Incident Analysis with Ethics Emerging Topics: The Internet of Things, Economics, Computerized Elections, Cyber Warfare.

Text Books:

1) Pfleeger, C.P., Security in Computing, Prentice Hall,2010,5th edition.
2) Schneier, Bruce. Applied Cryptography, Second Edition, John Wiley&Sons,1996

Reference Books:

1) Rhodes-Ousley, Mark Information Security: The Complete Reference, Second Edition, Information Security Management:Concepts andPractice,McGraw-Hill,2013.
2) Whitman, Michael E. And Herbert J.Mattord. Roadmap to Information Security for IT and Info secManagers. Boston, MA: Course Technology, 2011.

OPTIMIZATION TECHNIQUES
(Professional Elective –I)

	L	T	P	C
III-B.Tech-I-Sem.				
Subject Code :21L03502	**3**	**1**	**0**	**3**

Pre Requisite: Nil

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

1. explain the classical optimization techniques
2. determine solution for linear problems using optimization techniques
3. solve unconstrained non linear problems using various methods
4. provide solution for constrained non linear problems using various methods
5. find solution for multivariable problems using dynamic programming

Unit-I **10 hours**

Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems. Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

Unit-II **9 hours**

Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm. Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

Unit-III **10 hours**

Unconstrained Nonlinear Programming: One dimensional minimization method, Classification, Fibonacci method and Quadratic interpolation method.

Unconstrained Optimization Techniques: Univariant, Powell's, steepest descent methods.

Unit-IV **10 hours**

Constrained Nonlinear Programming: Characteristics of aconstrained problem – classification – Basic approach of Penalty Function method – Basic approach of Penalty Function method – Basic approaches of Interior and Exterior penalty function methods – Introduction to convex programming problem.

Unit-V **9 hours**

Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution – examples illustrating the tabular method of solution.

Textbooks:

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4/e.
2. H. S. Kasene& K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004

References:

1. H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007

MECHANICS OF COMPOSITE MATERIALS
(Professional Elective –I)

	L	T	P	C
III-B.Tech-I-Sem.				
Subject Code :21P03511	**3**	**0**	**0**	**3**

Pre Requisite: Nil

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

1. explain the applications of composite materials
2. illustrate the concepts of fiber reinforced plastic processing
3. differentiate micro and macro mechanics of composite lamina
4. apply failure criteria and critically evaluate the results
5. analyze the mechanical behavior of metal matrix composites

Unit- I **10 hours**

Introduction to Composite Materials Applications: Introduction to Composite Materials: Definition, classification and characteristics of composite Materials – fibrous composites, laminated composites, particulate composites. Applications: Automobile, Aircrafts. Missiles. Space hardware, Electrical and electronics, Marine, recreational and sports equipment, future potential of composites.

Unit-II **9 hours**

Fiber Reinforced Plastic Processing : Lay up and curing, fabricating process, open and closed mould process, hand lay up techniques; structural laminate bag molding, production procedures for bag molding; filament winding, pultrusion, pulforming, thermo-forming, injection molding, blow molding.

Unit-III **10 hours**

Micro Mechanics of a Lamina: Introduction, Evaluation of the four elastic moduli by Rule of mixture, Numerical problems. **Macro Mechanics of a Lamina:** Hooke's law for different types of materials, Number of elastic constants, Two - dimensional relationship of compliance and stiffness matrix.

Unit-IV **10 hours**

Biaxial Strength Theories: Maximum stress theory, Maximum strain theory, Tsai-Hill theory, Tsai, Wu tensor theory, Numerical problems.
Macro Mechanical Analysis of Laminate: Introduction, code, Kirchoff hypothesis, CL T, A, B, and D matrices (Detailed derivation), Special cases of laminates, Numerical problems.

Unit-V **9 hours**

Metal Matrix Composites Fabrication Process for MMCs: Metal Matrix Composites: Reinforcement materials, types, characteristics and selection base metals selection. Need for production MMC's and its application. Fabrication Process for MMC's: Powder metallurgy technique, liquid metallurgy technique and secondary processing, special fabrication techniques.

Textbooks:

1. Mechanics of Composite Materials/ R. M. Jones,TMH, New York, 1975.
2. Engineering Mechanics of Composite Materials, Isaac and M Daniel, Oxford University Press.

References:

1. Analysis and performance of fibre Composites, B. D. Agarwal and L. J. Broutman, Wiley- Inter Science, New York, 1980.
2. Mechanics of Composite Materials,2nd Edition, Autar K. Kaw, Publisher: CRC.

MACHINE TOOLS & METROLOGY LAB

	L	T	P	C
III-B.Tech-I-Sem.				
Subject Code :21P03511	**0**	**0**	**3**	**1.5**
Pre Requisite:				

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

1. perform step turning, taper turning, thread cutting, drilling and tapping operations on lathe
2. develop simple features by performing operations on shaper, planer and milling machines
3. measure the bores by internal micrometers and dial bore indicators
4. determine the angle and taper using Bevel protractor and Sine bar
5. evaluate screw thread parameters

LIST OF EXPERIMENTS

Section -A:

1. Introduction of general purpose machine -Lathe, Drilling machine, Milling machine, Shaper.
2. Planing machine, slotting machine, Cylindrical Grinder, surface grinder and tool and cutter grinder.
3. Step turning and taper turning on lathe machine.
4. Thread cutting and knurling on -lathe machine.
5. Drilling and Taping
6. Shapping and Planning
7. Slotting
8. Milling
9. Cylindrical Surface Grinding
10. Grinding of Tool angles

Section -B:

1. Use of gear teeth Vernier calipers for checking the chordal addendum and chordal height of the spur gear.
2. Machine tool alignment of test on the lathe.
3. Tool maker's microscope and its application
4. Angle and taper measurements by bevel protractor and sine bars.
5. Use of spirit level and optical flats in finding the flatness of surface plate.
6. Thread measurement by 2-wire and 3-wire methods.

HEAT TRANSFER LAB

	L	T	P	C
III-B.Tech-I-Sem.				
Subject Code :21P03512	**0**	**0**	**3**	**1.5**
Pre Requisite:				

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

1. find thermal conductivity of common metallic materials
2. determine the amount of heat transfer between fluid and solid boundaries
3. estimate the amount of heat exchanged between fluids in heat exchangers
4. determine the emissivity and Stefan Boltzmann constant for radiation
5. evaluate heat transfer coefficient in natural, forced convection and analyze simple heat transfer systems

List of Experiments (perform any 12 experiments):

1. Composite Slab Apparatus – overall heat transfer coefficient
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
6. Experiment on Transient Heat Conduction
7. Heat transfer in forced convection apparatus
8. Heat transfer in natural convection
9. Parallel and counter flow Heat Exchanger
10. Emissivity apparatus
11. Stefan Boltzmann apparatus
12. Critical heat flux apparatus
13. Study of heat pipe and its demonstration
14. Film and Drop wise condensation apparatus

EMPLOYABILITY SKILLS -I

	L	T	P	C
III-B.Tech-I-Sem.				
Subject Code :21S03511	**1**	**0**	**2**	**2**

Pre Requisite: Nil

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

1. demonstrate verbal and written skills effectively
2. develop professional correspondence skills
3. build proficiency in quantitative reasoning
4. improve critical thinking skills
5. exhibit confidence in facing the interview process

Unit–I **06 Hours**

Verbal Ability: Fundamentals of Grammar - Sentence Structure - Parts of Speech.
Analytical Skills: Averages -Basic Concepts, combined mean, average principles, wrong values taken, number added or deleted, average speed.
Percentages - Basic Concepts, conversions, finding percentages from given numbers, quantity increases or decreases by given percentage, population increase by given percentage, comparisons, consumption when a commodity price increase or decrease and applications.
Data Interpretation -Introduction to Data Interpretation, quantitative and qualitative data, Tabular Data, Line Graphs, Bar Chart, Pie Charts, X-Y Charts.

Unit–II **06 Hours**

Verbal Ability: Synonyms and Antonyms, Homonyms and Homophones, Word Formation, Idioms and Phrases, Analogy, One-word Substitutes.
Analytical Skills: Reasoning - Number Series, Letter Series, Series completion and correction, Coding and Decoding.

Unit–III **08 Hours**

Part-A: Verbal Ability: Exercises on Common Errors in Grammar.
Analytical Skills: Word analogy-Applied analogy.

Part-B: Verbal Ability: Vocabulary Enhancement, Study skills and using a Dictionary.
Analytical Skills: Classifications, verbal classification.

Unit–IV **10 Hours**

Verbal Ability: Paragraph writing, Picture description, Text Completion, Essay writing.
Analytical Skills: Reasoning Logical Diagrams -Simple diagrammatic relationship, Multi diagrammatic relationship, Venn-diagrams, Analytical reasoning.

Unit–V **10 Hours**

Verbal Ability: Sentence Equivalence, Comparison and Parallelism, Letter writing and e-mail writing.
Analytical Skills: Reasoning Ability - Blood Relations, Seating arrangements, Directions, Decision making.

ActivitiesList:

1. Regular cumulative practice tests.
2. Quiz, Crossword, Word-search and related activities.
3. Picture Description including Description of Photos/Images/Posters/Advertisement Analysis etc.,

PROFESSIONAL ETHICS AND HUMAN VALUES
(Mandatory Course)

	L	T	P	C
III-B.Tech-I-Sem.				
Subject Code :21M00501	**2**	**0**	**0**	**0**

Pre Requisite: Nil

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

1. illustrate diverse ethical issues rooted in society and its impact on trade, business and societal issues.
2. impart professional skills as managers, advisors, experts and consultants.
3. apply observations of a spiritual discourse for a better society.
4. make use of professional ethics and rights
5. apply the principles of professional ethics for a better practice in the field of choice

Unit I

Human Values: Morals, values, ethics – integrity – work ethics –service learning –civic virtue – respect for others- living peacefully - Caring –sharing –honesty – courage –valuing time – cooperation – commitment – empathy – self-confidence –spirituality – character- Mini-Cases

Unit II

Professional Ethics: Profession- and professionalism - Two models of professionalism –Professional etiquette -Three types of Ethics or morality Responsibility in Engineering – Engineering standards – Engineering Ethics – Positive and Negative Faces. Professional Codes and Code of conduct of Institute of Engineers . Mini-cases .

UnitIII

Professional Responsibilities: Ethical standards Vs Professional Conduct – Zero Tolerance for Culpable Mistakes – Hazards and Risks - congeniality, collegiality and loyalty. Respect for authority – conflicts of interest –Mini-Cases.

Unit IV

Professional Rights: professional rights and employee rights communicating risk and public policy – Whistle blowing - Professionals /engineers as managers, advisors, experts, witnesses and consultants – moral leadership- Monitoring and control- Mini-Cases

Unit V

Ethics in global context: Global issues in MNCs- Problems of bribery, extortion, and grease payments – Problem of nepotism, excessive gifts – paternalism – different business practices –
Negotiating taxes - Mini-Cases

References

1. S B George, Human Values and Professional Ethics, Vikas Publishing.
2. KR Govindan &Saenthil Kumar: Professional Ethics and Human Values, Anuradha Publications.
3. S K Chakraborthy&D.Chakraborthy: Human Values and Ethics, Himalaya.
4. M. Govindarajan, S. Natarajan, & V.S. Senthilkumar: Engineering Ethics(Includes Human Values), HI Learning Pvt. Ltd., New Delhi – 110001

III-B.TECH.-II SEMESTER SYLLABUS

CAD/CAM

III-B.Tech-II-Sem. **L T P C**
Subject Code :21P03601 **3 0 0 0**
Pre Requisite: Nil

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

1. applythe concepts of curves in desiging various elements
2. applythe concepts of surface and solid modeling techniques in 3-D modeling
3. calculate mass properties, translate the data and outline the features of CNC
4. write CNC part program for lathe and milling operations
5. explain group technology, CAPP and flexible manufacturing systems

Unit- I **10 hours**
Introduction to CAD: Product cycle, coordinate system, basic features, modeling strategies, model viewing. Curves: curve entities, curve representation, line, circle, ellipse, Bezier curve, B-spline curve, curve manipulations.

Unit- II **10 hours**
Surface Modeling: surface entities, surface representation, analytic surface, Bezier surface, B-spline surface.
Solid Modeling: solid entities, concept of B-rep, constructive solid geometry, sweep representation.

Unit- III **08 hours**
Mass Properties: Mass Properties on CAD/CAM systems,Product Data Exchange: IGES, STEP. **Computer Numerical Contro**l: Introduction, numerical control, numerical control modes, numerical control elements, CNC machine tools, feedback devices, coordinate system.

Unit- IV **10 hours**
CNC milling program: Preparatory functions, miscellaneous functions, tool length compensation, cutter radius compensation, canned cycles, examples.
CNC Turning program: Axes system, general programming functions, motion commands, facing and turning cycle, thread cutting, examples.

Unit- V **10 hours**
Group Technology: Classification and coding, production flow analysis, cellular manufacturing **Computer Aided Process Planning**: Retrieval and generative CAPP systems.
Flexible Manufacturing System: Introduction, FMS equipment, tool management system, system layouts, FMS control

Text Books:

1. Ibrahim Zeid, Mastering CAD/CAM, McGraw Hill, 2015. (Units I, II & III)

2. P. N. Rao, CAD/CAM Principles and Applications, McGraw Hill, 3rd Edition, 2015.

Reference Books:

1. Ibrahim Zeid, CAD/CAM Theory and Practice, McGraw Hill, , 2007.

2. Sadhu Singh, Computer Aided Design and Manufacturing, Khanna Publishers.

3. M. P. Groover and E. W. Zimmers, CAD/CAM, PHI, 1st Edition, 1995.

FINITE ELEMENT METHODS

III-B.Tech-II-Sem. **L T P C**
Subject Code :21P03602 **3 1 0 0**
Pre Requisite: Nil

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

1. explain the fundamentals of FEM
2. solve the linear equations of truss elements, beam elements using FEM
3. evaluate the load and displacements for 2-D problems
4. apply the FE method for heat transferproblems
5. demonstrate the dynamic analysis for various objects using FEM

Unit- I **10 hours**

Introduction: Historical Background - Mathematical modeling of field problems in Engineering - Governing Equations - Weighted Residual Methods - Variational Formulation of Boundary Value Problems - Ritz Technique - Basic concepts of the Finite Element Method - Stress and Equilibrium. Boundary conditions. Strain - Displacement relations. Stress - strain relations for 2-D and 3-D Elastic problems.
One Dimensional Problems: Finite element modeling coordinates and shape functions. Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions. Temperature effects.

Unit- II **09 hours**

Analysis of Trusses: Stiffness Matrix for Plane Truss Elements, Stress Calculations and problems.
Analysis of Beams: Element stiffness matrix for two noded, two degrees of freedom per node beam element and simple problems.

Unit-III **10 hours**

Finite element modeling of two-dimensional stress analysis with constant strain triangles and treatment of boundary conditions, Estimation of Load Vector, Stresses.

Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements. Two dimensional four noded Iso-parametric elements and problems.

Unit-IV **09 hours**

Steady State Heat Transfer Analysis: One dimensional analysis of slab, fin and two-dimensional analysis of thin plate. Analysis of a uniform shaft subjected to torsion.

Unit-V **10 hours**

Dynamic Analysis: Formulation of finite element model, element - Mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar, truss. Finite element - formulation to 3 D problems in stress analysis, convergence requirements, Mesh generation, techniques such as semi-automatic and fully Automatic use of softwares such as ANSYS, NISA, NASTRAN, etc.

Textbooks:

1. Introduction to Finite element analysis,S.Md.Jalaludeen, Anuradha Publications, Print-2012
2. Finite Element Methods: Basic Concepts and applications,Alavala, PHI.

References:

1. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu, PHI.
2. Finite Element Method, Zincowitz,TMH.
3. A First Course in the Finite Element Method, Daryl Logan, Cengage Learning, 5thEdition.

DESIGN OF MACHINE ELEMENTS –II

III-B.Tech-II-Sem. **L T P C**
Subject Code :21P03603 **3 1 0 0**
Pre Requisite: Nil

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

1. analyse the importance of sliding contact bearings
2. design the different types of rolling contact bearings
3. explain the concepts of springs and power transmission systems.
4. design different categories of engine parts.
5. evaluate the design procedure for gears and power screws

Unit-I **10 hours**

Sliding contact bearings: Types of Journal bearings – Lubrication –Bearing Characteristic Number and Bearing Modulus –Full and partial bearings – Clearance ratio – Heat Generated and dissipation of bearings, journal bearing design, Properties of Sliding Contact Bearing, Bearing materials.

Unit-II **09 hours**

Rolling contact bearings: Types of Rolling Contact bearings, Ball and roller bearings – Static load – dynamic load – equivalent radial load – Reliability of a Bearing - design and selection of ball & roller bearings.

Unit-III **10 hours**

Part-A: Mechanical Springs: Stresses and deflections of helical springs – Extension and compression springs – Design of springs for fatigue loading – Energy storage capacity.

Part-B: Belts & Pulleys: Transmission of power by Belt and Rope ways, Transmission efficiencies,Belts – Flat and V types, Ropes Drive.

Unit-IV **09 hours**

IC Engine Parts: Piston- Forces acting on piston – Construction, Design and proportions of piston. Connecting Rod: Thrust in connecting rod – stresses due to whipping action on connecting rod ends.

Unit-V **10 hours**

Gears: Spur gears & Helical gears- Brief introduction involving important concepts – Design of gears using AGMA procedure involving Lewis and Buckingham equations. Check for dynamic and wear considerations. **Design of Power Screws:** Design of screw. Square, ACME, Buttress screws, Stresses in Power Screws. Compound screw, Differential screw, possible failures.

Textbooks:

1. Machine tool design, V.B. Bhandari,TMH.
2. Design of Machine Elements, Spotts, Pearson.

References:

1. Design of Machine Elements-II, Annaiah, New Age.
2. Design of Machine Elements, Sharma and Purohit, PHI.
3. Mechanical Engineering Design, Richard G. Budyanas and J. Keith Nisbett,S hygley.

Data Books:

1. Design Data Book - P.S.G. College of Technology.

REFRIGERATION & AIR-CONDITIONING
(Professional Elective –II)

	L	T	P	C
III-B.Tech-II-Sem.				
Subject Code :21L03601	**3**	**0**	**0**	**3**

Pre Requisite: Nil

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

1. apply the concepts of refrigeration to various systems
2. explain the methods to improve performance of vapor compression systems
3. illustrate the componentsof refrigerationsystem
4. analyze vapor absorption, steam jet refrigeration systems
5. determine cooling and heating loads in air conditioning systems

Unit-I **10 hours**

Introduction to Refrigeration: - Necessity and applications – Unit of refrigeration and C.O.P. – Mechanical Refrigeration – Types of Ideal cycle of refrigeration. Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems – Actual air refrigeration system – Refrigeration needs of Air crafts- Air systems – Actual Air refrigeration system – Refrigeration needs of Air crafts – Application of Air Refrigeration, Justification – Types of systems – Problems

Unit-II **09 hours**

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 – Problems.

Unit-III **10 hours**

System Components: Compressors – General classification – comparison – Advantages and Disadvantages.Condensers – classification – Working Principles of evaporators – classification – Working Principles ofexpansion devices – types.

Unit-IV **09 hours**

Vapor Absorption System – Calculation of max COP – description and working of NH_3 – water system – Li – Br system. Principle and operation of three fluid absorption system, salient features. Steam Jet Refrigeration System.

Unit-V **10 hours**

Introduction to Air Conditioning: Psychometric Properties & Processes – Sensible and latent heat loads – Characterization – Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, ASHF, ESHF and ADP. Concept of human comfort and effective temperature –Comfort Air conditioning –Air conditioning Load Calculations.

Air Conditioning systems: Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers deodorants, fans and blowers. Heat Pump - Heat sources - different heat pump circuits - Applications.

Textbooks:

1. A Course in Refrigeration and Air conditioning / SC Arora &Domkundwar / Dhanpatrai
2. Refrigeration and Air Conditioning/ Manohar Prasad/ New Age

References:

1. Refrigeration and Air Conditioning / CP Arora / TMH.
2. Principles of Refrigeration - Dossat / Pearson Education

UNCONVENTIONAL MACHINING PROCESSES
(Professional Elective –II)

	L	T	P	C
III-B.Tech-II-Sem.				
Subject Code :21L03602	**3**	**0**	**0**	**3**

Pre Requisite: Nil

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

1. explain the need, applications of modern machiningprocesses and principles of USM
2. outline working principles of AJM, WJM and AWJMtechniques
3. summarize working principles of EDM, EDG and EDWprocesses
4. illustrate working principles of EBM, LBM and PAMprocesses
5. adapt working principles of CM and ECMprocesses

Unit-I **10 hours**

Introduction: Need For Non-Traditional Machining Methods-Classification of Modern Machining Processes –Considerations in Process Selection, Materials, Applications.

Ultrasonic Machining: Elements of the Process, Mechanics of Metal Removal Process Parameters, Economic Considerations, Applications and Limitations, Recent Development.

Unit-II **9 hours**

Abrasive Jet Machining, Water Jet Machining and Abrasive Water Jet Machine: Basic Principles, Equipments, Process Variables, Mechanics of Metal Removal, MRR, Application and Limitations. Magnetic Abrasive Finishing, Abrasive Flow Finishing

Unit-III **10 hours**

General Principle And Applications of Electric Discharge Machining, Electric Discharge Grinding and Electric Discharge Wire Cutting Processes –Power Circuits for EDM, Mechanics of Metal Removal in EDM.**:** Process Parameters, Selection of Tool Electrode And Dielectric Fluids, Methods Surface Finish And Machining Accuracy, Characteristics of Spark Eroded Surface And Machine Tool Selection. Wire EDM, Principle, Applications.

Unit-IV **09 hours**

Generation and Control of Electron Beam for Machining, Theory of Electron Beam Machining, Comparison of Thermal and Non-Thermal Processes –General Principle and Application of Laser Beam Machining – Thermal Features, Cutting Speed and Accuracy of Cut. Application of Plasma For Machining, Metal Removal Mechanism, Process Parameters,Accuracy And Surface Finish And Other Applications of Plasma In Manufacturing Industries.

Unit-V **08 hours**

Fundamentals of Electrochemical Machining, Electrochemical Grinding, Electro Chemical Honing and Deburring Process, Metal Removal Rate in ECM, Tool Design, Surface Finish and Accuracy Economic Aspects of ECM –Simple Problems for Estimation of Metal Removal Rate.Fundamentals of Chemical Machining, Chemical Machining Principle, Maskants, Etchants, Advantages and Applications of Chemical Machining.Metal Removal Rate, Electro Stream Drilling, Shaped Tube Electrolytic Machining.

Textbooks:

1. Advanced machining processes by VK Jain, Allied publishers.

References:

1. Modern Machining Process, Pandey P.C. and Shah H.S., TMH.
2. New Technology, Bhattacharya A, The Institution of Engineers, India 1984.

PRODUCTION PLANNING AND CONTROL
(Professional Elective –II)

	L	T	P	C
III-B.Tech-II-Sem.				
Subject Code :21L03603	**3**	**0**	**0**	**3**

Pre Requisite: Nil

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

1. illustrate the functions of PPC
2. outline the principles and types of forecasting
3. differentiate various inventory control techniques
4. solve routing and scheduling problems
5. summarize dispatching process

Unit-I **10 hours**

Introduction: Definitions: PPC - Objectives and applications of production planning and control, Functions of production planning and control, elements of production planning and control- Types of productions: job, batch and mass production- Organizations of production planning and control — internal organizations and departments- Marketing aspect.

Unit-II **09 hours**

Forecasting: Introduction, Importance and General Principles of forecasting -Types of forecasting techniques: Qualitative methods, quantitative methods, Long term and Short term sales forecasting methods Applications of forecasting.

Unit-III **10 hour**

Inventory management: Introduction- Functions of inventory control-ABC analysis- VED Analysis- EOQ technique.**Models of Inventory control systems:** P-Systems and Q-Systems -Introduction to MRP And ERP, LOB(Line of balance), JIT inventory, Japanese concepts.

Unit-IV **10 hours**

Routing: Definition – routing procedure- Route sheets - Bill of material- factors affecting routing procedure. Schedule - definition - difference with loading -Scheduling policies - techniques, standard scheduling methods- job shop, flow shop- Line balancing, aggregate planning- methods for aggregate planning- Purchase planning, expediting, control aspects.

Unit-V **09 hours**

Dispatching: Dispatching procedure, follow up - definition - functions - types of follow up and their functions, applications of computer in production planning and control.

Textbooks:

1. Production Planning and Control! M.Mahajan, Dhanpatirai& Co.
2. Production Planning and Control, Jam & Jam, Khanna publications.

References:

1. Production Planning and Control, Text & cases, SK Mukhopadhyaya, PHI.
2. Production and operations Management U R.Panneer Selvam, PHI.
3. Production and Operations Management (Theory and Practice), Dipak.

COMPUTER AIDED ANALYSIS LAB

	L	T	P	C
III-B.Tech-II-Sem.				
Subject Code :21P03611	**0**	**0**	**3**	**1.5**
Pre Requisite:				

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

1. determine the deflections and stresses in trusses andbeams
2. find the stresses in 2D structural members
3. develop harmonic and mode shapes for variety ofbeams
4. perform heat transfer analysis involving conduction andconvection
5. conduct thermal stressanalysis

LIST OF EXPERIMENTS

1. Determine the deflections and stresses in 2D truss for the truss system
2. Determination the deflection and stresses in 2D beams also determine the nodal deflections, reaction forces for the beam
3. Determination of deflections, principal and Von-Mises stresses in plane stress components.
4. Determination of deflections, principal and Von-Mises stresses in plane strain components.
5. Determination of stresses in 3D Shell component
6. Determination of the Frequency response of cantilever Beam
7. Determination of deflections, thermal stresses in a plane slab.
8. Determination of Thermal Stress of a cylinder Using Axisymmetric Elements
9. Analysis of a square plate considering conduction and convection
10. Analysis of a compound bodies considering conduction and convection

INSTRUMENTATION AND CONTROL SYSTEMS LAB

	L	T	P	C
III-B.Tech-II-Sem.				
Subject Code :21P03612	**0**	**0**	**3**	**1.5**
Pre Requisite:				

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

1. calibrate the measuring devices
2. demonstrate pressure, displacement and vibration measuring devices
3. analyze the temperature measuring devices
4. determine the speed using photo and magnetic speed pickups
5. perform and calibrate rotameter for flow measurement

LIST OF EXPERIMENTS:

1. Calibration of Pressure Gauges
2. Calibration of thermistor and RTD for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for deflection 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 for the measurement of vibration modes of an engine bed at various loads.
11. Study and calibration of Mcleod gauge for low pressure.

COMPUTER AIDED MANUFACTURING LAB

	L	T	P	C
III-B.Tech-II-Sem.				
Subject Code :21P03613	**0**	**0**	**3**	**1.5**

Pre Requisite:

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

1. develop part programming for lathe and mill operations using CAM software
2. produce components on CNC lathe
3. manufacture components on CNC Milling machine
4. generate .stl files from the models
5. create components on 3D Printer

LIST OF EXPERIMENTS

1. Study of various Post Processor used in NC machines
2. Development of NC codes for lathe operations using CAM software
3. Development of NC codes for milling operations using CAM software
4. Machining of simple components on NC lathe by transferring NC Code/from CAM software
5. Machining of simple components on NC Mill by transferring NC Code/from CAM software
6. Study on 3D printer
7. Create the design files for Rapid Prototyping
8. Create a simple solid cube using 3D Printer
9. Create a Hexagonal Nut using 3D Printer
10. Create a U Bracket Sheet Metal using 3D Printer

EMPLOYABILITY SKILLS – II

III-B.Tech-II-Sem. **L T P C**
Subject Code :21S03611 **2 0 1 2**
Pre Requisite: Nil

Course Outcomes: At the end of the course, the student will be able to
1. make use of soft skills to become a professional team member
2. demonstrate quantitative aptitude concepts
3. apply knowledge of decision making, leadership, motivation
4. adapt principles of quantitative aptitude to achieve qualitative results
5. exhibit confidence in facing the interview process

Unit–I **08 Hours**

Soft Skills: Self awareness and Self esteem, Discipline, Integrity, Attitude, Change and Adaptability.
Quantitative Aptitude:Number Systems: Basic Concepts, Number Systems: Natural numbers, whole numbers, integers, fractions, Rational Numbers, Irrational Numbers, Real Numbers, Divisibility Rules, Logic Equations, Remainder theorem, Unit digit calculation

Unit-II **08 Hours**

Soft Skills:People Skills: Relationships - Personal & Professional Relationships – Rapport Building – Personal Space; Definition of Motivation –Motivation – Self-motivation; Time Management – Stephen Covey's time management.
Quantitative Aptitude:
Profit and Loss: Basic Concepts, discounts, marked price and list price,dishonest shopkeeper with manipulated weights, successive discounts etc.
Interest (Simple and Compound): Basic Concepts, Yearly, Half-yearly, and quarterly calculations, multiples, differences between simple and compound interest.
Ratio and Proportion: Basic Concepts of ratio and proportion, continued or equal proportions, mean proportions, invest proportion, alternative proportion, division proportion, compound proportion,

Unit–III **08 Hours**

Soft Skills:Teamwork: Definition of Team, Team Dynamics – Specialization and Teamwork – Rewards of Teamwork.**Leadership:** Definition of Leadership, Leading a Team, Leadership Qualities – Leader vs Manager – Leadership Styles.
Quantitative Aptitude:Speed, Time and Distance: Basic Concepts, Single train problems,two train problems:**Time and Work:**Basic Concepts, comparative work, mixed work, alternative work,middle leave and middle join,ratio efficiency.

Unit IV **08 Hours**

Soft Skills:Problem Solving and Decision Making: Definitions –Problem Solving and Decision Making – Hurdles in Decision Making - Case studies.**Quantitative Aptitude:Permutations and combinations:**Basic Concepts, differences between permutations and combinations, always together-never together, alternative arrangement

Unit – V **09 Hours**

Soft Skills:Preparation for Interviews: Body Language – Posture - Dressing and Grooming – Researching the Industry and the Organization- Types of Interviews – First Impressions – Dos and Don'ts of an Interview.**Quantitative Aptitude:Geometry and Mensuration:**Basic concepts, types of angles.**Plane figures:** rectangles, squares, triangles, quadrilateral,areas,perimeters,etc.**Solid figures:**cubes,cuboids,cylinders-area (total surface area and lateral surface area), volumes, perimeters.**Others:** Parallelogram, Rhombus, Trapezium, Circle, Sector,Segment, Cone, Sphere, Hemisphere, etc.

IPR & PATENTS
(Mandatory Course)

III-B.Tech-II-Sem. **L T P C**
Subject Code :21M00601 **2 0 0 0**
Pre Requisite: Nil

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

1. outline basics of intellectual propertylaw
2. identify the various trademarks
3. analyze patent and copy rights law
4. differentiate trade secret and unfair practice
5. summarize new developments in Intellectual Property Rights

Unit-I **06 hours**

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

Unit-II **07 hours**

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 **09 hours**

Part-A: 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.

Part-B: Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

Unit-IV **06 hours**

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.
Unfair competition: Misappropriation right of publicity, false advertising.

Unit-V **06 hours**

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.

Textbooks:

1. Intellectual property right, Deborah, E. Bouchoux, cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, prabuddhaganguli, TMH.

IV-B.TECH.-I SEMESTER SYLLABUS

POWER PLANT ENGIEERING
(Professional Elective –III)

	L	T	P	C
IV-B.Tech-I-Sem.				
Subject Code :21L03701	**3**	**0**	**0**	**3**

Pre Requisite: Nil

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

1. illustrate the concepts of energy sources, steam power plants and combustion process
2. explain the working principles of diesel and gas-turbine power plants
3. establish the hydro electric power plant with various layouts
4. outline the concepts of nuclear power plants
5. determine optimum parameters for power plants

Unit-I **10 hours**

Introduction to the Sources of Energy: Resources and Development of Power in India.
Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipment, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems. **Combustion Process:** Properties of coal - overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and drought system, Fluidized Bed Combustion, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection.

Unit-II **09 hours**

Diesel Power Plant: Introduction - IC Engines, types, construction - Plant layout with auxiliaries - fuel supply system, engine starting equipment, lubrication and cooling system - super charging, Turbocharging.**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.

Unit-III **10 hours**

Hydro Electric Power Plant: Water power-Hydro logical cycle / flow measurement, Hydro graphs, storage and Poundage, classification of dams and spill ways.**Hydro Projects and Plant:** Classification- Typical layouts, plant auxiliaries-plant operation pumped storage plants.

Unit-IV **09 hours**

Nuclear Power Station: Nuclear fuel-breeding and fertile materials -Nuclear reactor - reactor operation. 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.

Unit-V **10 hours**

Power Plant Economics and Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor -related exercises.

Textbooks:

1. A Text Book of Power Plant Engineering / Rajput / Laxmi Publications.
2. Power Plant Engineering! P.C.Sharma / S.K.Kataria Pub.
3. A Course in Power Plant Engineering: Arora and S. Domkundwar.

References:

1. Power Plant Engineering: P.K.Nag,2nd Edition, TMH.
2. Power plant Engg, Elanchezhian, I.K. International Pub.

FLEXIBLE MANUFACTURING SYSTEM
(Professional Elective –III)

IV-B.Tech-I-Sem.	**L**	**T**	**P**	**C**
Subject Code :21L03702	**3**	**0**	**0**	**3**

Pre Requisite: Nil

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

1. explain the concepts of FMS
2. make use of automated material handling systems
3. performengineering analysis of ASRS
4. identify bottlenecks in FMS operational issues
5. summarize the concepts of JIT and lean manufacturing

Unit-I **10 hours**

Introduction: Flexibility – Types of FMS – FMS components: Workstations, Material Handling and Storage Systems – Computer Control Systems – Human Resources – FMS Applications and Benefits.

Unit-II **09 hours**

Automated Material Handling Systems: Design Considerations in Material handling – Material Handling Equipment – Industrial Trucks, Automated Guided Vehicles, Monorails and Other Rail-Guided Vehicles – Analysis of Material Transport System.

Unit-III **10 hours**

Storage Systems in FMS: Storage Systems Performance and Location Strategies – Automated Storage/Retrieval Systems – Carousel Storage Systems. Engineering Analysis of Automated Storage/Retrieval Systems – Carousel Storage Systems.

Unit-IV **09 hours**

FMS Planning and Implementation: FMS Planning and Implementation issues- Quantitative Analysis of FMS – Bottleneck Model –FMS Operational Parameters – Simple Problem – Extended Bottleneck Model – Sizing of FMS.

Unit-V **10 hours**

Just-In-Time and Lean Production: Lean Production and Waste in Manufacturing - Just-In-Time Production Systems – Pull System of Production Control – Setup Time Reduction – Stable and Reliable Operations – Autonomation – Worker Involvement – Visual Management and 5S.

Textbooks:

1. Automation, Production Systems, and Computer Integrated Manufacturing, Mikell P.Groover, PHI.
2. Hand Book of Flexible Manufacturing Systems, Jha N K, Academic Press.

References:

1. Flexible Manufacturing Systems, H K Shivanand, New Age International, 2006.
2. Flexible Manufacturing Cells & Systems - William W. Luggen –Prentice hall, NJ.

TOTAL QUALITY MANAGEMENT
(Professional Elective –III)

	L	T	P	C
IV-B.Tech-I-Sem.				
Subject Code :21L03703	**3**	**0**	**0**	**3**

Pre Requisite: Nil

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

1. explain the TQM frame work and various quality control techniques
2. identify customer needs and apply benchmarking techniques
3. build organization for TQM using quality management tools
4. assess costs involvement in TQM process
5. apply ISO standards for design and development of products and services

Unit-I **10 hours**

Introduction: Concept of TQM, Quality and Business performance, attitude and involvement of top management, communication, culture and management systems.
Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

Unit-II **09 hours**

Process and customer relation: Customer satisfaction, internal customer conflict, quality focus, role of Marketing and Sales, Buyer - Supplier relationships.
Benchmarking: Introduction - Evolution of benchmarking, benefits of benchmarking, benchmarking procedure, pitfalls of benchmarking.

Unit-III **10 hours**

Organizing TQM: systems approach, Organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles.**Seven Tools of TQM:** Stratification, check sheet, Scatter diagram, Ishikawa diagram, Pareto diagram, Kepner & Tregoe Methodology.

Unit-IV **9 hours**

Cost of Quality: Definition, Quality Costs, Measuring Quality Costs, use of Quality Cost information, Accounting Systems and Quality Management.

Unit-V **10 hours**

1S09000: Universal Standards of Quality: ISO around the world, lSO9000 ANSI/ASQC Q- 90. Series Standards, benefits of ISO9000 certification, the third party audit, Documentation 1S09000 and services, the cost of certification implementing the system.

Textbooks:

1. Total Quality Management, I Joel E.Ross, Taylor and Franscis Limited.
2. Total Quality Management, P.N.Mukherjee, PHI.

References:

1. Beyond TQM, Robed LFlood.
2. Statistical Quality Control, El. Grant.
3. Total Quality Management:A Practical Approach, H. La

DESIGN OF EXPERIMENTS
(Professional Elective –IV)

IV-B.Tech-I-Sem.	**L**	**T**	**P**	**C**
Subject Code :21L03704	**3**	**0**	**0**	**3**

Pre Requisite: Nil

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

1. illustrate the experimental design strategies
2. acquire the concepts of two level and three level factors in DOE
3. adapt various techniques to improve reliability
4. apply orthogonal arrays for the improvement of linear graphs
5. evaluate signal to noise ratio for dynamic problems

Unit–I **09 hours**

Introduction: Strategy of Experimental design, Basic Principles, Guidelines for Designing Experiments, Concepts of random variable, distribution functions. Sample and population, Measure of Central tendency, Variability, Concept of confidence level. Statistical Distributions:. Illustration through Numerical examples.

Unit –II **10 hours**

Classical Experiments: Factorial Experiments: Terminology: factors, levels, interactions, treatment combination, randomization, Two-level experimental designs for two factors and three factors. Three-level experimental designs for two factors and three factors, Factor effects, Factor interactions, Fractional factorial design, Saturated Designs, Central composite designs. Illustration through Numerical examples.

Unit –III **10 hours**

Measures of variability, Ranking method, Column effect method & Plotting method, Analysis of variance (ANOVA) in Factorial Experiments: Regression analysis, Mathematical models from experimental data. Taguchi's quality philosophy, elements of cost, Noise factors causes of variation. Quadratic loss function & variations of quadratic loss function. Robust Design: Steps in Robust Design: Reliability Improvement through experiments, Illustration through Numerical examples.

Unit–IV **09 hours**

Types of Orthogonal Arrays, selection of standard orthogonal arrays, Linear graphs and Interaction assignment, Dummy level Technique, Compound factor method, Modification of linear graphs. Illustration through Numerical examples.

Unit–V **10 hours**

Evaluation of sensitivity to noise. Signal to Noise ratios for static problems: Smaller-the-better type, Nominal-the –better-type, Larger-the-better type. Signal to Noise ratios for Dynamic problems. Illustration through Numerical examples.

Textbooks:

1. Quality Engineering using Robust Design, Madhav S Phadke, Prentice Hall.
2. Design of Experiments for Engineers and Scientists,Jiju Antony,Elsevier S&T Books

References:

1. Design and Analysis of Experiments, Montgomery John Wiley and Sons.

ELECTRIC, HYBRID AND HYDROGEN VEHICLES
(Professional Elective –IV)

IV-B.Tech-I-Sem. **L T P C**
Subject Code :21L03705 **3 0 0 3**
Pre Requisite: Nil

Course Outcomes: At the end of the course, the student will be able to
1. illustrate working of different configurations of electric vehicles,
2. describe hybrid vehicle configuration and its components, performance analysis
3. determine the properties of batteries and its types electric vehicle drive systems.
4. apply suitable hybrid electric vehicle configurations
5. apply hydrogen fueling techniques appropriately

Unit-I Electric Vehicle **10 hours**

Introduction, Components, vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion - Propulsion System Design. **Batteries**: Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

Unit-II DC & AC Electrical Machines and Electric Vehicle Drive Train **09 hours**

Motor and Engine rating, Requirements, DC machines, Three phase A/c machines, Induction machines, permanent magnet machines, switched reluctance machines. Transmission configuration, Components – gears, differential, clutch, brakes regenerative braking, motor sizing.

Unit-III Hybrid Electric Vehicles **08 hours**

Types – series, parallel and series, parallel configuration – Design – Drive train, sizing of components.

Unit-IV Hydrogen Vehicles **08 hours**

Hydrogen fuel cells, Fuel cells for automotive applications – technology advances in fuel cell vehicle systems – onboard hydrogen storage – liquid hydrogen and compressed hydrogen – metal hydrides, fuel cell control system – alkaline fuel cell – road map to market

Unit-V Hydrogen Fueling **10 hours**

Fueling Hydrogen storage technology – pressure cylinders, liquid hydrogen, metal hydrides, carbon fibers – reformer technology – steam reforming, partial oxidation, auto thermal reforming – CO removal, fuel cell technology based on removal like bio-mass.

Textbooks:

1. Iqbal Hussain, ―Electric & Hybrid Vehicles – Design Fundamentals‖, Second Edition, CRC Press,2011. T2.
2. Fuel Cells for automotive applications – professional engineering publishing UK.

References:

1. James Larminie, ―Electric Vehicle Technology Explained‖, John Wiley & Sons, 2003.
2. Fuel Cell Technology Handbook SAE International Gregor Hoogers CRC Press ISBN 0-8493-0877-1-2003.

COMPUTATIONAL FLUID DYNAMICS
(Professional Elective –IV)

IV-B.Tech-I-Sem.	**L**	**T**	**P**	**C**
Subject Code :21L03706	**3**	**0**	**0**	**3**

Pre Requisite: Nil

Course Outcomes: At the end of the course, the student will be able to
1. Distinguish various numerical methods used in CFD
2. Explain the basic rules of FVM
3. Apply FVM to solve convection and diffusion problems
4. Solve flow field problems using CFD
5. Analyze turbulent flows by applaying CFD concepts

Unit-I **10 hours**

Introduction to Numerical Methods: Finite Difference, Finite element and finite volume methods - classification of partial differential equations – solution of linear algebraic equations – direct and iterative approaches.
Finite difference methods: Taylor's series – FDE formulation for 1D and 2D steady state heat transfer problems – Cartesian, cylindrical and spherical co-ordinate systems – boundary conditions – Un-steady state heat conduction – Errors associated with FDE – Explicit Method – Stability criteria – Implicit Method – Crank Nickolson method – 2-D FDE formulation – ADI – ADE

Unit-II **9 hours**

Finite Volume Method: Formation of Basic rules for control volume approach using 1D steady heat conduction equation – Interface Thermal Conductivity – Extension of General Nodal Equation to 2D and 3D Steady heat conduction and unsteady heat conduction.

Unit-III **10 hours**

FVM to Convection and Diffusion: Concept of Elliptic, Parabolic and Hyperbolic Equations applied to fluid flow – Governing Equations of Flow and Heat transfer. Steady 1D Convection Diffusion – Discretization Schemes and their assessment – Treatment of Boundary Conditions.

Unit-IV **10 hours**

Calculation of Flow Field: Vorticity & Stream Function Method – Staggered Grid as Remedy for representation of Flow Field – Pressure and Velocity Corrections – Pressure Velocity Coupling – SIMPLE & SIMPLER (revised algorithm) Algorithm.

Unit-V **09 hours**

Turbulent Flows: Direct Numerical Simulation, Large Eddy Simulation and RANS Models Compressible Flows: Introduction – Pressure, Velocity and Density Coupling.

Textbooks:

1. Numerical heat transfer and fluid flow – S.V. Patankar (Hemisphere Pub. House)
2. An Introduction to Computational Fluid Dynamics – FVM Method – H.K. Versteeg, & Co., PHI.

References:

1. Computational Fluid Dynamics – Hoffman and Chiang, Engg Education System.
2. Computational Fluid Dynamics – Anderson (TMH).

ADDITIVE MANUFACTURING
(Professional Elective –V)

IV-B.Tech-I-Sem. **L T P C**
Subject Code :21L03707 **3 0 0 3**
Pre Requisite: Nil

Course Outcomes: At the end of the course, the student will be able to
1. explain the concepts of AdditiveManufacturing
2. differentiate liquid and solid based rapid prototyping systems
3. illustrate powder based rapid prototyping and tooling systems
4. apply various data file formats in 3D printing
5. summarize various RP applications

Unit-I **09 hours**

Introduction: Prototyping fundamentals, Historical development, Fundamentals of Rapid Prototyping, Advantages, and Limitations of Rapid Prototyping, commonly used Terms, Classification of RP process, Rapid Prototyping Process Chain: Fundamental Automated Processes, Process Chain.

Unit-II **10 hours**

Liquid-based Rapid Prototyping Systems: Stereo lithography Apparatus (SLA), Models and specifications, Process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, Applications, Case studies.
Solid-based Rapid Prototyping Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Case studies.Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Case studies.

Unit-III **10 hours**

Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Case studies.

Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, need for RT. Rapid Tooling Classification; Indirect Rapid Tooling Methods: Spray Metal Deposition, Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

Unit-IV **09 hours**

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, Features of various RP software's like Magics, Mimics, Solid View, View Expert, 3D View, Velocity 2, Rhino, STL View 3 Data Expert and 3D doctor.

Unit-V **10 hours**

RP Applications: Application - Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules.

Textbooks:

1. Rapid prototyping; Principles and Applications, Chua C.K., Leong K.F. and LIM C.S, WSP.
2. Rapid Manufacturing, D.T. Pham and S.S. Dimov/Springer.

References:

1. Terry Wohlers, Wholers Report 2000, Wohlers Associates.
2. Rapid Prototyping and Manufacturing, PaulF.Jacobs, ASME.

ADVANCED MACHINING PROCESSES
(Professional Elective –V)

IV-B.Tech-I-Sem. **L T P C**
Subject Code : 21L03708 **3 0 0 3**
Pre Requisite: Nil

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

1. explain the need, applications of modern machining processes and principles of USM
2. outline working principles of AJM, WJM and AWJM techniques
3. summarize working principles of EDM, EDG and EDW processes
4. illustrate working principles of EBM, LBM and PAM processes
5. adapt working principles of CM and ECM processes

Unit-I Unconventional Machining Processes **10 hours**

Introduction to unconventional machining Processes – classification - Abrasive jet machining, ultra sonic machining process. Plasma Arc Machining - Working principle, Equipment and Characteristics.Water Jet Machining, Abrasive Water Jet Machining.

Unit-II Electric Discharge Machining **9 hours**

EDM Circuits, Electric discharge wire cutting, Electron Beam Machining. Electrochemical Machining - Process, Principle, Equipment, Mechanism and Applications. Introduction to laser, production of laser and laser Beam Machining.

Unit-III Unconventional Welding Processes **10 hours**

Laser Beam Welding, Electron Beam Welding, Ultra-Sonic Welding,Plasma Arc Welding, Explosive Welding, Under Water Welding, Micro Welding Processes.

Unit-IV Unconventional Forming Processes **09 hours**

Explosive forming, Electro hydraulic forming, Electro magnetic forming, Laser Bending, Powder rolling, Spray rolling, Hydro forming, Hydrostatic and Powder extrusion, rotary and isothermal forming.

Unit-V Rapid Prototyping **08 hours**

RP Definition, types of prototypes, Classification of Rapid Prototyping systems. StereolithographySystem, Selective laser sintering, Solid ground curing, Laminated object manufacturing.

Textbooks:

1. Advanced machining processes by VK Jain, Allied publishers.

References:

1. Modern Machining Process, Pandey P.C. and Shah H.S., TMH.
2. New Technology, Bhattacharya A, The Institution of Engineers, India 1984.

PRODUCT LIFECYCLE MANAGEMENT
(Professional Elective –V)

IV-B.Tech-I-Sem. **L T P C**
Subject Code :21L03709 **3 0 0 3**
Pre Requisite: Nil

Course Outcomes: At the end of the course, the student will be able to
1. explain product life cycle management concepts.
2. analyse schemes of concurrent engineering.
3. appraise product data management concepts.
4. adapt PDM system architecture for a case study
5. apply the projects and roles

Unit-I **10 hours**
Product life cycle management – Need for PLM, Components of PLM, Product Data and Product workflow, Drivers for Change, The PLM Strategy, Developing a PLM Strategy, A Five-step Process.

Unit-II **08 hours**
Cost of design changes, Concurrent Engineering, schemes for concurrent engineering like Design for manufacturing and assembly, robust design, failure mode and effect-analysis, Computer aided DFM, Design rules.

Unit-III **08 hours**
Basic functionality of PDM: Information architecture, PDM System architecture, Applications used in PDM systems. Trends in PDM

Unit-IV **08 hours**
Document Management Systems: Document management and PDM, Document life cycle, Content Management. Workflow Management in PDM: Structure Management, Engineering Change Management, Release Management, Version Management, Configuration Management

Unit-V **10 hours**
Creating Product Structures: Part centric approach, CAD centric approach, Product Structure configuration, Managing Product Structures

Textbooks:
1. Product Lifecycle Management Paradigm for century Product Realization - John Stark, SpringerVerlag, 21st, London, 3rd printing -2006
2. Crnkovic, Ivica; Asklund, Ulf; &Dahlqvist, Annita Persson. Implementing and Integrating Product Data Management and Software Configuration Management, Artech House Publishers, 2003.

References:
Burden, Rodger PDM: Product Data Management, Resource Pub, 2003. ISBN 0970035225 Grieves, Michael. Product Lifecycle Management, McGraw-Hill, 2006. ISBN 0071452303

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LAB
(Professional Elective –V)

IV-B.Tech-I-Sem.	**L**	**T**	**P**	**C**
Subject Code : 21S03701	**1**	**0**	**2**	**2**

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

1. prepare Data preprocessing with Weka or Python
2. build Decision Trees for Soybean classification model using Weka or Python
1. apply the knowledge of artificial intelligence and machine learning models along with imageclassifiers and automatic facial recognition using various software tools.

LIST OF EXPERIMENTS

1. Data Preprocessing with Weka or Python
2. Building Decision Trees for Soybean classification model using Weka or Python
3. Generating association rules on Weather data using Weka or Python
4. Exploring machine learning models including classification and clustering using scikitlearn orWeka or Python
5. Build Neural Network Classifier using Weka or Python
6. Supervisely - Perform Data Labeling for various images using object recognition
7. Image Classifier using Tensor Flow or OpenCV
8. Automatic Facial recognition using Microsoft Azure or OpenCV