VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY

Nambur (V), Pedakakani (M), Guntur (Dt.), Andhra Pradesh – 522 508

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE STRUCTURE AND SYLLABUS (R19)

for

B. Tech Mechanical Engineering

(Applicable for batches admitted from 2019-2020)

VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY

(Autonomous)

Approved by AICTE, Permanently Affiliated to JNTUK,

NAAC Accredited with 'A' Grade, ISO 9001:2015 Certified

Nambur (V), Pedakakani (M), Guntur (Dt.), Andhra Pradesh – 522 508

ACADEMIC REGULATIONS (R19) FOR B. TECH. (REGULAR)

Applicable for the students of B. Tech. (Regular) from the Academic Year 2019-20 onwards

The B.Tech Degree of Jawaharlal Nehru Technological University Kakinada, Kakinada shall be conferred on candidates who are admitted to the programme and who fulfill all the requirements for the award of the Degree.

VISION

To impart quality education through exploration and experimentation and generate socially-conscious engineers, embedding ethics and values, for the advancement in science and technology.

MISSION

- To educate students with a practical approach to dovetail them to industry-needs.
- To govern the institution with a proactive and professional management with passionate teaching faculty.
- To provide holistic and integrated education and achieve over all development of students by imparting scientific and technical, social and cognitive, managerial and organizational skills.
- To compete with the best and be the most preferred institution of the studious and the scholarly.
- To forge strong relationships and linkage with the industry.

OBJECTIVES

- Equip the institute with state of the art infrastructure comparable to the best in the industry.
- Tap the resources of the best minds in the field as faculty and visiting faculty.
- Groom students to become global entrepreneurs and responsible citizens.

- Provide financial assistance to meritorious students.
- Requisition the services of the best HR managers to place our students inreputed industries.
- Provide conducive atmosphere to the faculty for Research & Developmentand ensure active participation of the students.

1. Admission Criteria

The eligibility criteria for admission into UG Engineering programmes are as per the norms approved by Government of Andhra Pradesh from time to time. The sanctioned seats in each programme in the college are classified into CATEGORY-A, and CATEGORY-B at 1st year level and only CATEGORY-A at Lateral Entry 2nd year level. The percentages of Category–A, Category-B and Lateral Entry Seats are decided from time to time by the Government of Andhra Pradesh.

- CATEGORY – A (70%): These seats are filled through Convener, EAMCET as per the norms approved by the Government of Andhra Pradesh.
- CATEGORY – B (30%): These seats are filled by the College as per the norms approved by the Government of Andhra Pradesh.
- Lateral Entry: Lateral entry candidates shall be admitted into the Third semester directly as per the norms approved by the Convener, ECET, and Government of Andhra Pradesh.

2. Award of B. Tech. Degree

A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

- A student after securing admission shall complete the B.Tech programme in a minimum of four academic years (8 Semesters), and a maximum period of eight academic years starting from the date of commencementof first year first semester, failing which student shall forfeit seat in B.Tech Course. Each student shall secure 160 credits (with CGPA>=4) required for the completion of the under graduate programme and awardof B.Tech Degree.

3. Courses of Study

The following courses of study are offered at present as specializations for the B. Tech. Courses

S. No	Branch	Branch Code	Intake
1	Civil Engineering	01	120
2	Electrical and Electronics	02	180
3	Mechanical Engineering	03	180
4	Electronics and Communication	04	180
5	Computer Science and Engineering	05	240
6	Information Technology	12	180

4. Distribution and Weightage of Marks

i) The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory subject and 75 marks for practical subject. The Mini project work shall be evaluated for 50 marks and the Major Project work shall be evaluated for 150 Marks.

ii) For theory subjects the distribution shall be 40 marks for Internal Evaluation and 60 marks for the Semester End Examinations.

iii) For theory subjects, during the semester there shall be two internal Mid Examinations. The weightage of internal marks for 40 consists of Descriptive Test – 15 Marks, Assignment Test- 10 Marks (Open book system with questions of L4 standard on Bloom's scale), Objective Test - 10 Marks and Subject Seminar 5 marks.The Descriptive Test is for 90 minutes duration conducted for 30 marks and will be scaled down to 15 Marks. Each Descriptive test question paper shall contain 3 questions, one question from each unit and all questions need to be answered. All the questions shouldbe mapped to all levels of Blooms Taxonomy.

- The Assignment Test conducted for 20 Marks and will be scaled down to 10 Marks. The test is open book system and the duration of the exam is 60 minutes. The assignment question paper contains 3 questions given by the subject teacher concerned and all questions should be answered. Students can bring a maximum of three printed text books related to that subject. (Soft copies of the text books will not be allowed.) The assignments have to provide broadened exposure to the course. The questions shall include problem solving approach, problem analysis & design, implementation, case studies etc.
- The objective examination is for 20 minutes duration. (Conducted with 20 multiple choice question with a weightage of ½ Mark each)
- For the subject seminar, marks of each student shall be evaluated based on the presentation on any topic of his/her choice in the subject duly approved by the faculty member concerned.
- Internal Marks shall be calculated with 70% weightage for better of the two Mid Exams and 30% weightage for other.

iv) The Semester End Examination shall be conducted for 3 hours duration. The question paper shall be given in the following pattern: The question paper contains one question from each unit with internal choice. Each question carries 12 marks. Each course shall consist of five units of syllabus. The questions shall be framed in line with the Course Outcomes defined and cognitive levels.

v) For practical subjects there shall be continuous evaluation during the semester for 25 marks and 50 Marks for Semester end examination. The internal 25 marks shall be awarded as follows: day to day work - 05 marks, Record-05 marks and the remaining 15 marks are to be awarded by conducting an internal laboratory test of 3 hours duration. The semester end examination for laboratory courses shall be conducted for three hour duration at the end of semester for 50 marks as follows: Procedure - 10 marks, Experiment/Program execution – 15 Marks, Results-10 Marks and Viva-voice -15 Marks. For laboratory course in English 30 marks for written exam which includes listening comprehension and 20 marks for viva which includes JAM and Group Discussion.

vi) For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 40 marks for internal evaluation (20 marks for day–to– day work, and 20 marks for internal tests) and 60 marks for end examination. There shall be two internal tests in a Semester and the Marks for 20 can be calculated with 70% weightage for better of the two performances and 30% weightage for other and these are to be added to the marks obtained in day-to-day work.

vii) For Engineering Project for Community services / Mini Project, there shall be continuous evaluation during the semester for 20 marks and semester end evaluation for 30 marks. The distribution of continuous evaluation marks is as follows: Day to Day Assessment- 05 Marks and average of two reviews of 15 Marks each.The distribution of semester end examination marks for Engineering Project for Community services/Mini Project is as follows: Report -10 Marks and Presentation and Viva Voce – 20 Marks.

vii) For Major Project, there shall be continuous evaluation during the semester for 50 marks and semester end evaluation for 100 marks The distribution of continuous evaluation marks is as follows: Day-to-day Assessment- 30 Marks and average of at least two reviews of 20 Marks each. The Departmental review committee consists of HoD, Two senior Faculty and supervisor concerned.The semester end examination for Major Project work shall be conducted at the end of VIII Semester. It is evaluated by the Committee consisting of an external examiner, Head of the Department, Senior Faculty and Supervisor of the Project

viii) Laboratory marks and the internal marks awarded by the faculty are final. However, any grievance regarding marks will be addressed by theresult committee if necessary. The recommendations of the committee are final and binding.

ix) MOOCS Courses: All students are eligible to register and complete MOOCS courses relevant to their professional electives listed by therespective departments in the curriculum.However, if any student fails to complete a MOOCS course, or the course is not offered by the agency concerned, that student is eligible to attend the examination following the same syllabus and pattern of examination in the VIII semester.The MOOCS grades awarded to the student by the agency are converted to the course grades based on the percentage of marks obtained. The duration for course registered under MOOCS should range between 8 to 12 Weeks.

x) A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Industrial Oriented Mini Project/Summer Internship/practical training, if the student secures not less than 40% of marks (i.e., 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if he/she (i) does not submita report on Industrial Oriented Mini Project/Summer Internship, or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) does not present the seminar as required, or (iii) secures less than 40% of marks in Industrial Oriented Mini Project/Summer Internship and project seminar evaluations. A student may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such ‘one reappearance’ evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

5. Attendance Requirements

- Students shall put in a minimum average attendance of 75% in the semester. Condonation of shortage in attendance may be recommended by respective Heads of Departments on genuine medical grounds, provided the student puts in at least 65% attendance provided the Principal is satisfied with the genuineness of the reasons and the conduct of the student.
- Students, having more than 65% and less than 75% of attendance, shall have to pay requisite fee towards condonation.
- Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled. They will not be promoted to the next semester. They may rejoin in that semester in which the student is detained by getting approval from the principal.

- If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible readmit into the same class.

6. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to theattendance requirements mentioned in item No.5

- A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to each theory/practical design/drawing subject/project and secures not less than 35% of marks in the end semester exam, and minimum 40% of marks in the sum total of the internal marks and end semesterexamination marks.
- A student shall be promoted from first year to second year if he fulfills the minimum attendance requirement.
- A student will be promoted from II year to III year if he fulfills the academic requirement of 40% of the credits up to II B.Tech II semester from all the examinations.
- A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to III year II semester from all the examinations.
- A student shall register and put up minimum attendance in all 160 credits and earn all 160 credits.Break in Study: Student who discontinues the studies for whatever may be the reason, can get readmission into appropriate semester of B. Tech programme after break in study, with the prior permission of the Principal and following the transitory regulations applicable to each batch in which he/she joins. A student may utilize this break in study (Maximum of Two years) only once in the entire period of B. Tech program.

7. Course Pattern

- The entire course of study is for four academic years, all the years are on semester pattern and the medium of instruction is English.

- A student who eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conducted next.
- When a student is detained for lack of credits/shortage of attendance, he may be readmitted in to the same semester in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

8. CGPA

The grade points and letter grade will be awarded to each course based on students' performance as per the grading system shown in the following Table.

% of Marks (Theory/Lab)	**Letter Grade**	**Level**	**Grade Points**
≥ 90	**O**	Outstanding	10
≥ 80 to <90	**S**	Excellent	9
≥ 70 to <80	**A**	Very Good	8
≥ 60 to <70	**B**	Good	7
≥ 50 to <60	**C**	Fair	6
≥ 40 to <50	**D**	Satisfactory	5
<40	**F**	Fail	0
ABSENT	**AB**	Absent	0

Computation of SGPA

- The performance of each student at the end of the each semester is indicated in terms of Semester Grade Point Average(SGPA)calculated as shown in below equation (1).
  - --**SGPA (Si) = ∑ (Ci X Gi) / ∑ Ci** ---(1)
- Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Computation of CGPA

- The Cumulative Performance of each student at the end of each semester is indicated in terms of CGPA is calculated as shown in equation (2).

  - ---**CGPA = ∑ (Ci X Si) / ∑ Ci**---(2)

- Where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.

- The SGPA and CGPA shall be rounded off to 2 decimal points andreported in the transcripts.

- The approximate equivalence of marks to a given CGPA is calculated byusing the formula:

  - Percentage Equivalence of CGPA = [CGPA – 0.5] x 10

9. <u>Award of Class</u>

The criterion for award of division, after successful completion of program is as shown in the following table.

Class Awarded	CGPA to be secured	
First Class with distinction*	≥7.75	**From the CGPAsecured from 160 credits**
First Class	≥6.5 - <7.75	
Second Class	≥5.5 - <6.5	
Pass Class	≥4 - <5.5	
Fail	<4	

- Awarded only if all the credit courses prescribed are cleared within four years for regular candidates and three years for lateral entry candidates

- The students who are approved for break in study for entrepreneurships/start-ups will also be considered for award of first class with distinction

- For the purpose of awarding First, Second and Pass Class, CGPA obtained in the examinations appeared within the maximum period allowed for the completion of the program shall been considered.

10. Minimum Days of Instructions

Each semester consists of a minimum of 90 instruction days excluding examination days.

11. Transfer of Branch

There shall be no branch transfer after the completion of the first year admission process.

12. Withholding of results

If the student has not paid any dues to the college or if any case of indiscipline is pending against him/her, the result of the student will be withheld. His/her degree will be withheld in such cases.

13. Transitory Regulations

A candidate, who is detained or discontinued a semester, on re-admission shall be required to pass all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently and the academic regulations be applicable to him/her which are in force at the time of his/her admission. However, exemption will be given to those candidates who have already passed in such courses in the earlier semester(s) and additional courses are to be studied as approved by Board of Studies and ratified by Academic Council.

14. Amendments to Regulations

Revisions of Regulations, Curriculum and Syllabi

The college may from time to time revise, amend or change the Regulations, Curriculum, Syllabus and Scheme of examinations through the Board of Studies with the approval of Academic Council and Governing Body of the college.

15. Transferred Students

The students seeking transfer to VVIT from various Universities/ Institutions have to obtain the credits of any equivalent subjects as prescribed by the Academic Council. Only the internal marks obtained in the previous institution will be considered for evaluation of failed subjects.

ACADEMIC REGULATIONS (R19) FOR B. TECH.

(LATERAL ENTRY SCHEME)

Applicable for the students admitted into II year B. Tech. from the Academic Year 2020-21 onwards

1. Award of B. Tech. Degree

A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

- A student shall be declared eligible for the award of the B. Tech Degree, if he pursues a course of study in not less than three academic years and not more than six academic years.
- The candidate shall register for 120 credits and secure all the 120 credits. The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech Lateral Entry Students.

2. Promotion Rule

- A student shall be promoted from second year to third year if he fulfills the minimum attendance requirement.
- A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to III year II semester fromall the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

3. Award of Class

After a student has satisfied the requirement prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured	From the CGPA secured from 121 credits for CE,EEE and MECH Branches, 119.5 credits for ECE,CSE & IT Branches
First Class with distinction*	≥7.75	
First Class	≥6.5 - <7.75	
Second Class	≥5.5 - <6.5	
Pass Class	≥4 - <5.5	
Fail	<4	

All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B. Tech Lateral Entry Scheme.

MALPRACTICE RULES

DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

S.No.	Nature of Malpractices/Improper conduct	Punishment
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 University.
3.	Impersonates any other candidate in connection withthe examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical 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 University 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 Answerbook 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 University 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 Chief Superintendent /Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination	

	hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the 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 forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

7.	Leaves the exam hall taking away answer script or intentionally tears 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 University 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 forfeits 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 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 forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examinationhall.	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 University for further action to award suitable punishment.	

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

- Ragging within or outside any educational institution is prohibited.
- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of 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. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing hurt	2 Years	+	Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	10 Months	+	Rs. 50,000/-

In case any emergency call Toll Free No. 1800 425 1288

LET US MAKE VVIT A RAGGING FREE CAMPUS

Ragging

ABSOLUTELY NO TO RAGGING

1. Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.
2. Ragging entails heavy fines and/or imprisonment.
3. Ragging invokes suspension and dismissal from the College.
4. Outsiders are prohibited from entering the College and Hostel without permission.
5. Girl students must be in their hostel rooms by 7.00 p.m.
6. All the students must carry their Identity Cards and show them when demanded
7. The Principal and the Wardens may visit the Hostels and inspect the rooms any time.

In case any **emergency** call Toll Free No. 1800 425 1288
LET US MAKE VVIT A RAGGING FREE CAMPUS

Department of Mechanical Engineering

B.Tech. 1st Year Proposed Course Structure (w.e.f AY 2019-20)

I Year I Semester (Semester-1)

S. No.	Course Code	Course Title	L	T	P	Credits
1	HS1101	Communicative English (Common to ALL)	2	1	0	3
2	BS1101	Mathematics – I (Common to ALL)	3	0	0	3
3	BS1102	Engineering Physics	3	0	0	3
4	ES1101	Programming for Problem Solving Using C (Common to ALL)	3	0	0	3
5	ES1102	Engineering Graphics (Common EEE, ME & ECE)	1	0	3	2.5
6	BS1102L	Engineering Physics Lab	0	0	3	1.5
7	ES1101L	Programming for Problem Solving Using C Lab (Common to ALL)	0	0	3	1.5
8	HS1101L	Communicative English Lab-I (Common to ALL)	0	0	3	1.5
9	MC1101	Constitution of India (Common to EEE, ME & ECE)	3	0	0	0
		Total Credits				**19**

Category	CREDITS
Basic Science Course	7.5
Engineering Science Course	7.0
Humanities and Social Science	4.5
Mandatory Course	0.0
TOTAL CREDITS	**19.0**

I Year II Semester (Semester-2)

S. No.	Course Code	Course Title	L	T	P	Credits
1	BS1201	Mathematics - II (Common to ALL)	2	1	0	3
2	BS1202	Mathematics - III (Common to ALL)	2	1	0	3
3	BS1203	Engineering Chemistry	3	0	0	3
4	ES1201	Engineering Mechanics (Common to CE & ME)	3	0	0	3
5	ES1202	Basic Electrical and Electronics Engineering (common to CE, ME, CSE& IT)	3	0	0	3
6	ES1203L	Engineering Workshop (Common to EEE, ME &ECE)	0	0	3	1.5
7	BS1203L	Engineering Chemistry Lab	0	0	3	1.5
8	ES1202L	Basic Electrical and Electronics Engineering Lab (common to CE, ME, CSE& IT)	0	0	3	1.5
9	HS1201L	Communicative English Lab - II (Common to ALL)	0	0	3	1.5
10	MC1201	Environmental Science (Com. to EEE, ME & ECE)	3	0	0	0
		Total Credits				**21**

Category	CREDITS
Basic Science Course	10.5
Engineering Science Course	09
Humanities and Social Science	1.5
Mandatory Course	0.0
TOTAL CREDITS	21

II Year I Semester (Semester-3)

S. No.	Course Code	Course Title	L	T	P	Credits
1	BS2101	Complex Variables and Statistical Methods (Common to CE, EEE, ME & ECE)	3	0	0	3
2	PC2101	Mechanics of Solids	3	0	0	3
3	PC2102	Material Science and Metallurgy	3	0	0	3
4	PC2103	Production Technology	3	0	0	3
5	PC2104	Thermodynamics	3	0	0	3
6	ES2101	Computer Aided Advanced Engg. Drawing	1	0	3	2.5
7	PC2103L	Production Technology Lab	0	0	3	1.5
8	PC2105L	Metallurgy & Mechanics of Solids Lab	0	0	3	1.5
9	MC2101	Essence of Indian Traditional Knowledge (Common to ALL)	2	0	0	0
		Total Credits				20.5

Category	**CREDITS**
Basic Science Course	3
Professional Core courses	15
Engineering Science Course	2.5
Mandatory Course	0.0
TOTAL CREDITS	20.5

II Year II Semester (Semester-4)

S.No	Course Code	Course Title	L	T	P	Credits
1	PC2201	Kinematics of Machinery	3	0	0	3
2	PC2202	Applied Thermodynamics	3	0	0	3
3	PC2203	Fluid Mechanics and Hydraulic Machines	3	0	0	3
4	PC2204	Design of Machine Members-I	3	0	0	3
5	ES2201	Python Programming	3	0	0	3
6	PC2202L	Thermal Engineering Lab	0	0	3	1.5
7	PC2203L	Fluid Mechanics and Hydraulic Machines Lab	0	0	3	1.5
8	PC2205	Machine Drawing	0	0	3	1.5

9	ES2201L	Python Programming Lab	0	0	3	1.5
10	PR2201	Socially relevant project	0	0	2	0.5
		Total Credits				21.5

Category	**CREDITS**
Professional Core courses	17
Engineering Science Course	4.5
Socially relevant project	0
TOTAL CREDITS	21.5

III Year I Semester (Semester-5)

S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	PC3101	Dynamics of Machinery	3	0	0	3
2	PC3102	Design of Machine Members-II	3	0	0	3
3	PC3103	Metal Cutting and Machine Tools	3	0	0	3
4	PC3104	Finite Element Methods	3	0	0	3
5	ES3101	Internet of Things	3	0	0	3
6	ES3101L	Internet of Things Lab	0	0	3	1.5
7	PC3101L	Theory of Machines Lab	0	0	3	1.5
8	PC3103L	Machine Tools Lab	0	0	3	1.5
		Total Credits				19.5

Category	CREDITS
Professional Core courses	15
Engineering Science Course	4.5
TOTAL CREDITS	19.5

III Year II Semester (Semester-6)

S. No	Course Code	Course Title	L	T	P	Credits
1	OE320X	OPEN ELECTIVE -I	3	0	0	3
2	PC3201	Heat Transfer	3	0	0	3
3	HS3201	Managerial Economics and Financial Accountancy (Common to EEE & ME)	3	0	0	3
4	PE320X	Professional Elective- I	3	0	0	3
5	PE320X	Professional Elective- II	3	0	0	3
6	PC3201L	Heat Transfer Lab	0	0	3	1.5
7	PC3202L	Simulation Lab	0	0	3	1.5
8	PR3201	Mini Project	0	0	6	3
		Total Credits				21

SUMMER INTERNSHIP

(INTER SEMESTER)

S. No.	Course Code	Course Title	L	T	P	Credits
1	PROJ- ME	Summer Internship	0	0	60 Hrs	0

Category	CREDITS
Professional Core courses	6
Professional Elective courses	6
Open Elective courses	3
Humanities and Social Science	3
Mini Project	3
TOTAL CREDITS	21

IV Year I Semester (Semester-7)

S. No.	Course Code	Course Title	L	T	P	Credits
1	HS4101	Management Science (Common to ME & EEE)	3	0	0	3
2	PE410X	Professional Elective- III	3	0	0	3
3	PE410X	Professional Elective- IV	3	0	0	3
4	OE410X	OPEN ELECTIVE -II	3	0	0	3
5	PC4101	Instrumentation Control Systems and Engineering Metrology	3	0	0	3
6	PC4101L	Instrumentation Control Systems and Engineering Metrology Lab	0	0	2	1.5
7	PR4101	Project 1	0	0	6	3
		Total Credits				19.5

Category	CREDITS
Professional Core courses	4.5
Humanities and Social Science	3
Professional Elective courses	6
Open Elective courses	3
Project	3
TOTAL CREDITS	19.5

IV Year II Semester (Semester-8)

S. No.	Course Code	Course Title	L	T	P	Credits
1	PE420X	Professional Elective- V	3	0	0	3
2	PE420X	Professional Elective- VI	3	0	0	3
3	OE420X	OPEN ELECTIVE -III	3	0	0	3
4	OE420X	OPEN ELECTIVE -IV	3	0	0	3
5	PR4201	Project 2	0	0	12	6
		Total Credits				18

Category	**CREDITS**
Professional Elective courses	6
Open Elective courses	6
Project	6
TOTAL CREDITS	18

PROFESSIONAL ELECTIVES

Professional Elective- I PE320X	**Professional Elective- II** PE320X	**Professional Elective- III** PE410X	**Professional Elective- IV** PE410X	**Professional Elective- V** PE420X	**Professional Elective- VI** PE420X
Composite Materials	Advanced Mechanics of Solids	Mechanical Vibrations	Automation in Manufacturing	Industrial Robotics	Condition Monitoring
Refrigeration & Air Conditioning	. Power Plant Engineering	CAD/CAM	Additive Manufacturing	Gas Dynamics and Jet Propulsion	Computational Fluid Dynamics
Advanced Manufacturing Processes	Design for Manufacturing & Assembly	Renewable Energy Sources	Automobile Engineering	Nano Materials	Non Destructive Evaluation
Statistical Quality Control	Mechatronics	Production Planning Control	Optimization Techniques	Reliability Engineering	Industrial Hydraulics and Pneumatics

OPEN ELECTIVES OFFERED BY DEPARTMENT

Open Elective- I OE320X	**Open Elective- II** OE410X	**Open Elective- III** OE420X	**Open Elective- IV** OE420X
MEMS	Indusrial psychology	Green Energy Systems	Total Quality Management
Optimization methods	Safety Engineering	Robotics	Supply Chain Management
Operations Management	Basics of Fluid Mechanics and Heat Transfer	Energy Consumption and Management	Product Design & Development
Nano Technology	Traditional and Modern Machining	IPR& Patents	Entrepreneurship

Category	**CREDITS**
Basic Science Course	21
Engineering Science Course	27.5
Humanities and Social Science	12
Professional core courses	57.5
Professional Elective courses	18
Open Elective courses	12
Summer Internships and Projects	12
Mandatory Courses	00
TOTAL CREDITS	160

I-Year-I Semester	COMMUNICATIVE ENGLISH	L	T	P	C
HS1101		3	0	0	3

(Common to All Branches)

Course Objectives

- Adopt activity based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions.
- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Course Outcomes

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

CO1. identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English (L3)

CO2. formulate sentences using proper grammatical structures and correct word forms (L3)

CO3. speak clearly on a specific topic using suitable discourse markers in informal discussions (L3)

CO4. write summaries based on global comprehension of reading/listening texts (L3)

CO5. produce a coherent paragraph interpreting a figure/graph/chart/table (L4)

CO6. take notes while listening to a talk/lecture to answer questions (L3)

Syllabus Blueprint

Contents	Learning Outcomes	Bloom's Level	No of Hrs
Unit-1 **Listening:** Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. **Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information. **Reading for Writing:** Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.	1. Identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English 2. ask &answer general questions on familiar topics 3. employ suitable strategies for skimming &scanning to get the general idea of a text and specific information 4. recognize paragraph structure with beginnings/endings 5. form sentences using proper grammatical structures and correct word forms	L3 L2 L3 L3 L3	10
Unit-2 **Listening:** Answering a series of questions about main idea and supporting ideas after listening to audio texts. **Speaking:** Discussion in pairs/ small groups on specific topics followed by short structured talks. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. **Writing:** Paragraph writing	1. comprehend short talks on general topics 2. speak clearly on a specific topic using suitable discourse markers in informal discussions 3. understand the use of cohesive devices for better reading comprehension 4. write well-structured paragraphs on specific topics	L2 L3 L2	10

(specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters. **Grammar and Vocabulary:** Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.	5. make necessary grammatical corrections in short texts	L3 L3	
Unit-3 **Listening:** Listening for global comprehension and summarizing what is listened to. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed **Reading:** Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. **Grammar and Vocabulary:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.	1. summarize the content with clarity &precision from short talks 2. report what is discussed in informal discussions 3. infer meanings of unfamiliar words using contextual clues 4. write summaries based on global comprehension of reading/ listening texts 5. use correct tense forms, appropriate structures and a range of reporting verbs in speech and writing	L3 L3 L3 L3 L3	10
Unit-4 **Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.	1. infer &predict about content of spoken discourse 2. engage in formal/informal conversationsunderstanding verbal &non-verbal features of communication 3. interpret graphic elements used in academic texts 4. produce a coherent paragraph interpreting a figure / graph / chart / table 5. use language appropriate for description and interpretation of graphical elements	L4 L3 L2 L4	10

Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms		L4	
Unit-5 **Listening:** Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. **Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides. **Reading:** Reading for comprehension. **Writing:** Writing structured essays on specific topics using suitable claims and evidences **Grammar and Vocabulary:** Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)	1. take notes while listening to a talk/lecture to answer questions 2. make formal oral presentations using effective strategies 3. produce a well-organized essay with adequate details 4. edit short texts by correcting common errors	L3 L3 L3 L4	10

Detailed Syllabus

Unit 1 A Proposal to Girdle the Earth (Excerpt) by Nellie Bly

Theme: Exploration

1. **"How to Fashion Your Own Brand of Success" by Howard Whitman**
2. **"How to Recognize Your Failure Symptoms" by Dorothea Brande**

Listening

- identifying thetopic, the context and specific pieces of information

Speaking

- introducing oneself and others

Reading

- skimming for main ideas
- scanning for specific pieces of information

Writing/ Reading for Writing

- paragraphs, beginnings, introducing the topic, key words, main idea

Grammar and Vocabulary

- content words and function words
- word forms: verbs, nouns, adjectives and adverbs
- nouns: countable and uncountable; singular and plural forms
- basic sentence structures; simple question form: why-questions; word order in sentences

Learning Outcomes

- understand social or transactional dialogues spoken by native and non-native speakers of English and identify the context, topic, and pieces of specific information.
- ask and answer general questions on familiar topics and introduce oneself/others
- employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- recognize paragraph structure and be able to match headings/main ideas with paragraphs
- form sentences using proper grammatical structures and correct word forms

Unit 2 An excerpt from The District School As It Was by One Who Went to It by Warren Burton

Theme: On Campus

- "How to Conquer the Ten Most Common Causes of Failure" by Lois Binstock
- "How to Develop Your Strength to Seize Opportunities" by Maxwell Maltz

Listening

- answering a series of questions about main idea and supporting ideas after listening to audio texts

Speaking

- discussion in pairs/ small groups on specific topics; preparing and delivering short structured talks using suitable cohesive devices

Reading

- identifying sequence of ideas

- recognizing verbal techniques that help link the ideas in a paragraph

Writing/ Reading for Writing

- paragraph writing (specific topics) using suitable cohesive devices; using key words/phrases and organizing points in a coherent manner
- mechanics of writing: punctuation, capital letters

Grammar and Vocabulary

- cohesive devices-linkers, sign posts and transition signals
- use of articles and zero articles
- prepositions

Learning Outcomes

- comprehend short talks on general topics
- participate in informal discussions and speak clearly on a specific topic using suitable discourse markers
- understand the use of cohesive devices for better reading comprehension
- write well-structured paragraphs on specific topics using suitable cohesive devices
- identify basic errors of grammar/usage and make necessary corrections in short texts

Unit 3 The Future of Work?

Theme: Working Together

- **"How to Make the Most of Your Abilities" by Kenneth Hildebrand**
- **"How to Raise Your Self-Esteem and Develop Self-Confidence" by James W. Newman**

Listening

- listening for global comprehension
- summarizing what is listened to

Speaking

- discussing specific topics in pairs/ small groups
- reporting what is discussed

Reading

- reading a text in detail by making basic inferences

- recognizing and interpreting specific context clues
- strategies to use text clues for comprehension

Writing/ Reading for Writing

- summarizing-identifying main idea/s
- rephrasing what is read
- avoiding redundancies and repetitions

Grammar and Vocabulary

- Verbs-tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes

Learning Outcomes

- comprehend short talks and summarize the content with clarity and precision
- participate in informal discussions and report what discussed
- infer meanings of unfamiliar words using contextual clues
- write summaries based on global comprehension of reading/listening texts
- use correct tense forms, appropriate structure and a range of reporting verbs in speech and writing.

Unit 4 H.G Wells and the Uncertainties of Progress by Peter J. Bowler

Theme: Fabric of Change

- **"How to Win Your War Against Negative Feelings" by Dr Maxwell Maltz**
- **"How to Find the Courage to Take Risks" by Drs Tom Rust and Randy Reed**

Listening

- making predictions while listening to conversations/transactional dialogues without video
- listening with video

Speaking

- role plays for practice of conversational English in social and academic contexts (formal & informal)
- asking for and giving information/directions/instructions/suggestions

Reading

- understand and interpret graphic elements used in texts (convey information, reveal trends/patterns/relationships, communicate processes or display data)

Writing/ Reading for Writing

- information transfer
- describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables

Grammar and Vocabulary

- quantifying expressions-adjectives and adverbs
- comparing and contrasting
- degrees of comparison
- use of antonyms

Learning Outcomes

- make inferences and predictions while listening to spoken discourse
- understand verbal and non-verbal features of communication and hold formal / informal conversations
- interpret graphic elements used in academic texts
- produce a coherent paragraph interpreting a figure/graph/chart/table
- use language appropriate for description and interpretation of graphical elements

Unit 5 Leaves from the Mental Portfolio of a Eurasian by Sui Sin Far

Theme: Tools for Life

9. **"How to Become a Self-Motivator" by Charles T Jones**
10. **"How to Eliminate Your Bad Habits "by OgMandino**

Listening

- identifying the key terms
- understanding concepts
- answering a series of relevant questions that test comprehension

Speaking

- formal oral presentations on topics from academic contexts-without the use of PPT slides

Reading

- reading for comprehension

Writing/ Reading for Writing

- writing structured essays on specific topics using suitable claims and evidences

Grammar and Vocabulary

- reinforcing learning: articles, prepositions, tenses, subject-verb agreement

Learning Outcomes

- take notes while listening to a talk/lecture and make use of them to answer questions
- make formal oral presentations using effective strategies
- comprehend, discuss and respond to academic texts oral and in writing
- produce a well-organized essay with adequate support and detail
- edit short texts by correcting common errors

*****

I-Year-I Semester		L	T	P	C
		3	0	0	3
MATHEMATICS – I (Calculus)					

(Common to ALL branches)

Course Objectives:

1) This course will illuminate the students in the concepts of calculus.
2) To enlighten the learners in the concept of differential equations and multivariable calculus.
3) To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

UNIT-1:

DIFFERENTIAL EQUATIONS OF FIRST ORDER AND FIRST DEGREE: 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 – Orthogonal trajectories – Electrical circuits.

UNIT-2:

LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER: Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, $\sin ax$, $\cos ax$, polynomials in x^n , $e^{ax}V(x)$ and $x^nV(x)$ - Method of Variation of Parameters.
APPLICATIONS: LCR circuit – Simple harmonic motion

UNIT-3:

MEAN VALUE THEOREMS: 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.

UNIT-4:

PARTIAL DIFFERENTIATION: Introduction – Homogeneous function – Euler's theorem **-** Total derivative – Chain rule – Jacobian – Functional dependence – Taylor's and Mc Laurent's series expansion of functions of two variables.

APPLICATIONS: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

UNIT-5:

MULTIPLE INTEGRALS: Double integrals (Cartesian and Polar) – Change of order of integration – Change of variables (Cartesian to Polar) –Triple integrals.

APPLICATIONS: Areas by double integrals and Volumes by triple integrals.

TEXT BOOKS:

1) **B.S. Grewal,** Higher Engineering Mathematics, 44^{th} Edition, Khanna Publishers.
2) **B.V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

REFERENCE BOOKS:

1) **H. K. Das,** Advanced Engineering Mathematics, 22^{nd} Edition, S. Chand & Company Ltd.
2) **Erwin Kreyszig**, Advanced Engineering Mathematics, 10^{th} Edition, Wiley-India.

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

CO1 : solve the differential equations related to various engineering fields.

CO2 : utilize mean value theorems to real life problems.

CO3 : familiarize with functions of several variables which is useful in optimization.

CO4 : apply double integration techniques in evaluating areas bounded by region.

CO5 : learn important tools of calculus in higher dimensions. Students will become familiar with 2-dimensional and 3 – dimensional coordinate systems.

I-Year-I Semester		L	T	P	C
		3	0	0	3
ENGINEERING PHYSICS					

Course Objectives:

Engineering Physics curriculum which is re-oriented to the needs of non-circuital branches of graduate engineering courses offered by Vasireddy Venkatadri Institute of Technology, which serves as a transit to understand the branch specific advanced topics.

The course is designed to:

1) Impart Knowledge of physicaloptics phenomena like Interference and Diffraction required to design instruments with higher resolution.
2) Impart knowledge in basic concepts of LASERs and Holography along with their engineering applications
3) Impart the knowledge of materials with characteristic utility in appliances.
4) Impart the knowledge on acoustic quality of concert halls and concepts of flaw detection techniques using ultrasonics.
5) Study the structure- property relationship exhibited by solid materials within the elastic limit.

UNIT-I:

WAVE OPTICS : Interference : PrincipleofSuperposition-Interferenceoflight Conditions for sustained Interference-Interference in thin films (reflected geometry) - Newton's Rings (reflected geometry)

DIFFRACTION: Fraunhofer Diffraction: - Diffraction due to single slit (quantitative), double slit(qualitative), N –slits(qualitative) and circular aperture (qualitative) – Intensity distribution curves - Diffraction grating – Grating spectrum – missing order– resolving power – Rayleigh's criterion – Resolving powers of Microscope(qualitative), Telescope(qualitative) and grating (qualitative).

UNIT– II:

LASERS AND HOLOGRAPHY LASERs: Interaction of radiation with matter – Spontaneous and Stimulated emission of radiation – population inversion – Einstein's coefficients & Relation between them and their significance - Pumping Mechanisms - Ruby laser – Helium-Neon laser – Applications.

HOLOGRAPHY: Introduction – principle – differences between photography and holography – construction and reconstruction of hologram – applications of holograms

UNIT-III :

MAGNETISM AND DIELECTRICS : Magnetism: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment – Bohr magneton-Classification of magnetic materials: Dia, para & Ferro – Domain concept of Ferromagnetism - Hysteresis – soft and hard magnetic materials – applications of Ferromagnetic material.

DIELECTRICS: Introduction- Dielectricpolarization, Dielectric polarizability, Susceptibility and Dielectricconstant- Types of polarizations: Electronic and Ionic (Quantitative), Orientation Polarizations (Qualitative) - Lorentz Internal field-Claussius –Mossotti's equation- Frequency dependence of polarization - Applications of dielectrics.

UNIT-IV:

ACOUSTICS AND ULTRASONICS : Acoustics: Introduction – Reverberation - Reverberation time - Sabine's formula–absorption coefficient and its determination- factors affecting acoustics of buildings and their remedies.

ULTRASONICS: Properties –Production of ultrasonics by Magnetostriction & Piezoelectric methods – Non-Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays–applications.

UNIT-V:

ELASTICITY: Stress & strain —stress &strain curve– generalized Hooke's law – different types of moduli and their relations – bending of beams – Bending moment of a beam – Depression of cantilever.

TEXT BOOKS:

1) "Engineering Physics" by B. K. Pandey, S. Chaturvedi - Cengage Publications, 2012

2) "A Text book of Engineering Physics" by M.N. Avadhanulu, P.G.Kshirsagar - S.Chand, 2017.

3) "Engineering Physics" by D.K.Bhattacharya and Poonam Tandon, Oxford press (2015).

4) "Engineering Physics" by R.K Gaur. and S.L Gupta., - Dhanpat Rai publishers, 2012.

REFERENCE BOOKS:

1) "Engineering Physics" by M.R.Srinivasan, New Age international publishers (2009).

2) "Optics" by AjoyGhatak, 6th Edition McGraw Hill Education, 2017.

3) "Solid State Physics" by A.J.Dekker, Mc Millan Publishers (2011).

COURSE OUTCOMES: After completing this course, Students will be able to

CO1 : **Understand** the principles such as interference and diffraction to design and enhance the resolving power of various optical instruments.

CO2 : **Learn** the basic concepts of LASER light Sources and Apply them to holography

CO3 : **Study** the magnetic and dielectric materials to enhance the utility aspects of materials.

CO4 : **Analyze** acoustic properties of typically used materials in buildings

CO5 : **Understand** the concepts of shearing force and moment of inertia

<table>
<tr><td rowspan="2">I-Year-I Semester</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="6">PROGRAMMING FOR PROBLEM SOLVING USING C</td></tr>
</table>

(Common to All Branches)

COURSE OBJECTIVES:

1) To familiarize to notion of an algorithm, editing and executing programs in Linux.
2) To Understanding branching, iteration.
3) To represent Data using arrays.
4) To use Modular programming and recursive solution formulation.
5) To familiarize pointers and dynamic memory allocation.
6) To handle data through files

UNIT-I:

INTRODUCTION TO C: Introduction to Computers: hardware, Memory hierarchy, Types of Computers, Types of Software – Operating Systems, Translators, Device drivers and packages. Algorithms and its characteristics, Program development steps. Structure of a C program, Features of C, The main () Function, Standard I/O functions.

PROGRAMMING STYLE - Indentation, Comments, Identifiers, Data Types**,** Operators, Precedence and Associativity. Variables and Declarations, Format Modifiers, Escape Sequences, Types of Statements

CASTING - Implicit Type Conversions, Explicit Type Conversions, Mathematical Library Functions

UNIT-II:

CONTROL FLOW & MODULES : Selection: if-else Statement, nested if, examples, Multi-way selection: switch, else-if, examples. **Repetition**: Basic Loop Structures, Pre-test and Post-test Loops, Counter-Controlled andCondition-Controlled Loops, for, while and do while.

BRANCHING: break & continue.

MODULAR PROGRAMMING: Function and Parameter Declarations, Returning a Value, Types of parameters. Parameter – scalar data as argument.

RECURSION: Definition, Base condition for recursion, Mathematical Recursion, Recursion versus Iteration.

UNIT-III :

ARRAYS & STRINGS: **Arrays:** Introduction to Arrays, Input and Output of Array Values, Array Initialization, Arrays as Function Arguments, Two-Dimensional Arrays, Larger Dimensional Arrays- Matrices, 1D & 2D arrays as arguments.

STRINGS: String Fundamentals, String Input and Output, String Processing, Library Functions, Strings as arguments.

UNIT – IV :

POINTERS & STRUCTURES : Pointers: Concept of a Pointer, Initialization of Pointer variables, Pointers as function arguments, Passing by address, Dangling memory, Pointer Arithmetic, Character pointers, Pointers to Pointers, Array of pointers & Pointer to array, Dynamic memory management functions, Command line Arguments.

STRUCTURES: Derived types, Structure's declaration, Initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef, enum, bit-fields.

UNIT-V:

FILES : Storage classes – auto, static, extern, register. Pre-processor statements

DATA FILES: Declaring, Opening, and Closing File Streams, File handling functions, Reading from and Writing to Text Files, File copy, merge, Writing and reading records, Random File Access.

TEXT BOOKS:

1) ANSI C Programming, E Balaguruswamy, Mc-GrawHill, 5th Edition
2) ANSI C Programming, Gary J. Bronson, Cengage Learning.
3) Programming in C, ReemaThareja, OXFORD Publications

REFERENCE BOOKS:

1) C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage.
2) Let us C, YashwantKanetkar, BPB Publications
3) Mastering in C, KR Venu Gopal, TMH

COURSE OUTCOMES: After completing this course, Students will be able to-

CO 1 **:** Understand algorithms and basic terminology of C

CO 2 **:** Solve problems using control structures and modular approach

CO 3 **:** Make use of 1D and 2D arrays along with strings for linear data handling

CO 4 **:** Determine the use of pointers and structures

CO 5 **:** Implement various operations on data files.

I-Year-I Semester		L	T	P	C
		1	0	0	2.5
ENGINEERING GRAPHICS & DESIGN					

COURSE OBJECTIVES:

1) Expose the students to use Drafting packages for generating Engineering curves and conventions followed in Preparation of engineering drawings.
2) Make the students to understand the concepts of orthographic projections of Lines and Plane Surfaces.
3) To understand the concepts of orthographic projections of Regular Solids.
4) Develop the ability of understanding sectional views and Development of Solid Surfaces.
5) Enable them to use computer aided drafting packages for Conversion of Isometric view to Orthographic Projection and vice versa.

UNIT-I :

INTRODUCTION TO AUTOCAD: Basic commands, Customization, ISO and ANSI standards for coordinate dimensioning, Annotations, layering, 2D drawings of various mechanical components, 2D drawings of various electrical and electronic circuits. Creation of engineering models- floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; (Experiments should be Planned According to respective Core Branch Applications)

UNIT-II :

THEORY OF PROJECTION: Principles of Orthographic Projections-Convention: Projections of Points, Projections of Lines inclined to both planes, Projections of planes inclined to one Plane & Projections of planes inclined to both Planes

UNIT III:

PROJECTIONS OF REGULAR SOLIDS: Projections of Solids –with the axis perpendicular to one of the principal planes, with the axis Inclined to one of the principal planes, Projections of Solids –with the axis Inclined to Both the principal planes

UNIT IV:

DEVELOPMENT OF SURFACES & SECTIONAL ORTHOGRAPHIC VIEWS: Development of surfaces of Right Regular Solids – Prism, Pyramid, Cylinder and, Cone. Draw the sectional orthographic views of geometrical solids

UNIT V:

ISOMETRIC PROJECTIONS

Conversion of isometric views to orthographic views, drawing of isometric views - simple Solids, Conversion of orthographic views to isometric views of simple Drawings

TEXT BOOKS:

1) Engineering Drawing by N.D. Butt, Chariot Publications
2) Engineering Graphics with Autocad by Kulkarni D.M , PHI Publishers
3) Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age
4) Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

REFERENCE BOOKS:

1) Engineering Drawing by K.L.Narayana& P. Kannaiah, Scitech Publishers
2) Engineering Graphics for Degree by K.C. John, PHI Publishers
3) Engineering Graphics by PI Varghese, McGrawHill Publishers
4) AutoCAD 2018 Training Guide (English, Paperback, Sagar Linkan) ISBN: 9789386551870, 938655187X RUPAPUBLICATIONS

WEBSITES

1) https://www.autodesk.com.au/campaigns/autocad-tutorials
2) https://nptel.ac.in/courses/112104172

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO1: Prepare erinngineeg drawings as per BIS conventions { Understand level, KL2}

CO2: Produce computer generated of orthographic projections of Lines and Plane surfaces using CAD software {Apply level, KL3}

CO3 : information/concepts and present the same in the form of drawings {Apply level, KL3}

CO4 : Use the knowledge of sectional views and Development of Solid Surfaces in Real time Applications {Apply level, KL3}

CO5 : Develop isometric drawings of simple objects reading the orthographic projections of those objects {Analyze level, KL4}

*****

I-Year-I Semester		L	T	P	C
		0	0	3	1.5

ENGINEERING PHYSICS LAB

COURSE OBJECTIVES:

The Applied Physics Lab is designed to:

1) Understand the concepts of interference and diffraction and their applications.
2) Apply the concept of LASER in the determination of wavelength.
3) Recognize the importance of energy gap in the study of conductivity and Hall Effect.
4) Illustrate the magnetic and dielectric materials applications.
5) Apply the principles of semiconductors in various electronic devices.

COURSE OUTCOMES: The students will be able to:

CO 1 : Operate optical instruments like microscope and spectrometer

CO 2 : Determine thickness of a paper with the concept of interference

CO 3: Estimate the wavelength of differentcolours using diffraction grating and resolving power

CO 4: Plot the intensity of the magnetic field of circular coil carrying current with distance

CO 5: Calculate the band gap of a given semiconductor

LIST OF EXPERIMENTS : (Any 10 of the following listed 15 experiments)

1) Determination of wavelength of a source-Diffraction Grating-Normal incidence.
2) Newton’s rings – Radius of Curvature of Plano - Convex Lens.
3) Determination of thickness of a spacer using wedge film and parallel interference fringes.
4) Magnetic field along the axis of a current carrying coil – Stewart and Gee’s apparatus.
5) Energy Band gap of a Semiconductor p - n junction.
6) Characteristics of Thermistor – Temperature Coefficients
7) Determination of dielectric constant by charging and discharging method
8) Variation of dielectric constant with temperature
9) Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
10) LASER - Determination of wavelength by plane diffraction grating
11) Verification of laws of vibrations in stretched strings – Sonometer.

12) Determine the radius of gyration using compound pendulum

13) Rigidity modulus of material by wire-dynamic method (torsional pendulum)

14) Dispersive power of diffraction grating.

15) Determination of Hall voltage and Hall coefficients of a given semiconductor using Hall Effect.

I-Year-I Semester		L	T	P	C
		0	0	3	1.5
PROBLEM SOLVING USING C LAB					

(Common to All Branches)

COURSE OBJECTIVES:

1) Apply the principles of C language in problem solving.
2) To design flowcharts, algorithms and knowing how to debug programs.
3) To design & develop of C programs using arrays, strings pointers & functions.
4) To review the file operations, pre-processor commands.

EXERCISE - 1 : Control Flow - I

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

b) Write a C Program to find second biggest of three numbers (Assume that all the numbers are unique).

EXERCISE – 2 : Control Flow - II

b) Write a C Program to Find Whether the Given Number is

i) Prime Number

ii) Armstrong Number

EXERCISE – 3 : Control Flow - III

a) Write a C program to print Floyd Triangle

b) Write a C Program to print Pascal Triangle

c) Write a C program to display a Pyramid

EXERCISE – 4 : Arrays - Demonstration of arrays

a) Search-Linear.

b) Sorting-Bubble

c) Operations on Matrix. - Add, Subtract, Multiply

EXERCISE – 5 : Strings

a) Implementation of string manipulation operations **with** library function: Copy, length, compare

b) Implementation of string manipulation operations **without** library function: copy, length, compare

EXERCISE – 6 : 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 – 7 : Functions - Continued

Write a C Program to compute the values of sin x and cos x and ex values using Series expansion. (Use factorial function)

EXERCISE - 8 : Arrays, Strings and Pointers

a) Write a C Program to find min and max of an array of elements using pointers

b) Write a C Program to concatenate one string to another using pointer.

EXERCISE – 9 Dynamic Memory Allocations

Write a C program to represent 1D and 2D arrays using malloc () function.

EXERCISES - 10 Structures

a) Write a C Program to Store Information of a Movie Using Structure

b) Write a C Program to sort a set of student records in ascending order.

c) Write a C Program to Add, subtract & multiply Two Complex Numbers.

EXERCISES -11 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 the content of one file to another.

C) Write a C program merges two files and stores their contents in another file

COURSE OUTCOMES: By the end of the Lab, the student able to

1) **Comprehend** the various concepts of a C language
2) **Develop** algorithms and flowcharts
3) **Design** and development of C problem solving skills.
4) **Acquire** modular programming skills.

******

I-Year-I Semester		L	T	P	C
		0	0	3	1.5
COMMUNICATIVE ENGLISH LAB I					

(Common to All Branches)

COURSE OBJECTIVES

The main objective of the course is to adopt activity-based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions and appear confidently for competitive examinations for career development.

The specific objectives of the course are to

1) Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native and non-native speakers
2) Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials like newspapers, magazines, periodicals, journals, etc.
3) Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
4) Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
5) Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

DETAILED SYLLABUS

CALL based activity. English course books selected for classroom teaching will be used for practice in the computer-based language labs. However, a brief introduction to the English Phonetics will be given to the students. Activities that encourage individual learning of the students based on the suggested texts and web resources will be used in the practical sessions.

INTRODUCTION TO SOUND SYSTEM OF ENGLISH

Articulation - Airstream mechanism, Manners of Articulation, Places of Articulation, English phonetic symbols. Accent - Syllabification, word stress and accent, stress rules and stress shift, exceptions to rules.Intonation - Stress and accent in connected speech. Types and functions of Intonation in English.

Pair work, Role play, conversational practice and Individual speaking activities based on following essays from ***University of Success.***

1) "How to Fashion Your Own Brand of Success" by Howard Whitman
2) "How to Recognize Your Failure Symptoms" by Dorthea Brand
3) "How to Conquer the Ten Most Common Causes of Failure" by Lois Binstock
4) **"**How to Develop Your Strength to Seize Opportunities" by Maxwell Maltz
5) "How to Make the Most of Your Abilities" by Kenneth Hildebrand
6) "How to Raise Your Self-Esteem and Develop Self-Confidence" by James W. Newman
7) "How to Win Your War Against Negative Feelings" by Dr Maxwell Maltz
8) "How to Find the Courage to Take Risks" by Tom Rust and Randy Reed
9) "How to Become a Self-Motivator" by Charles T Jones
10) "How to Eliminate Your Bad Habits" by OgMandino

TEXT BOOKS

1) English All Round: Communication Skills for Undergraduate Learners-Volume 1, Orient Black Swan, 2019 (to be released)
2) University of Success by OgMandino, Jaico, 2015.

REFERENCE BOOKS

1) Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2) Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3) Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4) Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.

AICTE RECOMMENDED BOOKS

1) Meenakshi Raman and Sangeeta Sharma. Technical Communication. Oxford University Press, 2018.
2) Pushplata and Sanjay Kumar. Communication Skills, Oxford University Press, 2018.
3) Kulbushan Kumar. Effective Communication Skills. Khanna Publishing House, Delhi

SAMPLE WEB RESOURCES

Grammar / Listening / Writing 1-language.com http://www.5minuteenglish.com/ https://www.englishpractice.com/ Grammar/Vocabulary English Language Learning Online http://www.bbc.co.uk/learningenglish/ http://www.better-english.com/ http://www.nonstopenglish.com/ https://www.vocabulary.com/ BBC Vocabulary Games Free Rice Vocabulary Game	Reading: https://www.usingenglish.com/comprehension/ https://www.englishclub.com/reading/shortstories.htm https://www.english-online.at/Listening https://learningenglish.voanews.com/z/3613 http://www.englishmedialab.com/listening.html Speaking https://www.talkenglish.com/ BBC Learning English – Pronunciation tips Merriam-Webster – Perfect pronunciation Exercises
All Skills https://www.englishclub.com/ http://www.world-english.org/ http://learnenglish.britishcouncil.org/	

COURSE OUTCOMES : At the end of the course, the learners will be able to

CO1 : identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English and speak clearly on a specific topic using suitable discourse markers in informal discussions (L3)

CO2 : take notes while listening to a talk/lecture; to answer questions in English; formulate sentences using proper grammatical structures and correct word forms; and use language effectively in competitive examinations (L3)

CO3 : write summaries based on global comprehension of reading/listening texts; produce a coherent write-up interpreting a figure/graph/chart/table; and use English as a successful medium of communication. (L3)

I-Year-I Semester		L	T	P	C
		3	0	0	0
CONSTITUTION OF INDIA					

COURSE OBJECTIVES:

1) To Enable the student to understand the importance of constitution
2) To understand the structure of executive, legislature and judiciary
3) To understand philosophy of fundamental rights and duties
4) To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
5) To understand the central and state relation financial and administrative.

UNIT-I

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

LEARNING OUTCOMES: After completion of this unit student will

1) Understand the concept of Indian constitution
2) Apply the knowledge on directive principle of state policy
3) Analyze the History, features of Indian constitution
4) Evaluate Preamble Fundamental Rights and Duties

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;

LEARNING OUTCOMES: - After completion of this unit student will

1) Understand the structure of Indian government
2) Differentiate between the state and central government
3) Explain the role of President and Prime Minister
4) Know the Structure of supreme court and High court

UNIT-III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

LEARNING OUTCOMES: - After completion of this unit student will

1) Understand the structure of state government
2) Analyze the role Governor and Chief Minister
3) Explain the role of state Secretariat
4) Differentiate between structure and functions of state secretariate

UNIT-IV

Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation Panchayati: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

LEARNING OUTCOMES: -After completion of this unit student will

1) Understand the local Administration
2) Compare and contrast district administration role and importance
3) Analyze the role of Myer and elected representatives of Municipalities
4) Evaluate Zilla panchayat block level organisation

UNIT-V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission: Functions of Commissions for the welfare of SC/ST/OBC and women

LEARNING OUTCOMES: -After completion of this unit student will

1) Know the role of Election Commission apply knowledge
2) Contrast and compare the role of Chief Election commissioner and Commissionerate
3) Analyze role of state election commission
4) Evaluate various commissions of viz SC/ST/OBC and women

REFERENCES:

1) Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt.Ltd.. New Delhi
2) Subash Kashyap, Indian Constitution, National Book Trust
3) J.A. Siwach, Dynamics of Indian Government & Politics
4) D.C. Gupta, Indian Government and Politics
5) H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6) J.C. Johari, Indian Government and Politics Hans
7) J. Raj Indian Government and Politics
8) M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt.Ltd.. New Delhi
9) Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

E-RESOURCES:

1) nptel.ac.in/courses/109104074/8
2) nptel.ac.in/courses/109104045/
3) nptel.ac.in/courses/101104065/
4) www.hss.iitb.ac.in/en/lecture-details
5) www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

COURSE OUTCOMES:

At the end of the semester/course, the student will be able to have a clear knowledge on Understand historical background of the constitution making and its importance for building a democratic India.

1) Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
2) Understand the value of the fundamental rights and duties for becoming good citizen of India.
3) Analyze the decentralization of power between central, state and local self-government.
4) Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

COURSE OUTCOMES:

CO-1 Know the sources, features and principles of Indian Constitution.

CO-2 Learn about Union Government, State government and its administration.

CO-3 Get acquainted with Local administration and Pachayati Raj.

CO-4 Be aware of basic concepts and developments of Human Rights.

CO-5 Gain knowledge on roles and functioning of Election Commission

****

I-Year-II Semester		L	T	P	C
		3	0	0	3
MATHEMATICS-II					

(Common to All)

COURSE OBJECTIVES:

1) To elucidate the different numerical methods to solve nonlinear algebraic equations
2) To disseminate the use of different numerical techniques for carrying out numerical integration
3) To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications

UNIT-1:

Iterative methods:

Introduction–Bisection method–Method of false position–Iteration method–Newton-Raphson method (one variable)–Jacobi and Gauss-Seidel methods for solving system of equations.

UNIT-2:

Interpolation:

Introduction–Errors in polynomial interpolation–Finite differences–Forward differences–Backward differences–Central differences –Relations between operators–Newton's forward and backward formulae for interpolation–Gauss's forward and backward formulae for Interpolation – Interpolation with unequal intervals–Lagrange's interpolation formula–Newton's divide difference formula.

UNIT-3:

Numerical integration and solution of ordinary difference equations:

Trapezoidal rule–Simpson's $1/3^{rd}$ and $3/8^{th}$ rule–Solution of ordinary differential equations by Taylor's series–Picard's method of successive approximations–Euler's method–Modified Euler's method–Runge-Kutta method (second and fourth order).

UNIT–4:

Laplace Transforms:

Laplace transforms of standard functions – Shifting theorems – Transforms of derivatives and integrals – Unit step function – Dirac's delta function –Periodic function - Inverse Laplace transforms – Convolution theorem (without proof)

Applications: Evaluation of integrals using Laplace transforms - Solving ordinary differential equations (Initial value problems) using Laplace transforms.

UNIT 5:

Fourier series and Fourier Transforms:

Fourier series: Introduction – Periodic functions – Fourier series of periodic function – 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 – Properties – Inverse transforms – Finite Fourier transforms.

TEXT BOOKS:

1) **B.S. Grewal,** Higher Engineering Mathematics, 44^{th} Edition, Khanna Publishers.

REFERENCE BOOKS:

1) **B.V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
2) **H.K.Das,** Advanced Engineering Mathematics, 22^{nd} Edition, S. Chand & Company Ltd.
3) **Erwin Kreyszig**, Advanced Engineering Mathematics, 10^{th} Edition, Wiley-India.

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

1) Evaluate approximate in the roots of polynomial and transcendental equations by different algorithms (EVALUATE)
2) Solve system of linear algebraic equations using Gauss Jacobi, Gauss Seidel and apply Newton's forward and backward interpolation and Lagrange's formulae for equal and unequal intervals (SOLVE , APPLY,FIND)
3) Apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations and also by Laplace the transforms for solving differential equations (SOLVE , APPLY,FIND)
4) Find or compute the Fourier series of periodic signals (SOLVE ,APPLY, FIND, ANALYSE)
5) Know and be able to apply integral expressions for the forwards and inverse Fourier transform to range of non-periodic waveforms (SOLVE , APPLY, FIND)

I-Year-II Semester		L	T	P	C
		3	0	0	3
MATHEMATICS-III					

(Common to All)

Course Objectives:

1) To instruct the concept of Matrices in solving linear algebraic equations
2) To familiarize the techniques in partial differential equations
3) To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications

UNIT-I:

Solving system of linear equations, Eigen values and Eigen Vectors

Rank of a matrix by Echelon form and normal form–solving system of homogeneous and non-homogeneous linear equations–Gauss elimination, Gauss Jordan for solving system of equations- Eigen values and Eigen vectors and their properties

UNIT-II:

Cayley-Hamilton theorem and quadratic forms:

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

Application: Free vibration of two mass systems.

UNIT – III:

Vector Differentiation:

Scalar and Vector point functions-Vector Differential operator- Gradient – Directional derivatives–Divergence – Curl – Laplacian second order operator- Vector identities- Scalar Potential.

UNIT– IV:

Vector Integration:

Line integral – Work done – Circulation- Surface integral- Volume integral Vector integral theorems (without proof): Greens theorem in a plane- Stokes theorem- Gauss Divergence theorem.

UNIT– V:

Solutions of Partial differential Equations

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

Second order PDE: Solutions of linear partial differential equations with constant coefficients RHS term of the type $e^{ax+by}, \sin(ax+by), \cos(ax+by), x^m y^n$.

TEXT BOOKS:

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

REFERENCE BOOKS:

1) **B.V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
2) **H.K.Das,** Advanced Engineering Mathematics, 22nd Edition, S. Chand & Company Ltd.
3) **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

COURSE OUTCOMES: 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 practical applications (L6)
2) solve system of linear algebraic equations using Gauss elimination, Gauss Jordan (L3)
3) to interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
4) estimate the work done against a field, circulation and flux using vector calculus (L5)
5) identify the solution methods for partial differential equation that model physical processes (L3)

<table>
<tr><td rowspan="2">I-Year-II Semester</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="6" align="center">ENGINEERING CHEMISTRY</td></tr>
</table>

COURSE OBJECTIVES:

Knowledge of basic concepts of chemistry for Engineering students will help them as professional engineers later in design and material selection as well as utilizing the available resources.

LEARNING OBJECTIVES:

1) Significance and use of plastics in household appliances and composites (FRP) in aerospace and automotive industries.
2) Outline the basics for the construction of electrochemical cells, batteries and fuel cells.Understand the mechanism of corrosion and how it can be prevented.
3) Importance of advanced materials and their engineering applications.
4) Differentiate and discuss the materials used in major industries like steel industry, metallurgical industries, construction industries, electrical equipments and manufacturing industries. Lubrication is also summarized.
5) Essentiality of fuel technology.
6) Need of water purification and importance of various water purification methods.

UNIT-I:

POLYMER TECHNOLOGY

Polymerisation: Introduction-Methods of polymerisation-(emulsion and suspension)-Physical and mechanical properties.

Plastics: Compounding-Fabrication (compression, injection, blown film, extrusion)-Preparation, properties and applications of PVC, ploycarbonates and Bakelite-Mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.

Elastomers: Natural rubber-Drawbacks-Vulcanization-Preparation-Propertiesand applications of synthetic rubbers (Buna S, thiokol and polyurethanes)

Composite Materials: Fiber reinforced plastics-CFRP and GFRP.

Conducting polymers*:* Polyacetylene, doped conducting polymers- p-type and n-type doping.

Bio degradable polymers: Biopolymers and biomedical polymers.

UNIT-II:

ELECTROCHEMICAL CELLS AND CORROSION

Single electrode potential-Electrochemical series and uses of series-Standard hydrogen electrode, calomel electrode, concentration cell, construction of glass electrode, Batteries: Dry cell, Ni-Cd cells, Ni-Metal hydride cells, Li-ion battery, Zinc air cells, Fuel cells-H_2 –O_2, CH_3OH-O_2, phosphoric acid, molten carbonate.

Corrosion: Definition-theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, water-line corrosion- passivity of metals-galvanic series-factors influencing rate of corrosion-corrosion control: (proper designing, cathodic protection)-protective coatings: cathodic and anodic coatings, electroplating, electroless plating (nickel), paints (constituents and its functions).

UNIT-III:

CHEMISTRY OF MATERIALS

Nano materials*:* Introduction, sol-gel method, characterization by BET, SEM and TEM methods, applications of graphene- carbon nanotubes and fullerenes: Types, preparation of carbon nanomaterials by carbon-arc, laser ablation method, and applications.

Refractories: Definition , classification, properties (refractoriness, refractoriness under load, porosity and thermal spalling), failure of refractories.

Lubricants: Definition, mechanism of lubricants and properties (definition and importance).

Cement: Constituents, manufacturing, parameters to characterize the Clinker formation: lime saturation factor (LSF), silica ratio (SR), and alumina ratio (AR). Chemistry of setting and hardening, deterioration of cement.

UNIT-IV:

FUELS

Introduction-calorific value - HCV and LCV – problems using Dulong's formula – proximate and ultimate analysis of coal sample – significance of these analysis – problems – petroleum (refining – cracking) – synthetic petrol (Fischer-Tropsch & Bergius) – petrol knocking, diesel knocking – octane and cetane rating – anti-knocking agents – introduction to alternative fuels (bio-diesel, ethanol, methanol, natural gas, LPG, CNG) – Flue gas analysis by Orsat apparatus – rocket fuels.

UNIT-V:

WATER TECHNOLOGY

Hardness of water – determination of hardness by complexometric method – boiler troubles (priming and foaming, scale formation, boiler corrosion, caustic embrittlement) – internal treatments – softening of hard water (zeolite process and ion exchange process) – treatment of industrial waste water – potable water and its specifications – steps involved in purification of water – chlorination, break point chlorination – reverse osmosis and electro dialysis.

REFERENCE BOOKS:

1) A text book of Engineering Chemistry by S.S. Dara, S. S. Umare; S. Chand & Co., Ltd., Latest Edition.
2) Engineering Chemistry by Shashi Chawla; Dhanpat Rai Publicating Co., Latest Edition.

TEXT BOOKS:

1) Engineering Chemistry by Jain & Jain; Dhanpat Rai Publicating Co., Latest Edition
2) Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2019 Edition.
3) Engineering Chemistry by Prasanth Rath, B. Ramadevi, Ch. Venkata Ramana Reddy, Subendu Chakravarthy; Cengage Publications, 2019 Edition.

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

1) explain the preparation, properties and applications of thermoplastics, thermosettings, elastomers and conducting polymers.
2) know the importance of various materials and their uses in the construction of batteries and fuel cells.
3) to acquire the knowledge of nanomaterials, refractories, lubricants and cement.
4) assess the quality of various fuels.
5) understand the importance of water and its usage in various industries.

I-Year-II Semester		L	T	P	C
		3	0	0	3
ENGINEERING MECHANICS					

(Common to CE and ME)

COURSE OBJECTIVES:

1) To understand the resolution of forces, equilibrium of force systems
2) To learn the analysis of forces in the structures and also the basic concepts of friction and its Applications to simple systems.
3) To understand the concepts of centroid, moment of inertia, centre of gravity and mass moment of inertia.
4) To understand the basic concepts of kinematics and kinetics.
5) To learn the concepts of work energy method and impulse momentum

UNIT- I:

INTRODUCTION TO ENGINEERING MECHANICS

Force systems: Basic Concepts, Resultant of coplanar concurrent forces, Components of force in space, Moment of force and its applications, couples and resultant of force systems, Equilibrium of Force Systems, Free body diagram, Equations of equilibrium, Equilibrium of planar and spatial system.

UNIT-II:

ANALYSIS OF STRUCTURES AND FRICTION (12 hours)

Trusses*:* Introduction, Analysis of trusses by method of joints, method of sections;

Friction: Introduction to Friction, Laws of friction, Application to simple systems and connected systems.

UNIT-III:

CENTROID AND CENTRE OF GRAVITY, AREA MOMENT OF INERTIA AND MASS MOMENT INERTIA

Centroid: Centroid of simple figures from basic principles, centroid of composite sections;

Centre of Gravity: Center of gravity of simple body from basic principles, Center of gravity of composite bodies, Pappus theorems.

Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures.

Mass Moment of Inertia: Introduction of Mass Moment of Inertia, mass moment of inertia of composite bodies

UNIT IV:

INTRODUCTION TO KINEMATICS AND KINETICS

Kinematics: Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion.

Kinetics: Analysis as a Particle and Analysis as a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.

UNIT – V:

WORK -ENERGY METHOD

Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method

TEXT BOOKS:

1) Reddy Vijay Kumar K. and K. Suresh Kumar (2010), Singer's Engineering Mechanics.
2) S.P. Timoshenko and D.H. Young, Engineering Mechanics, McGraw-Hill International Edition,1983.
3) Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

REFRENCE BOOKS:

1) Engineering Mechanics statics and dynamics – R.C. Hibbeler, 11th Edn – Pearson Publ.
2) Mechanics for Engineers, statics - F.P. Beer & E.R. Johnston – 5th Edn Mc Graw Hill Publ.
3) Engineering Mechanics statics and dynamics, A Nelson, Mc Graw Hill publications

E-RESOURCES:

1) http://nptel.ac.in/
2) http://mhrd.gov.in/e-contents
3) http://spoken-tutorial.org

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

1) Compute the resultant and moment of a force system and apply the equations of equilibrium for a generalized force system **(Apply)**
2) Solve the forces in trusses, frames and also friction in various mechanical devices. **(Apply)**
3) Interpret the centroids, centers of gravity and moments of inertia of simple geometric shapes and understand the physical applications of these properties. (**Apply**)
4) Apply the basic concepts of dynamics to solve problems of engineering applications (**Apply**)
5) Solve problems using work energy equations for translation, fixed axis rotation and plane motion. (**Apply**)

I-Year-II Semester		L	T	P	C
		3	0	0	3
BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING					

(Common to CSE, IT, CE and ME)

COURSE OBJECTIVES:

1) To introduce basics of electric circuits and to teach DC and AC electrical circuit analysis.
2) To explain the working principles DC machines and speed control of various DC motors.
3) To explain the working principles of transformers and AC machines and its applications.
4) To introduce the basics of semiconductor physics and operation and applications of Diodes.
5) To introduce the basics of transistors and explain the transistor configurations

UNIT 1 : DC & AC Circuits:

DC Circuits:

Electrical circuit elements (R - L and C) – Kirchhoff's laws -Voltage and Current division rules-series, parallel circuits and star-delta and delta-star transformations- [Elementary treatment only]

AC Circuits:

Representation of sinusoidal waveforms - Peak and RMS values - phasor representation - real power - reactive power - apparent power - power factor.[Elementary treatment only]

UNIT 2 : DC Machines:

DC Generator:

Construction-Principle and operation of DC Generator - EMF equation -Types– Applications[Elementary treatment only]

DC Motor:

Principle and operation of DC Motor – types-Torque equation - Speed control of DC Motor-Brake test-Swinburne's test-Applications. [Elementary treatment only]

UNIT 3 : AC Machines:

Single Phase Transformer:

Construction, Principle and operation of Single Phase Transformer –EMF Equation-Losses-Efficiency. [Elementary treatment only]

Three Phase Induction Motor: Construction- Principle and operation of three phase Induction Motor-Types- Applications. [Elementary treatment only].

UNIT 4

Semiconductor Devices

Semiconductor Physics, PN Junction Diode & Zener Diode-characteristics- Applications: Rectifiers (Half Wave Rectifier & Full Wave Rectifier) [Elementary treatment only], Clippers and Clampers.

UNIT 5

Bipolar Junction Transistors

Construction and working of bipolar junction transistor, CB, CE and CC Configurations and characteristics. [Elementary treatment only], Transistors as amplifiers, op-amp basics.

TEXT BOOKS:

1) D. P. Kothari and I. J. Nagrath- "Basic Electrical Engineering" - Tata McGraw Hill - 2010.
2) Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, 9^{th} edition, PEI/PHI 2006.

REFERENCES:

1) L. S. Bobrow- "Fundamentals of Electrical Engineering" - Oxford University Press - 2011.
2) E. Hughes - "Electrical and Electronics Technology" - Pearson - 2010.

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

1) Apply concepts of KVL/KCL in solving DC circuits.(Apply, Find, Solve)
2) Choose correct machine for a specific application. (Understand, Apply)
3) Illustrate working principles of DC and AC Machines. (Understand, Apply)
4) Describe working principles of diodes and transistors. (Understand, Apply)
5) Understand the applications of diodes and transistors. (Understand, Analyze)

*****

I-Year-II Semester		L	T	P	C
		0	0	3	1.5
ENGINEERING WORK SHOP					

COURSE OBJECTIVE:

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

WOOD WORKING:

Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint
b) Dovetail joint
c) Bridle joint

SHEET METAL WORKING:

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

FITTING:

Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit b) Dovetail fit c) square fit d) Semi-circular e) Two Wheeler tyre puncture and change of two wheeler tyre

ELECTRICAL WIRING:

Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series b) Two-way switch c) Godown lighting d) Tube light

e) Three phase motor f) Soldering of wires

COURSE OUTCOMES: After completion of this lab the student will be able to

1) Apply wood working skills in real world applications. (L3)
2) Build different parts with metal sheets in real world applications. (L3)
3) Apply fitting operations in various applications. (L3)
4) Apply different types of basic electric circuit connections. (L3)
5) Demonstrate soldering and brazing. (L2)

<table>
<tr><td rowspan="2">I-Year-II Semester</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td colspan="6">ENGINEERING CHEMISTRY LAB</td></tr>
</table>

COURSE OBJECTIVES: **The main objectives are**

1) To furnish the students with a solid foundation in Chemistry Laboratory required to solve the Engineering problems.
2) To expose the students in practical aspects of the theoritical concepts like pH, hardness of water etc.
3) To guide the students on how to handle the instruments like UV-visible spectrophotometer, potentiometer and conductometer.

LIST OF EXPERIMENTS: (Any 10 of the following listed 16 experiments)

1) Determination of HCl using standard Na_2CO_3 solution.
2) Determination of alkalinity of a sample containing Na_2CO_3 and NaOH.
3) Determination of Mn (II) using standard oxalic acid solution.
4) Determination of ferrous iron using standard $K_2Cr_2O_7$ solution.
5) Determination of Copper (II) using standard EDTA solution.
6) Determination of temporary and permanent hardness of water using standard EDTA solution.
7) Determination of Iron (III) by colorimetric method.
8) Determination of the concentration of acetic acid using sodium hydroxide (pH-metric method).
9) Determination of concentration of strong acid vs strong base (by conductometric method).
10) Determination of strong acid vs strong base (by potentiometric method).
11) Determination of Mg^{+2} present in an antacid.
12) Determination of $CaCO_3$ presence in an egg shell.
13) Estimation of vitamin- C.
14) Determination of phosphoric content in soft drinks.
15) Adsorption of acetic acid by charcoal.

16) Prepatation of nylon-6, 6 and Bakelite (demonstration only)

COURSE OUTCOMES: **Upon successful completion of the course, the student will be able to**

CO 1 : To estimate the amount of metal ions present in different solutions (L4 & L3)

CO 2 : To analyze the quality parameters of water (L4)

CO 3 : To determine the strength of different solutions by using different instrumentation techniques (L3)

I-Year-II Semester		L	T	P	C
		0	0	3	1.5
BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB					

(Common to CSE, IT, CE and ME)

COURSE OBJECTIVES:

1) To Verify Kirchhoff's laws, Voltage and Current division rules.
2) To learn speed control and testing of DC Shunt Motor.
3) To learn and understand the operation of induction motor.
4) To learn applications of diodes and transistors.

LIST OF EXPERIMENTS: -

1) Verification of Kirchhoff laws.
2) Verification of Voltage division rule and current division rule.
3) Speed control of DC Shunt Motor.
4) Perform Brake test on DC Shunt Motor.
5) Conduct Swinburne's test on DC Shunt Motor.
6) Brake test on 3-phase Induction Motor.
7) Draw the V-I characteristics of P-N Junction Diode.
8) Draw the V-I characteristics of zener Diode.
9) Half wave rectifier and Full wave rectifier operations using diodes.
10) Draw the BJT-CB Configuration characteristics.
11) Draw the BJT-CE Configuration characteristics.
12) Draw the BJT-CC Configuration characteristics.
13) Study of circuit simulation software (any one- TINA-PRO/ PSPICE/ CIRCUIT MAKER/ GPSIM/ SAPWIN etc).

TEXT BOOKS:

1) D. P. Kothari and I. J. Nagrath- "Basic Electrical Engineering" - Tata McGraw Hill - 2010.
2) Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

REFERENCES:

1) L. S. Bobrow- "Fundamentals of Electrical Engineering" - Oxford University Press - 2011.
2) E. Hughes - "Electrical and Electronics Technology" - Pearson - 2010.

COURSE OUTCOMES:

1) Verify Kirchhoff's Laws and voltage and current division rules for DC supply.
2) Analyze the performance of AC and DC Machines by testing.
3) Perform speed control of DC shunt motor.
4) Perform the half wave and full wave rectifier.

I-Year-II Semester		L	T	P	C
		0	0	3	1.5
COMMUNICATIVE ENGLISH LAB					

(Common to All Branches)

COURSE OBJECTIVES:

The main objective of the course is to adopt activity-based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions and appear confidently for competitive examinations for career development. The specific objectives of the course are to

1) Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native and non-native speakers
2) Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials like newspapers, magazines, periodicals, journals, etc.
3) Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
4) Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
5) Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

DETAILED SYLLABUS

CALL based activity. English course books selected for classroom teaching will be used for practice in thecomputer-based language labs. Watching and listening to Video clips.

LISTENING ACTIVITY: Selected speeches of eminent personalities, audio texts, dialogues and discussions

SPEAKING: JAM, Oral Presentations, Group Discussions

WRITING: Different types of reports

PROJECT: Power point presentation of 5 min on a specific topic Pair work, Role play, conversational practice and Individual speaking activities based on following essays from ***University of Success***.

1) “How to Get Yourself Organized” by Michael LeBeouf
2) “How to Turn Your Desires into Gold” by Napoleon Hill
3) “How to Look Like a Winner How to Increase Your Value” by OgMandino
4) “How to Swap a Losing Strategy” by Auren Uris and Jack Tarrant
5) “How to Bounce Back from Failure” by OgMandino
6) “How to Prevent Your Success from Turning into Ashes” by Allan Fromme
7) “How to Have a Happy Life” by Louis Binstock
8) “How to Keep the Flame of Success Shining Brightly” by Howard Whitman Any ten Supplementary Language Activities from ***UN Global Goals***document
9) “Developing children’s understanding of the Global Goals” by Carol Read
10) “End poverty in all its forms everywhere” by SylwiaZabor-Zakowska
11) “End hunger, achieve food security and improved nutrition and promote sustainable agriculture” by Linda Ruas
12) ‘Ensure healthy lives and promote well-being for all at all ages” by Carmen Flores
13) “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” by Daniel Xerri
14) “Achieve gender equality and empower all women and girls” by Jemma Prior and Tessa Woodward
15) “Ensure availability and sustainable management of water and sanitation for all” by Wei KeongToo
16) “Ensure access to affordable, reliable, sustainable and modern energy for all” by Phil Wade
17) “Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all” by Nik Peachey
18) “Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation” by MaluSciamarelli
19) “Reduce inequality within and among countries” by Alan Maley
20) “Make cities and human settlements inclusive, safe, resilient and sustainable” by David Brennan
21) “Ensure sustainable consumption and production patterns” by Laszlo Katona and Nora Tartsay
22) “Take urgent action to combat climate change and its impacts” by Maria Theologidou
23) “Conserve and sustainably use the oceans, seas and marine resources for sustainable development” by Jill Hadfield and Charlie Hadfield

24) “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss” by ChrysaPapalazarou
25) “Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels” by Rebeca Duriga
26) “Strengthen the means of implementation and revitalise the global partnership for sustainable development” by Jennifer Verschoor and Anna Maria Menezes
27) “Content and the Sustainable Development Goals: going beyond language learning” by AdrianTennant
28) “Using extensive reading creatively to raise awareness of issues of equality and justice” by SueLeather
29) “Storytelling for a better world” by David Heathfield
30) “Using the Sustainable Development Goals in the EAP classroom” by Averil Bolster and PeterLevra

TEXT BOOKS

1) Alan Maley and Nik Peachy. *Integrating global issues in the creative English Classroom: Withreference to the United Nations Sustainable Development Goals.* British Council Teaching English, 2018 (Public Domain UN Document)
2) *University of Success* by OgMandino, Jaico, 2015 (Reprint).

REFERENCE BOOKS

1) Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
2) Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
3) Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4) Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
5) Chaturvedi, P. D. and ChaturvediMukesh. *The Art and Science of Business Communication:Skills, Concepts, Cases and Applications.* 4Ed. Pearson, 2017.

AICTE RECOMMENDED BOOKS

1) Meenakshi Raman and Sangeeta Sharma. *Technical Communication.* Oxford University Press,2018.

2) Pushplata and Sanjay Kumar. *Communication Skills*, Oxford University Press, 2018.

3) Kulbushan Kumar. *Effective Communication Skills.* Khanna Publishing House, Delhi

SAMPLE WEB RESOURCES

Grammar / Listening / Writing 1-language.com http://www.5minuteenglish.com/ https://www.englishpractice.com/ Grammar/Vocabulary English Language Learning Online http://www.bbc.co.uk/learningenglish/ http://www.better-english.com/ http://www.nonstopenglish.com/ https://www.vocabulary.com/ BBC Vocabulary Games Free Rice Vocabulary Game	Reading https://www.usingenglish.com/comprehension/ https://www.englishclub.com/reading/short stories.htm https://www.english-online.at/ Listening https://learningenglish.voanews.com/z/3613 http://www.englishmedialab.com/listening.html Speaking https://www.talkenglish.com/ BBC Learning English – Pronunciation tips Merriam-Webster – Perfect pronunciation Exercises
All Skills https://www.englishclub.com/ http://www.world-english.org/ http://l	

COURSE OUTCOMES : At the end of the course, the learners will be able to

CO1. prioritize information from reading texts after selecting relevant and useful points and paraphrase short academic texts using suitable strategies and conventions (L3)

CO2. make formal structured presentations on academic topics using PPT slides with relevant graphical elements (L3)

CO3. participate in group discussions using appropriate conventions and language strategies (L3)

CO4. prepare a CV with a cover letter to seek internship/ job (L2)

CO5. collaborate with a partner to make presentations and Project Reports (L2)

I-Year-II Semester		L	T	P	C
		3	0	0	0
ENVIRONMENTAL SCIENCE					

(Common to CE, CSE & IT)

OBJECTIVE:

To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life to save earth from the inventions by the engineers.

UNIT – I :

MULTIDISCIPLINARY 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:

LEARNING OUTCOMES : Students will be able to

1) articulate the basic structure, functions, and processes of key social systems affecting the environment.
2) explain how water resources should be used.
3) articulate basic understanding of effects of modern agriculture on environment.
4) explain how various paradigms or world views and their implicit and explicit assumptions and values shape the viewer's perception of environmental problems and solutions.

UNIT – II:

Ecosystems, Biodiversity, and its Conservation

ECOSYSTEMS: Concept of an ecosystem. – Structure and function of an ecosystem – 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:

1) Forest ecosystem.

2) Grassland ecosystem

3) Desert ecosystem

4) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

BIODIVERSITY AND ITS CONSERVATION : Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

LEARNING OUTCOMES : Students will be able to

1) get a clear picture of structure and functions of ecosystems.
2) explain why renewable and non-renewable energy resources are important.
3) get awareness about land degradation, soil erosion & desertification.
4) gain a rigorous foundation in various scientific disciplines as they apply to environmental science, such as ecology, evolutionary biology, hydrology, and human behaviour.

UNIT – III:

Environmental Pollution and Solid Waste Management

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of :

1) Air Pollution.
2) Water pollution
3) Soil pollution
4) Marine pollution
5) Noise pollution
6) Thermal pollution
7) Nuclear hazards

SOLID WASTE MANAGEMENT: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

LEARNING OUTCOMES : Students will be able to

1) demonstrate knowledge and understanding of theories in the field of Biodiversity and Systematics in the broad sense.
2) conduct basic conservation biology research.
3) explain endangered and endemic species of India.
4) identify the threats to biodiversity.

UNIT – IV:

Social Issues and the Environment

SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed 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 – Wasteland reclamation. – Consumerism 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.

LEARNING OUTCOMES: Students will be able to

1) understand Cause, effects and control measures of air pollution.
2) understand soil, noise & water pollution.
3) explain the enforcement of Environmental legislation
4) understand solid waste management.

UNIT – V:

Human Population and the Environment

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – 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 area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

LEARNING OUTCOMES : Students will have

1) knowledge about watershed management and environmental ethics.
2) explain the reasons for global warming
3) explain principles and impact of disasters on environment.
4) explain disaster management cycle in India.

TEXT BOOKS:

1) Text book of Environmental Studies for Undergraduate Courses by ErachBharucha for University Grants Commission, Universities Press.
2) Environmental Studies by Palaniswamy – Pearson education
3) Environmental Studies by Dr.S.AzeemUnnisa, Academic Publishing Company

REFERENCES:

1) Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Publications.
2) Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
3) Comprehensive Environmental studies byJ.P.Sharma, Laxmi publications.
4) Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Prentice hall of India Private limited.
5) A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Publishing House
6) Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Prentice hall of India Private limited.

*****

<table>
<tr><td rowspan="2">II-Year-I Semester</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="6">COMPLEX VARIABLES AND STATISTICAL METHODS</td></tr>
</table>

(Common to ECE, EEE, CE and ME)

PRE-REQUISITES :

1) Calculus
2) Partial Differentiation
3) Multiple Integration
4) Basics of Probability

COURSE OBJECTIVES: The student should be able to

1) Familiarize the complex variables.
2) Familiarize the students with the foundations of probability and statistical methods
3) Equip the students to solve application problems in their disciplines.

UNIT -I

Functions of complex variable and complex integration:

INTRODUCTION – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne-Thompson method.

COMPLEX INTEGRATION: Line integral – Cauchy's integral theorem – Cauchy's integral formula. (all without proofs).

UNIT -II

SERIES EXPANSIONS AND RESIDUE THEOREM:

RADIUS OF CONVERGENCE – Expansion in Taylor's series, Maclaurin's series - Laurent's series.

TYPES OF SINGULARITIES: Isolated – pole of order m – Essential – Residues – Residue theorem (without proof)

UNIT -III

PROBABILITY, DISTRIBUTIONS AND SAMPLING THEORY:

Probability-Baye's theorem-Random variables-Discrete and Continuous random variables-Distribution function-Mathematical Expectation and Variance-

Application approach: Binomial, Poisson and Normal distributions.Population and samples-

Sampling distribution of Means -Point and Interval estimations

Applications: Maximumerrorofestimate – Bayesian estimate#.

UNIT -IV

TEST OF HYPOTHESIS:

INTRODUCTION–Hypothesis-Null and Alternative Hypothesis-Type I and Type II errors-Level of significance-One tail and two-tail tests-Tests concerning one mean and two means (Large and Small samples)-Tests on proportions,**Applications:Chi-square test and F-test on small samples#.**

UNIT – V

CURVE FITTING AND CORRELATION:

Method of least squares-Straight line-Parabola-Exponential-Power curves-Correlation-Correlation coefficient-Rank correlation-Regression coefficient and properties-Regression lines-**Multiple regressions#.**

Extra topics extension of existing syllabus

TEXT BOOKS:

1) **B.S. Grewal**, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2) **S. C. Gupta and V. K. Kapoor,** Fundamentals of Mathematical Statistics, 11/e (Reprint) 2019, Sultan Chand & Sons Publications.
3) **B.V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

REFERENCE BOOKS:

1) **Miller and Freund's,** Probability and Statistics for Engineers, 7/e, Pearson, 2008.
2) **T. K. V. Iyenger**, Probability and Statistics, S. Chand & Company Ltd, 2015.
3) **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
4) **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India..
5) **H. K. Das,** Advanced Engineering Mathematics, 22nd Edition, , S. Chand &Company Ltd.

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO1**: Apply** Cauchy-Riemann equations to complex function in order to determine whether a given continuous function is analytic (L3)

CO2**: Find** the differentiation, integration of complex functions used in engineering problems and make use of Cauchy residue theorem to evaluate certain integrals (L3)

CO3**: Apply** discrete and continuous probability distributions and design the components of a classical hypothesis test (L3 &L6)

CO4**: Infer** the statistical inferential methods based on small and large sampling tests. (L4)

CO5**: Interpret** the association of characteristics and through correlation and regression tools (L4)

*****

II-Year-I Semester		L	T	P	C
		3	0	0	3
MECHANICS OF SOLIDS					

PRE-REQUISITES :

1) Engineering Mathematics
   I. Calculus
   II. Differential
2) Engineering Mechanics

COURSE OBJECTIVES: The student should be able to

The students completing this course are expected to understand the basic terms like stress, strain, Poisson's ratio etc., and different stresses and deflections induced in beams, thin cylinders, thick cylinders, and columns. Further, the student shall be able to understand the shear stresses due to torsion in circula

UNIT : I

SIMPLE STRESSES & STRAINS: Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for different materials –Working stress–Factor of safety.Lateral strain, Poisson's ratio & volumetric strain – composite bars–Temperature stresses- Relation between elastic constants.

UNIT : II

SHEAR FORCE AND BENDING MOMENT: Definition of beam – Types of beams – Concept of shear force and bending moment – Relation between S.F., B.M and rate of loading at a section of abeam.S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads,U.D.L, uniformly varying loads and combination of these loads – Point of contra flexure.

UNIT : III

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.

TORSION: Introduction-Derivation- Torsion of Circular shafts -Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

UNIT : IV

PRINCIPAL STRESSES AND STRAINS - Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle. **Stress strain analysis of 3-D element**

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

THICK CYLINDERS: Lame's equation – cylinders subjected to inside & outside pressures.

UNIT : V

DEFLECTION OF BEAMS : Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads,U.D.L, uniformly varying loads by Double integration method, Macaulay's method and moment area method.

COLUMNS: Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine'sFormula.

TEXT BOOKS:

1) Mechanics of Materials/Gere and Timoshenko, CBS Publications.
2) Strength of materials by R.K. Bansal , Laxmi Publications

REFERENCE BOOKS:

1) Strength of materials by B.C. Punmia-lakshmi publications Pvt. Ltd, New Delhi.
2) Strength of materials /GH Ryder/ Mc Millan publishers IndiaLtd
3) Strength of Materials -By Jindal, UmeshPublications
4) Solid Mechanics, byPopov

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) https://swayam.gov.in/nd1_noc20_ce50/preview
2) https://swayam.gov.in/nd2_nou20_cs16/preview
3) https://swayam.gov.in/nd1_noc20_me46/preview
4) https://youtu.be/e1CL-OPWTX8

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO1 **: Compute** the stresses & deformations of a member due to axial loading under uniform and non uniform conditions. **(Apply level)**

CO2 **: Analyze** the variation of SF & BM in determinate beams. **(Analyze level)**

CO3 **: Examine** the structural members subjected to flexural and torsion loads. **(Apply level)**

CO4 **: Analyze** the biaxial stresses developed at a point of stressed member and analyze the thin Pressure vessels. **(Analyze level)**

CO5: **Find** deflections for statically determinate beams and buckling of Columns. **(Apply level)**

II-Year-I Semester		L	T	P	C
		3	0	0	3
MATERIAL SCIENCE& METALLURGY					

PRE-REQUISITES :

1. Engineering Chemistry
2. Engineering Physics

COURSE OBJECTIVES: The student should be able to

To understand the basic fundamentals of Material science and Physical metallurgy. The basic concepts to be taught will help for the improvement, proper selection and effective utilization of materials which is essential to satisfy the ever increasing demands of the society.

UNIT- I

INTRODUCTION:- Crystallography, Miller's indices, Packing Efficiency, Density calculations, Grains and Grain Boundaries, Effect of grain size on the properties, Determination of grain size by different methods,

CONSTITUTION OF ALLOYS: Necessity of alloying, Types of solid solutions, Hume - Rothery rules, Intermediate alloy phases. ***Crystal Defects***

UNIT- II

Introduction, phase diagrams, Phase rule, Lever rule, Binary phase Diagrams, Isomorphous transformations with examples, Eutectic transformations with examples, Eutectoid transformations with examples

UNIT- III

Introduction, Steels, Iron-Carbon Phase Diagram, Heat Treatment, Study of Fe-Fe3C phase diagram., Construction of TTT diagrams, Annealing, Normalizing, Hardening and Tempering of steels, Hardenability of Alloy steels.

UNIT- IV

Introduction - Cast Irons, Structure and properties of White Cast iron, Malleable Cast iron, Grey cast iron, Non-ferrous Metals and Alloys, Structure and properties of copper and its alloys, Aluminium and its alloys, Al-Cu phase diagram, Titanium and its alloys.***Super Alloys, Shape Memory Alloys***

UNIT- V

Introduction to Ceramics, Polymers, Composites, Crystalline ceramics structure, properties & Applications, Glasses, cermets structure, properties & applications, Classification, properties & applications of composites, Classification, Properties and Applications of Polymers. ***Nano Composites***

TEXT BOOKS:

1) Material Science and Metallurgy/ Kodgire
2) Essentials of Materials Science and engineering / Donald R.Askeland / Thomson

REFERENCE BOOKS:

1) Elements of Material science / V. Rahghavan
2) Engineering Material and Metallurgy – Er Amandeep Singh Wadhva
3) Materials Science and engineering / William and Callister
4) Introduction to Physical Metallurgy by Sidney H Avner, McGraw-Hill Publishers

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) http://nptel.ac.in/courses/113105024/
2) http://nptel.ac.in/courses/113105024/1
3) http://nptel.ac.in/courses/113105024/2
4) http://nptel.ac.in/courses/113105024/3
5) http://nptel.ac.in/courses/113105024/4
6) http://nptel.ac.in/courses/113105024/5
7) http://nptel.ac.in/courses/113105024/6

NPTEL VIDEO COURSES

1) https://www.youtube.com/watch?v=PVnftOMxl6w&list=PLbMVogVj5nJQbjE_u2KZhUmCypfLu nj G4
2) https://www.youtube.com/watch?v=FrhvKcjKdPo&index=5&list=PLbMVogVj5nJQbjE_u2KZhUm CypfLunjG4

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO1: Able to know the basic concepts of bonds in metals and alloys. To understand the basic requirements for the formation of solid solutions and other compounds.

CO2: Able to understand the regions of stability of the phases that can occur in an alloy system in order to solve the problems in practical metallurgy.

CO3: Able to study the basic concepts of steels, their properties and practical applications. And the affect of various alloying elements on iron-iron carbide system. And to understand the various heat treatment and strengthening processes used in practical applications.

CO4: Able to study the basic concepts of castiron, non-ferrous metals and alloys, their properties and practical applications.

CO5: Able to study the properties and applications of ceramic, composite and other advanced materials so as to use the suitable material for practical applications.

*****

II-Year-I Semester		L	T	P	C
		3	0	0	3
PRODUCTION TECHNOLOGY					

PRE-REQUISITES :

Ability to observe and understand various processes applied to metals from surroundings.

COURSE OBJECTIVES: **The student should be able to**

1) To impart basic knowledge and understanding about basic casting processes.
2) To impart basic knowledge and understanding about metal forming processes such as rolling, forging and extrusion.
3) To impart basic knowledge and understanding about Sheet metal forming operations.
4) To impart basic knowledge and understanding about various metal joining processes.
5) To impart basic knowledge and understanding about powder metallurgy and high energy rate forming processes.

UNIT -1

METAL CASTING PROCESSESS

Introduction: Definition of casting, steps involved in making a casting, advantages, limitations, applications Casting Terms, Sand Mould making process

(i) Single piece pattern

(ii) Split -piece pattern

Patterns: Definition, Pattern Allowances, Type of Patterns, Pattern materials, Pattern colour code

Moulds: Definition, Types of moulds based on mould material, Properties required for a moulding material, Testing sand properties, Moulding machines

Cores: Definition, Desired characteristics, Types of cores, Core prints.

Chaplets: Definition, Types of Chaplets, Materials for chaplets. Special casting process (i) Die casting, (ii) Investment casting, (iii) Centrifugal casting, (iv) Continuous casting process.

Casting defects & Remedies.

UNIT -II

METAL FORMING PROCESSES

Definition, Types of metal forming, Nature of plastic deformation, Hot working, Coldworking

Rolling: Principle, Roll stand arrangements, Roll passes, Tube making-Rollpiercing,Plugmill,Threadrolling

Forging:Principle , Forging operations , Types of forging , Forging defects, FORGING DIE **DESIGN**-parting plane, draft, Fillet & Corner radii, Shrinkage Allowance, Die wear Allowance, Finish Allowance, Cavities, Flash, Gutter, Stock.

Extrusion: Principle, Types of Extrusion Wire drawing, Rod & Tube drawing, swaging.

UNIT -III

SHEET METAL FORMING

Principle, Effect of clearance on shearing load and edge characteristics, Classification of Press tool operations based on typed of stress introduce into the component, Types of sheet metal cutting operations. Drawing, Spinning, Bending, Stretch forming, Embossing, Coining, Ironing

Shear - Effect of shear on maximum load on punch, Effect of shear on punch with resultant distortion of slug.Press tool and its terminology

Stock strip layout :Scrap-strip Terminology, Scrap-strip layout for (i) Contoured blanks (ii)Parallel blank edges

Centre line of pressure.

UNIT -IV

METAL JOINING PROCESSESS

Classification of joining processes, Define Autogenous, Heterogeneous and homogeneous joining processes. Principles of solid phase welding .liquid phase welding (fusion) Types of joints, Types of welding positions, Butt-joint edge preparation methods, Weld terminology.

Gas welding :Principle, Characteristics of different fuels, Oxy- Acetylene welding equipment, Acetylene generator, Different types of flames, Fore hand and back hand welding techniques, Gas cutting .

Electric-Arc welding: Principle, Types of Arc welding equipment (AC, DC), Characteristic curves of (i) Constant current (ii) Constant voltage arc welding machine.

Weld penetration as affected by the polarity of workpiece (DCSP/DCEN ,DCRP/DCEP)

Specification of arc welding machines- max rated open circuit voltage, rated current in ampere, Duty cycle

Electrodes: Consumable and Non-consumable electrodes. Purpose of coatings on electrodes. Arc blow in DC Arc welding. Modes of metal transfer in Arc welding.

Different types of Arc welding :(i) Gas Metal Arc Welding (GMAW)

(ii) TIG Welding, (iii) MIG Welding, (iv) Submerged Arc welding (SAW)

Resistance Welding :Principle, Heat balance, electrodes, Types of Resistance Welding

Electro slag welding, Thermit welding, Electron beam welding, laser beam welding, forge welding, Friction welding, Friction stir welding, Explosion welding, Brazing, Braze welding, Soldering, Advantages and Disadvantages,

UNIT -V

POWDER METALLURGY :

Definition, Flow diagram indicating various operations involved in powder metallurgy processing, Production of metallic powder, Mixing, Blending, compacting - Single level component, Two level component Sintering, Pre sintering Secondary operations: Re pressing, Sizing, Coining, Heat treatment, Infiltration, Impregnation, Finishing operations.

HIGH ENERGY RATE FORMING: Principles of explosive forming, Electromagnetic forming, Electro hydraulic forming, Rubber pad forming, Advantages and limitations,

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO1: Understand various steps, elements involved in sand casting process and various types of casting processes

CO2 : Understand principles involved in Different types of Metal Forming Processes

CO3 : Understand principles of different types of Sheet Metal Forming processes

CO4 : Apply the principles involved in Gas welding and Arc Welding in preparation of various types of joints and various types of welding technique and various defects in welding.

CO5 : Understand principles of different types high energy rate forming processes and powder metallurgy techniques

*****

II-Year-I Semester		L	T	P	C
		3	0	0	3
THERMODYNAMICS					

PRE-REQUISITES:

1) Engineering Mathematics

I. Calculus

II.Differential Equations

2) Engineering Chemistry

3) Engineering Physics

COURSE OBJECTIVES: The student should be able to

1) Identify the unique vocabulary associated with thermodynamics through the precise definition of basic concepts to form a sound foundation for the development of the principles thermodynamics and also review concepts of temperature and temperature scales.

2) Introduce the concept of energy, define its various forms and solve energy balance problems for closed (fixed mass) and open (fixed volume) systems that involve heat and work interactions for general pure substances, ideal gases, and incompressible substances.

3) Apply the second law of thermodynamics to cycles, cyclic devices, develop the absolute thermodynamic temperature scale and also establish the increase of entropy principle.

4) Illustrate the P-v, T-v, and P-T property diagrams and P-v-T surfaces of pure substances, demonstrate the procedures for determining thermodynamic properties of pure substances from tables of property data and also relate the specific heat with internal energy and enthalpy of an ideal gas.

5) Predict the P-v-T behavior of gas mixtures based on Dalton’s law of additive pressures and Amagat’s law of additive volumes; use the psychrometric chart as a tool to determine the properties of atmospheric air.

UNIT -I

BASIC CONCEPTS AND DEFINITIONS:

Macroscopic and Microscopic viewpoints, Thermodynamic System, Surrounding, Boundary, Universe, Control Volume, Control Surface, Classes of Systems, State, Thermodynamic Properties, Process and Cycles, Thermodynamic Equilibrium, Reversibility, Quasi static Process, Concept of

Continuum, Specific heat at constant volume, Enthalpy, Specific heat at constant pressure.

ZEROTH LAW OF THERMODYNAMICS: Concept of Temperature, Measurement of temperature, Scales of Temperature, Constant Volume Gas Thermometer,Advantages of gas thermometers over liquid thermometers.

WORK AND HEAT TRANSFER: Work transfer, P-dv work, Path and Point Functions,P-dv work in various Quasi-Static Processes, Types of Work Transfer, Free expansion with zero work transfer, Heat Transfer-a path function, specific heat and Latent heat.

UNIT -II

FIRST LAW OF THERMODYNAMICS: First law for a closed system undergoing a cycle(Joule's experiment) and a change of state, Energy- a property of the system,Energy in Stored and in Transition, Different forms of stored energy, limitations of the first law,PMMI.

THERMODYNAMIC ANALYSIS OF CONTROL VOLUME: Conservation of Energy Principle-Flow work, The Steady Flow Process-Steady Flow Energy Equation, Steady Flow Engineering Devices-Nozzles, Diffuser, Turbine, Throttling Valves and Heat Exchangers

UNIT -III

SECOND LAW OF THERMODYNAMICS: Introduction, Thermal Energy, Reservoirs, Heat Engines, Refrigerators, Heat Pumps, Kelvin-Planck & Clausius Statements of Second law of Thermodynamics, Equivalence of Kelvin-Plank and Clausius Statements, PMM II, Differences between reversible and Irreversible Process, Carnot Cycle and its specialties, Carnot Theorem, Corollary of Carnot's theorem, Thermodynamic scale of Temperature.

ENTROPY: Clausius Inequality, Entropy - Principle of Entropy Increase, Entropy Change for Ideal gases, Availability and Irreversibility(only definitions), Elementary Treatment of the Third Law of Thermodynamics. Second-law analysis of heat engines, Refrigerators and heat pumps.

UNIT -IV

PROPERTIES OF PURE SUBSTANCES: Pure Substances, Phases of Pure Substance, Properties of steam, p-v, p-T, T-s and h-s diagrams, P-V-T- surfaces, Dryness Fraction, Steam tables, Measurement of Steam Quality.

PERFECT GAS LAWS: Avogadro's law, Equation of State of a ideal gas, specific heats, Internal energy and Enthalpy of an ideal gas, Reversible Adiabatic Process, Reversible Isothermal process, Polytropic Process, entropy change of an ideal gas, Deviations from perfect Gas Model, Compressibility factor, Vander walls Equation of state ,Compressibility charts.

UNIT -V

MIXTURES OF PERFECT GASES: Composition of a gas mixture: Mass and Mole Fraction, Gravimetric and volumetric Analysis, Dalton's Law of partial pressure, Amagat`s Laws of additive volumes, Equivalent Gas constant and molecular Internal Energy, Enthalpy, Specific heats and

Entropy of mixture of perfect Gases.

PSYCHROMETRY: Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, Saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart.

TEXT BOOKS:

1) P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2) Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011.

REFERENCE BOOKS:

1) J.P.Holman, Thermodynamics, McGraw Hill Publications -2003.
2) Richard E.Sonntag,ClausBorgnakke,GordonJ.VanWylen,Fundamentals of Thermodynamics, Six Edition, Wiley-India Edition.
3) E.Rathakrishnan, Fundamentals of Engineering Thermodynamics‖, PHI, 2nd Edition, 2010.
4) Prasanna Kumar ,Thermodynamics, First Edition, Pearson Publications.
5) R.K. Rajput, S.Chand& Co., Thermal Engineering, 6/e, Laxmi publications, 2010

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) https://nptel.ac.in/courses/112/105/112105266/
2) https://nptel.ac.in/courses/103/103/103103144/
3) https://nptel.ac.in/courses/112/105/112105220/
4) https://nptel.ac.in/courses/101/104/101104067/
5) https://nptel.ac.in/courses/101/104/101104063/
6) https://nptel.ac.in/courses/103/104/103104151/

DATA BOOKS TO BE ALLOWED IN EXAMINATIONS:

1) S.C. Jain, Steam Tables, Birla Publications Pvt. Ltd – 2011
2) R.S. Khurmi& N. Khurmi, Steam Tables, S.Chand Publications – 2014

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO1 : Explain the fundamental concepts of Thermodynamics, energy transfer by heat, work including various forms of work and also review concepts of temperature and temperature scales.{Understand level, KL2}

CO2 : State and explain laws of thermodynamics and also solve energy balance problems for closed (fixed mass) and open (fixed volume) systems that involve heat and work interactions for general pure substances, ideal gases, and incompressible substances. {Apply level, KL3}

CO3 : Apply the second law of thermodynamics to cycles, cyclic devices, develop the absolute thermodynamic temperature scale and also establish the increase of entropy principle. {Apply level, KL3}

CO4 : Analyze the thermodynamic properties of pure substances from tables of property data and also relate the specific heat with internal energy and enthalpy of an ideal gas. {Analyze level, KL4}

CO5 : Envisage the P-v-T behavior of gas mixtures based on Dalton's law of additive pressures and Amagat's law of additive volumes; use the psychrometric chart as a tool to Compute the properties of atmospheric air. {Apply level, KL3}

*****

II-Year-I Semester		L	T	P	C
		1	0	3	2.5
COMPUTER AIDED ADVANCED ENGINEERING DRAWING					

PRE-REQUISITES:

1) Engineering Graphics / Drawing

2) Basic Computer Knowledge

CAD PACKAGE:

Any one of the CAD Tool i.e.CATIA / CREO / Solid Edge / Siemens PLM software / IRON CAD /Auto- CAD isused to learn the above course.

COURSE OBJECTIVES: The student should be able to

1) Impart knowledge related to principles, methods and techniques of 3D modeling in parametric CAD software. for Ex: CATIA / CREO / Solid Edge / Siemens PLM software / IRON CAD /Auto-CAD
2) To provide basic understanding of 2D drawing practice for various Engineering curves or simple mechanical parts.
3) The student will acquire knowledge of Basic 3D modeling & Advanced Solid Features for simple mechanical parts
4) To provide basic understanding of part design and Assembly design for various Engineering applications.
5) The student will be able to draw the assembly from the individual part drawing.

UNIT -I

Introduction to 3D Experience and Siemens Product Design Lab, software's used and Basic Introduction of CAD Tools and various levels of 3D Experience Lab such as CATIA/ Delmia /Simulia

SKETCHER: Workbench Introduction, Types of Sketches, Creating profiles, Practice of Profile tool bar, Sketcher constraints, sketcher operations, Transformation of profiles, Projection from 3D elements, Practice of transform tools with suitable sketches, Sketch analysis, Sketch modifications ,Create Basic Sketches with ISO Constraints

UNIT -II

PART DESIGN: Workbench Introduction, Reference Elements, Practice on types of points, lines and planes, Basic Solid Features, Practice on conversion of basic 2D to 3D parts.

UNIT -III

Advanced Solid Features: Practice of Ribs ,Slots& Multi- sections Dress up features , Practice of Fillets, chamfers, shell, Transformation of solids Practice of Pattern, mirror & Scaling Surface based features ,Practice of Splitting solids with surfaces , Maintenance of Specification tree. Introduction to Body concept, Practice 3D models using Booleans Creation of complex parts using body concept, Power copy, Practice of Power copy tool.

UNIT -IV

ASSEMBLY DESIGN: Introduction to Workbench, Importing of Parts & Products, Types of Assembly –approach, Practice with Top Down assembly and Bottom Up assembly Approaches, Assembly Constraints and Practice of Product structure tools with basic Assembly.

INTERPENETRATION OF RIGHT REGULAR SOLIDS: Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone, Prism Vs Cone.

UNIT -V

DRAFTING: Introduction to Workbench, Drafting Approach, View Creation, Dimensioning, Geometry modification, Editing Option and Developing sectional views with detailed dimensions. Introduction of Perspective Projections

TEXT BOOKS:

1) Engineering drawing by N.D Bhatt, Charotar publications.

2) Engineering Graphics, K.C. john, PHI Publications.

REFERENCE BOOKS:

1) Engineering Drawing – RK Dhawan, S Chand

2) Engineering Drawing – KL Narayana, P Kannaiah, Scitech

3) Engineering Drawing – Agarwal and Agarwal, Mc Graw Hill

4) Engineering Graphics – PI Varghese, Mc Graw Hill

5) Engineering Drawing + AutoCAD – K Venugopal, V. Prabhu Raja, New Age

6) Engineering Drawing and Graphics using Auto Cad – T Jeyapoovan, vikas

7) Engineering Drawing with auto-CAD, K.Venkata Reddy/B.S . Publications.

8) Toogood Roger Ph.D., P. Eng., Zecher Jack P.E., Creo Parametric 1.0 Tutorial and MultiMedia DVD, SDC Publications, USA (2012), ISBN: 978-1-58503-692-9, ISBN (Book + Software on Disk): 978-1-58503-730-8

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) http://www.maruf.ca/files/catiahelp/CATIA_P3_default.htm
2) CATIA V5 Design Fundamentals A Step by Step Guide,ISBN-13: 978-1477689028, Author:Jaecheol Koh Publisher: ONSIA Inc. (www.e-onsia.com)
3) http://www.staff.city.ac.uk/~ra600/Presentations/CATIA%20V5%20Lectures.pdf
4) https://www.scribd.com/doc/12516072/eBook-Catia-Tutorial-PDF
5) https://www.academia.edu/37546347/NX_12_for_Engineering_Design
6) https://www.youtube.com/playlist?list=PLkMYhICFMsGbYCvbGrrygtqGiBGguIzbf
7) Kelley David S., Pro/ENGINEER Wildfire 5.0 Instructor, Tata McGraw Hill (2011).

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

1) Gain the knowledge in basic modeling concepts using CAD tools such as CATIA / CREO / Solid Edge / Siemens PLM software / IRON CAD /Auto- CAD{Understand level, KL2}
2) Draw 2D sketches for Basic Engineering applications. {Apply level, KL3}
3) Create 3D modeling of various mechanical parts using Solid based features and Boolean operations. {Apply level, KL3}
4) Develop Assembly and Disassembly of various mechanical components. {Apply level, KL3}
5) Provide an experiential learning environment, while applying CAD tools to design of simple parts, assemblies, mechanisms and structures. {Analyze level, KL4}

II-Year-I Semester		L	T	P	C
		0	0	3	1.5
PRODUCTION TECHNOLOGY LAB					

PRE-REQUISITES :

1) Engineering Workshop

COURSE OBJECTIVES: To impart hands-on practical exposure on manufacturing processes a equipment.

LIST OF EXPERIMENTS: At least 10 Experiments are required to be conducted

I. METAL CASTING:

1) Testing of moulding sand Properties (Permeability, Hardness, Moisture, Strength)
2) Pattern Design and making - single piece, split piece
3) Mould Preparation- Single piece, split piece

Theory includes **"Study of Melting Practices, Gating System ".**

II.WELDING:

1) Gas Welding
2) Gas Cutting (Profile Cutting)
3) Manual metal arc welding - Lap & Butt joints.
4) TIG Welding (T-Joint)
5) Resistance Welding

III. METAL FORMING

1) Blanking and punching operations and study of simple, compound and progressive die (Washer preparation)

IV PROCESSING OF PLASTICS

1) Injection moulding
2) Blow moulding

Theory includes " **Study of Different types of plastics and their characteristics** "

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO1: Apply the knowledge in testing mould sand properties and making different Patterns use in casting

CO2: Understand and Analyze various welding process working principles and its Applications.

CO3: Apply the sheet metal forming knowledge to get various shapes by sheet metals.

CO4: Apply the knowledge of plastics and various plastics processing methods

Reference books: Lab Manual

*****

II-Year-I Semester		L	T	P	C
		0	0	3	1.5
MECHANICS OF SOLIDS & METALLURGY LAB					

COURSE OBJECTIVES: The student should be able to

To impart practical exposure on the microstructures of various materials and their hardness evaluation. Also to impart practical knowledge on the evaluation of material properties through various destructive testing procedures

Experiments:

NOTE: Any 6 experiments from each section A and B

(A)MECHNICS OF SOLIDS LAB

1) Determination of strength of ductile materials under tensile load by using UTM and to study stress strain characteristics.
2) Determination of shear strength of materials by using UTM.
3) Determination of stiffness and modulus of rigidity by conducting compression tests on springs.
4) Determination of hardness number by using Brinell Hardness Tester.
5) Determination of hardness number by using Rockwell Hardness Tester.
6) Determination of Impact strength on Izod Impact Testing Machine.
7) Determination of Impact strength on Charpy Impact Testing Machine.
8) Determination of Rigidity Modulus by conducting Torsion test on circular shafts.
9) Determination of Young’s Modulus for materials on simply supported beam.
10) Determination of Young’s Modulus for materials on Cantilever beam.

(B)METALLURGY LAB:

1) Preparation and study of the Micro Structure of pure metals like Iron, Cu andAl.

2) Preparation and study of the Microstructure of Mild steels, low carbonsteels, high – Csteels.

3) Study of the Micro Structures of Cast Irons.

4) Study of the Micro Structures of Non-Ferrous alloys.

5) Study of the Micro structures of Heat treated steels.

6) Hardenability of steels by Jominy End QuenchTest.

7) To findout the hardness of various treated and untreated steels.

II-Year-I Semester		L	T	P	C
		2	0	0	0

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

COURSE OBJECTIVES:

To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.

1) The course aim of the importing basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledge system
2) To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act 2003.
3) The courses focus on traditional knowledge and intellectual property mechanism of traditional knowledge and protection.
4) To know the student traditional knowledge in different sector.

UNIT -I

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

UNIT -II

Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT -III

Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act);B:The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003.

UNIT -IV

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

UNIT -V

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

TEXT BOOKS:

1) V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5thEdition,2014

2) SwamiJitatmanand,ModernPhysicsandVedant,BharatiyaVidyaBhavan

3) Fritzof Capra, Tao ofPhysics

4) Fritzof Capra, The wave ofLife

5) VNJha(Eng.Trans,),TarkasangrahaofAnnamBhatta,InernationalChinmayFoundation,Velliarnad, Amaku,am

6) YogaSutraofPatanjali,RamakrishnaMission,Kolkatta

7) GNJha(Eng.Trans.)Ed.RNJha,Yoga-darshanamwithVyasaBhashya,VidyanidhiPrakasham,Delhi, 2016

8) RNJha,ScienceofConsciousnessPsychotherapyandYogaPractices,VidyanidhiPrakasham,Delhi,

2016

9) PRSharma(Englishtranslation),ShodashangHridayam

10) Traditional Knowledge System in India, by Amit Jha, 2009.

11) Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.

12) Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002

13) "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) https://www.youtube.com/watch?v=LZP1StpYEPM

2) http://nptel.ac.in/courses/121106003/

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO1 : understand the concept of Traditional knowledge and its importance

CO2 : know the need and importance of protecting traditional knowledge

CO3 : Know the various enactments related to the protection of traditional knowledge.

CO4 : understand the concepts of Intellectual property to protect the traditional knowledge

II-Year-II Semester		L	T	P	C
		3	0	0	3
KINEMATICS OF MACHINERY					

PRE-REQUISITES :

1) Engineering Mathematics
2) EngineeringMechanics

COURSE OBJECTIVES:

The main objective of this course is to identify the basic components & layout of mechanisms and understand the kinematics of linkages in the machines.

UNIT -I

MECHANISMS : Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic 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 . Grubler'scriterion ,Grashoff's law , Degrees of freedom, Kutzbach criterion for planar mechanisms, Mechanism and machines – kinematic chain – inversion of mechanism – inversions of quadric cycle, chain – single and double slider crank chains. Kinematic structure of robot ,

LOWER PAIR MECHANISM: Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russel – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and straight line motion, Pantograph. Conditions for correct steering – Davis Steering gear, Ackermans steering gear mechanism.

UNIT -II

KINEMATICS: Velocity and acceleration – Motion of a link in machine – Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain. Velocity and acceleration analysis of for a given mechanism, Kleins construction, Coriolis acceleration, determination of Coriolis component of acceleration.

UNIT -III

CAMS: Definitions of cam and followers – their uses – Types of followers and cams – Terminology –Types of follower motion- Knife edge , Roller and Flat faced followers during Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases. Analysis of motion of followers.

UNIT -IV

BELT, ROPE AND CHAIN DRIVES: Introduction - Selection of belt drive- Types of belt drives-materials-Velocityratio-Slip-Creep-Tensions for flat belt drives & V-belt drive-Angle of contact-Centrifugal tension- Maximum tension – Rope drives. Terminology of Chain drives.

UNIT -V

GEARS: Higher pairs, friction wheels and toothed gears–types – law of gearing, condition for constant velocity ratio for transmission of motion, Form of teeth: cycloidal and involute profiles. Velocity of sliding – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact.

GEAR TRAINS: Introduction to gear Trains, Train value, Types – Simple and reverted wheel train – Epicyclic gear Train. Methods of finding train value or velocity ratio – Epicyclic gear trains. Selection of gear box-Differential gear for an automobile.

TEXT BOOKS:

1) AmbekarA.G. Mechanismand Machine Theory, Prentice Hall of India,NewDelhi, 2009.

2) Rattan S.S, Theory of Machines,3rdEdition, TataMcGraw Hill Publishing Company Ltd.,NewDelhi, 2011.

REFERENCE BOOKS:

1) ShigleyJ. E.AndUickerJ.J.”TheoryofMachinesand Mechanisms", 2ndEdition,McGraw-Hill,Inc., 1995

2) RaoJ.SandDukkipatiR.V,MechanismandMachineTheory,2ndEdition, NewAgeInternational, New Delhi, 2007.

3) SadhuSingh―TheoryofMachines,13rdEdition,PearsonEducation, 1997.

4) Ballaney.P.L―TheoryofMachines,20thEdition,KhannaPublishers, 1996.

5) ThomasBevan,"TheoryofMachines", 3rdEdition, CBSPublishersandDistributors, 2013.

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) https://swayam.gov.in/nd1_noc20_ce50/preview

2) https://www.youtube.com/watch?v=MJeRFzs4oRU&list=PLBEA57F7E7560C8E8

3) https://www.youtube.com/watch?v=yDEJxYGAoso&list=PLbRMhDVUMngdCkMipemSKP_dCgZLLfOe8

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Distinguish different mechanisms with their applications. (Analyze level)

CO 2 : Determine the velocities and accelerations of links in mechanisms.(Apply level)

CO 3 : Construct cam profiles for different types of follower motions.(Apply level)

CO 4 : Analyze belt and rope drives for the rated conditions of the machines.(Analyze level)

CO 5 : Demonstrate kinematic analysis of gears and gear trains. (Apply level)

*****

<table>
<tr><td rowspan="2">II-Year-II Semester</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="6">APPLIED THERMODYNAMICS</td></tr>
</table>

PRE-REQUISITES :

1) Engineering Thermodynamics
2) Engineering Physics
3) Engineering Chemistry

COURSE OBJECTIVES: The student should be able to

1) To familiarize with the various engine systems along with their function and necessity.
2) To perform testing on S.I and C.I Engines for the calculations of performance.
3) To provide basic knowledge of components being used in steam and gas power plant cycles and also analyze the energy transfers and transformations in these components.
4) To make students learn about different types of compressors, calculate the power and efficiency of air compressors.

UNIT -I

AIR STANDARD CYCLES: Otto, Diesel and Dual cycles, its comparisons.I. C. ENGINES : Classification - Working principles, Valve and Port Timing Diagrams, - Engine systems –Fuel, Carburettor, Fuel Injection System, Ignition, Cooling and Lubrication, principles of supercharging and turbo charging.

UNIT -II

MEASUREMENT, TESTING AND PERFORMANCE: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.

UNIT -III

VAPOUR POWER CYCLE: Performance parameters of vapour power cycle, Carnot vapour power cycle, Rankine cycle - schematic layout, thermodynamic analysis, effect of operating variables on Rankine cycle, methods to improve cycle performance – regeneration &reheating. Second law analysis of an ideal Rankine cycle, Cogeneration, Mercury-water binary vapour power cycle.

Boilers: Classification – working principles of L.P & H.P boilers with sketches.

STEAM TURBINES: Classification, Working Principle of Simple Impulse Turbine, Vector diagrams of velocities, Compounding of Impulse Turbine, Working Principle of Reaction Turbine, Velocity Diagram for Reaction Turbine, Degree of Reaction.

UNIT -IV

GAS TURBINES: Simple gas turbine plant, applications, ideal cycle, essential components, classification of gas turbines, comparison between close cycle and open cycle gas turbines, parameters of performance, actual cycle, regeneration, inter cooling and reheating , types of combustion chambers. Combined Gas-Vapour Power cycles

UNIT -V

COMPRESSORS – Classification, Reciprocating, Principle of operation, work required, Isothermal efficiency, volumetric efficiency and effect of clearance, multi stage compression, undercooling, saving of work, minimum work condition for two stagecompression.

ROTARY (POSITIVE DISPLACEMENT TYPE): Roots Blower, vane type compressor, mechanical details and principle of working, efficiency considerations.

DYNAMIC COMPRESSORS: Centrifugal compressors, mechanical details and principle of operation, velocity and pressure variation, Energy transfer, velocity diagrams, Axial Flow Compressors, Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction.

TEXT BOOKS:

1) I.C. Engines / V. Ganesan- Tata McGraw- Hill,4th edition.
2) Thermal Engineering by Mahesh Rathore, Tata McGraw- Hill,2010.

REFERENCE BOOKS:

1) Thermal Engineering / RK Rajput/ Lakshmi Publications,2010.

2) Thermal Engineering by Sadhu Singh, Sukumar Pati, Pearson Publications,First edition,2018.

3) IC Engines – M.L.Mathur&R.P.Sharma – Dhanpath Rai & Sons,2001.

4) I.C.Engines–AppliedThermosciences–C.R.Ferguson&A.T.Kirkpatrick-2ndEdition-Wiley Publ

5) I.C. Engines - J.B.Heywood /McGraw- Hill,2017.

6) ThermalEngineering – R.S.Khurmi&J.S.Gupta- S.chand Publications, 1997.

7) Thermal Engineering / PL Ballaney, Khanna Publishers

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) http://nptel.ac.in/courses/112105123/

2) http://nptel.ac.in/courses/112108148/

3) http://nptel.ac.in/courses/112104113/

4) http://nptel.ac.in/courses/112104033

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

Co1 : Understand about the IC Engines systems like fuel supply, cooling, lubricant ar ignition.{Understand level, KL2}

Co2 : Compute the performance of IC Engines {Apply level, KL3}

Co3 : Apply the thermodynamic laws and compute the performance of Rankine Cycle and als understand about the working of Boilers and Steam turbines. {Apply level,KL3}

Co4 : Apply the Thermodynamic analysis of Brayton cycle and its applications including metho to improve the thermal efficiency of open cycle gas turbine. {Apply level, KL3}

Co5 : Compute the performance of air compressors. {Apply level,KL3}

*****

II-Year-II Semester		L	T	P	C
		3	0	0	3
FLUID MECHANICS & HYDRAULIC MACHINES					

PRE-REQUISITES:

1) Engineering Physics
2) Engineering Mathematics

COURSE OBJECTIVES: The student should be able to

1) Describe briefly the concepts of different fluid properties, present numerous examples related to variation of pressure in a fluid and measurement of pressure and illustrate the flow field.
2) Formulate and Analyze simple problems related to Bernoulli's equation, different flow measuring devices and pipe flows.
3) Understand the concept of boundary layer flow, determine the lift and drag on different geometrical bodies and also analyze simple problems related to impact of jets.
4) Describe briefly hydraulic turbines and its performance characteristic curves.
5) Formulate and Analyze simple problems related to centrifugal and reciprocating pumps.

UNIT -I

FLUID STATICS: Definition of fluid, differences between a solid and fluids, physical properties of fluids- specific gravity, viscosity , surface tension, capillarity, vapor pressure, Pascal's law for pressure at a point, pressure variation in a fluid at rest, Absolute, gauge, Atmospheric and vacuum pressures, measurement of pressure, Manometers- Piezometer, U-tube, inverted and differential manometers.

FLUID KINEMATICS: Introduction, classification of flows, steady & un steady, uniform & non uniform, laminar & turbulent, rotational & irrotational flows, equation of continuity for one dimensional flow, Stream line, path line, streak lines and stream tube, Stream function ,velocity potential function, differences and relation between them, condition for irrotational flow.

UNIT -II

FLUID DYNAMICS: Surface & body forces, Euler's & Bernoulli's equations for flow along a stream line, momentum equation and its applications on force on pipe bend, Measurement of flow: pitot tube, venture meter and orifice meter, flow nozzle.

CLOSED CONDUIT FLOW: Reynold's experiment, Darcy Weisbach equation, Minor losses in pipes, pipes in series and pipes in parallel, total energy line-hydraulic gradient line, power transmission through pipes.

UNIT -III

BOUNDARY LAYER CONCEPTS: Definition, thicknesses, characteristics along thin plate, Definition of displacement, momentum, energy thickness, separation of boundary layers, Fluid flow around submerged objects, concepts of drag and lift, expression for drag and lift, types of drag, Streamlined body and bluff body.

IMPACT OF JETS: hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

UNIT -IV

Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube- theory functions and efficiency.

Performance of hydraulic turbines: Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT -V

Centrifugal pumps: classification, working principle, work done, different heads in a pumping system, different efficiencies of a centrifugal pump, specific speed, pumps in series and parallel, performance characteristic curves, cavitation , NPSH.

Reciprocating pumps: Working principle, types, Discharge and power requirement, slip, coefficient of discharge, effect of acceleration on indicator diagram.

TEXT BOOKS:

1) Hydraulics and Fluid mechanics including Hydraulic machinery MODI and SETH, Standard Book house publications.

2) Fluid Mechanics: Fundamentals and Applications by Y.A. Cengel&J.M.Cimbala, 6th Edn, McGrawHill

REFERENCE BOOKS:

1) Fluid Mechanics and Hydraulic Machines by R.K.Rajput,S.Chand Publications, Sixth Edition.

2) Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria& Sons, Nineth Edition

3) Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International,2007.

4) Hydraulic Machines by Banga & Sharma, Khanna Publishers,Eighth Edition.
5) Fluid Mechanics & Turbo machinery by Dixon, 7th Edn, Elesvier
6) Fluid Mechanics and Hydraulic Machines by Domkundwar&Domkundwar, Dhanpatrai& Co

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) https://nptel.ac.in/courses/112/105/112105171/
2) https://nptel.ac.in/courses/112/105/112105183/
3) https://nptel.ac.in/courses/105/101/105101082
4) https://nptel.ac.in/courses/105/103/105103095/

COURSE OUTCOMES: **Upon successful completion of the course, the student will be able to**

CO1 : Depict briefly the concepts of different fluid properties, Understand the variation of pressure in a fluid, measurement of pressure and also illustrate the flow field. {Understand level, KL2}

CO2 : Apply the Bernoulli's equation for various flow measurement devices and also compute the losses in pipe flows.{Apply level, KL3}

CO3 : Estimate the lift and drag on different geometrical bodies and also compute the force exerted by jet on vanes. {Apply level, KL3}

CO4 : Compute the performance of Hydraulic turbines. { Apply level, KL3}

CO5 : Analyze the performance of centrifugal and reciprocating pumps. {Analyze level, KL4}

*****

II-Year-II Semester		L	T	P	C
		3	0	0	3
DESIGN OF MACHINE MEMBERS-I					

PRE-REQUISITES :

1) Engineering Mathematics
2) Mechanics of Solids
3) Engineering Mechanics
4) Material Science

COURSE OBJECTIVES: The student should be able to

1) To introduce the fundamental knowledge of design, this deals about the shape, size and material of particular machine elements.
2) To implement the failure theory in designing and predicting the behavior of machine components.
3) To introduce the basic principles for design of some machine elements such as riveted joints, welded joints, bolted joints, cotter join and springs.

UNIT -I

DESIGN FOR STATIC STRENGTH:

Basic Procedure of Machine Design, Classifications of Machine design, Factors to be considered in Machine Design, Preferred numbers and significance.

Simple Stresses - stresses - Torsion and Bending stresses - stress strain relations, Theories of elastic failure – Maximum Principal stress theory, maximum shear stress theory, Distortion energy theory.

UNIT -II

DESIGN FOR FATIGUE STRENGTH:

Variable Stresses, Fatigue Failure, Fatigue strength, Endurance limit - Approximate estimation. Design for variable stresses – Gerber's Method, Goodman's Method, Soderberg's Method.

Stress concentration –stress concentration factors – Reduction of Stress Concentration. Cumulative damage in fatigue

UNIT -III

RIVETED JOINTS: Types of riveted joints, Modes of Failure, efficiency of riveted joint, Design of Joints for boiler Shell.

WELDED JOINTS: Types of welded joints, Strength of Parallel Fillet welds, Strength of Transverse Fillet welds, Axially Loaded unsymmetrical welded Joints.

BOLTED JOINTS: Stresses in bolts due to initial tightening, external loading and combined loading, eccentrically loaded bolted joints in shear, Eccentric loadperpendicular to axes of bolts.

UNIT -IV

SHAFTS: Transmission shafts- Shaft design on strength basis- Shaft design on torsional rigidity basis-ASME code for shaft design-Design of hollow shaft on strength and torsional rigidity basis.

KEYS & COUPLINGS:

Types of keys- Design of square and flat keys - Requirements – Rigid couplings-Muff coupling-Clamp coupling Flange coupling-Bushed pin flexible coupling.

UNIT -V

COTTER JOINTS: cotter joints-spigot and socket, sleeve and cotter, jib and cotter joints-

SPRINGS:Types of springs, Terminology of Helical Springs, End conditions, Stress and Deflection equations, Series and parallel Connections, Design of Helical springs.Introduction to Leaf springs, nipping of Leaf Spring.

TEXT BOOKS:

1) Design of Machine Elements, (3rd Edition) by V.B. Bhandari, Tata McGraw Hill Publishers, New Delhi, 2014.

2) Machine Design an Integrated Approach, (5th Edition) Robert L. Norton, Pearson Education Limited, New Delhi, 2013.

REFERENCE BOOKS:

1) A Textbook of Machine Design (SI Units) (12th Edition) by P. C. Sharma, Dr. D. K. Aggarwal, S. K. Kataria& Sons, New Delhi, 2012.

2) Mechanical Engineering Design, (8th Edition) by Joseph Shigley, Charles R Mischke, Tata McGraw Hill Publishers, New Delhi, 2008.

3) Design of Machine Elements, by C. S. Sharma, Kamlesh Purohit, Prentice Hall of India Private Limited (PHI), New Delhi, 2009.

4) A Textbook of Machine Design by R S Khurmi, J K Guptha, S Chand & Company Ltd., New Delhi., (25th Edition), 2005.

5) Design of Machine Elements, (2ndEdition) by P. Kannaiah, ScitechPublications India Private

Limited, Chennai, 2009.

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) https://swayam.gov.in/nd1_noc20_me46/preview

2) https://swayam.gov.in/nd1_noc20_ce50/preview

3) https://www.youtube.com/watch?v=-rZPnpzHutE&t=32s

4) https://www.youtube.com/watch?v=oBGzuZXBoQY&list=PLbjTnjt5GklgyqPw1ULGpWPPpvXWKioU

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Sketch the design Procedure and determine the dimensions of simple mechanical components subjected to static loads considering static theories of failure. KL-3

CO 2 : Apply the knowledge in designing mechanical components subjected to stress concentration and Fatigue loads considering fatigue theories of failure. KL-3

CO 3 : Design and analyze permanent joints such as riveted and welded joints under differentloading conditions. KL-4

CO 4 : Design and analyze temporary joints such as bolted and cotter joints under different loading conditions. KL-4

CO 5 : Design and analyze springs for the given loading. KL-4

*****

II-Year-II Semester		L	T	P	C
		3	0	0	3
PYTHON PROGRAMMING					

PRE-REQUISITES : Nil

COURSE OBJECTIVES: The student should be able to

1) Introduction to Scripting Language
2) Use various data handling mechanisms
3) Exposure to various problems solving approaches of computer science

UNIT -I

INTRODUCTION

History of Python, Need of Python Programming, differences between C and Python, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

Types, Operators and Expressions: Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions.

UNIT -II

FLOW CONTROL & DATA STRUCTURES

Control Flow - Order of Evaluations Control Flow- if, if-elif-else, for, while, break, continue, pass

Data Structures- Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.

UNIT -III

FUNCTIONS, MODULES & PACKAGES

Functions - Defining Functions, Calling Functions, Passing Arguments, Types of arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

Modules: Creating modules, import statement, from. Import statement, name spacing.

Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages

UNIT -IV

OOPs

Object Oriented Programming in Python: Definition, advantages of OOPs, OOPs principles, Data abstraction, Encapsulation, Classes, 'self variable', Methods, Constructor Method.

Inheritance: Introduction to Inheritance, Types of Inheritance, Overriding Methods, and Data hiding.

UNIT -V

STL

Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions

Data Handling: Math, Numpy Library, Matplotlib

TEXT BOOKS:

1) Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2) Learning Python, Mark Lutz, Orielly

REFERENCE BOOKS:

1) Think Python, Allen Downey, Green Tea Press
2) Core Python Programming, R Nageswara Rao, Dreamtech
3) Introduction to Python, Kenneth A. Lambert, Cengage

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) OOPS: https://www.youtube.com/watch?v=qiSCMNBIP2g
2) matplotlib: https://www.youtube.com/watch?v=0v7EMLNEAko
3) numpy: https://www.youtube.com/watch?v=oHaYdfWlgCg
4) Recursion:https://www.youtube.com/watch?v=FaEFpSJqsvk&list=PLqftY2uRk7oXvERQEgATSr-KzAh8WLW_D&index=113

COURSE OUTCOMES: **Upon successful completion of the course, the student will be able to**

CO 1 : Understand the need and the Jargon of Python language at its core.{ Understand level, KL2}

CO 2 : Experiment with various Data structures in interpreted Language. Also develop codes using the control structures in Python. {Apply level, KL3}

CO 3 : Build different types of functions, modules and packages for real software needs. {Apply level, KL3}

CO 4 : Implement Object Oriented Principles in Python. Able to understand advanced programming paradigm. { Apply level, KL3}

CO 5 : Analyze solutions using numpy& matplotlib library. Data visualization is experience by the students. {Apply level, KL3}

*****

II-Year-II Semester		L	T	P	C
		0	0	3	1.5
THERMAL ENGINEERING LAB					

PRE-REQUISITES :Nil

COURSE OBJECTIVES:The main objective of this course is to familiarize the principles and its evaluation of various performance parameters of mechanical systems and its impact on global environment.

LIST OF EXPERIMENTS: (At least 10 Experiments are required to be conducted)

1) I.C. Engines valve / port timing diagrams.
2) Testing of Fuels – Viscosity, flash point/fire point, carbon residue, calorific value.
3) I.C. Engines performance test on 4 -stroke diesel engine
4) I.C. Engines performance test on 2-stroke petrol engine
5) Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol engine.
6) Determination of FP by retardation and motoring test on IC engine.
7) I.C. Engines heat balance at different loads and show the heat distribution curve.
8) Economical speed test of an IC engine
9) Performance test on variable compression ratio engines
10) Performance test on reciprocating air compressor unit.
11) Dis-assembly / assembly of different parts of two wheelers. 3 wheelers & 4 wheelers. Tractor &Heavy duty engines covering 2-stroke and 4 stroke, SI and CI engines.
12) Study of Boilers.

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Compute the property of fuels using suitable tests. (Apply Level)

CO 2 : Analyze the performance characteristics of Internal Combustion Engines. (Analyze Level)

CO 3 : Compute the performance of multistage air compressor unit. (Apply Level)

CO 4 : Identify the accessories and mountings of various boilers and its working principles (Understand Level)

REFERENCE BOOKS: Lab Manual

II-Year-II Semester		L	T	P	C
		0	0	3	1.5
FLUID MECHANICS & HYDRAULIC MACHINES LAB					

PRE-REQUISITES : Nil

COURSE OBJECTIVES: To impart practical exposure on the various flow measuring equipment, performance evaluation methods of hydraulic turbines and pumps.

LIST OF EXPERIMENTS: (At least 10 Experiments are required to be conducted)

1) Calibration of Venturimeter
2) Calibration of Orifice meter
3) Determination of friction factor for a given pipe line.
4) Determination of loss of head due to sudden contraction in a pipeline.
5) Turbine flow meter.
6) Impact of jets on Vanes.
7) Performance Test on Pelton Wheel.
8) Performance Test on Francis Turbine.
9) Performance Test on Kaplan Turbine.
10) Performance Test on Single Stage Centrifugal Pump.
11) Performance Test on Multi Stage Centrifugal Pump.
12) Performance Test on Reciprocating Pump.

REFERENCE: Lab Manual

COURSE OUTCOMES: After completion of the course students are able to:

CO 1 Apply Bernoulli's principle in determining the coefficient of discharge of various flow meters. (Apply Level)

CO 2 Apply the knowledge in verification of fluid flow and estimate the friction factor and loss of head due to sudden contraction in a pipe line. (Apply Level)

CO 3 Apply Impulse Momentum principle in estimation of the force excerted by jet on a fixed flat plate. (Apply Level)

CO 4 Develop capability to apply conservation principles to hydraulic machines. (Apply Level)

****

<table>
<tr><td rowspan="2">II-Year-II Semester</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>1</td><td>0</td><td>2</td><td>2</td></tr>
<tr><td colspan="6">MACHINE DRAWING</td></tr>
</table>

PRE-REQUISITES :

1) Engineering Graphics / Drawing

2) Advanced 3d Modeling Tools

3) Fits & Tolerances

CAD PACKAGE:

Any one of the CAD Tool i.e.CATIA / CREO / Solid Edge / Siemens PLM software / IRON CAD /Auto- CAD isused to learn the above course.

COURSE OBJECTIVES: The student should be able to

1) The student will acquire knowledge of usage CAD Tools for Ex: CATIA / CREO / Solid Edge / Siemens PLM software / IRON CAD /Auto- CAD
2) The student will acquire knowledge of drawing conventions as per IS.
3) To provide basic understanding and drawing practice of various joints / fastening
4) arrangements simple mechanical parts.
5) The student will be able to draw the assembly from the individual part drawing.
6) The student also is enabled to prepare the assembly of various machine or engine components and miscellaneous machine components.

UNIT -I

Machine Drawing Conventions: Need for drawing conventions – introduction to IS conventions

a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.

b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.

c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.

d) Title boxes, their size, location and details - common abbreviations & their liberal usage.

e) Types of Drawings – working drawings for machine parts.

UNIT -II

Drawing of Machine Elements and simple parts:

Selection of Views, additional views for the following machine elements and parts with every drawing Proportions.

a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.

b) Keys, cotter joints and knuckle joint.

c) Riveted joints for plates

d) Shaft coupling, spigot and socket pipe joint.

e) Journal, pivot and collar and foot step bearings

UNIT -III

Assembly Drawing I: Drawings of assembled views for the part drawings of the following using conventions and easy drawing Proportions.

Engine parts:

a) Gear pump.

b) Fuel pump.

c) Petrol Engine connecting rod.

f) Piston assembly.

UNIT -IV

Assembly Drawings II: Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

Other machine parts:

a) Screws jacks.

b) Machine Vices.

c) Plummer block.

d) Tailstock.

UNIT -V

Assembly Drawings III: Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

Valves:

a) Spring loaded safety valve.

b) Feed check valve.

c) Air cock.

d) Control valves

TEXT BOOKS:

1) Machine Drawing – N.Siddeswar, K.Kannaiah&V.V.S.Sastry – TMH

2) Machine Drawing –K.L.Narayana, P.Kannaiah& K. Venkata Reddy / New Age/ Publishers

REFERENCE BOOKS:

1) Machine Drawing – P.S.Gill

2) Machine Drawing – Luzzader

3) Machine Drawing – Rajput

4) Machine Drawing – N.D. Junnarkar, Pearson

5) Machine Drawing – Ajeeth Singh, McGraw Hill

6) Machine Drawing – KC John, PHI

7) Machine Drawing – B Battacharya, Oxford

8) Machine Drawing – Gowtham and Gowtham, Pearson

9) Manuals & Tutorials on CAD/CAE packages like Pro/Engineer, Pro/Mechanica, ANSYS, etc latest available in the lab.

10) Kelley David S., Pro/ENGINEER Wildfire 5.0 Instructor, Tata McGraw Hill (2011).

11) Toogood Roger Ph.D., P. Eng., Zecher Jack P.E., Creo Parametric 1.0 Tutorial and MultiMedia DVD, SDC Publications, USA (2012), ISBN: 978-1-58503-692-9, ISBN (Book + Software on Disk): 978-1-58503-730-8

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) http://www.maruf.ca/files/catiahelp/CATIA_P3_default.htm
2) https://www.youtube.com/playlist?list=PLkMYhICFMsGbYCvbGrrygtqGiBGguIzbf
3) http://www.staff.city.ac.uk/~ra600/Presentations/CATIA%20V5%20Lectures.pdf
4) https://www.scribd.com/doc/12516072/eBook-Catia-Tutorial-PDF

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Gain the knowledge in advanced modeling concepts using CAD tools such as CATIA / CREO / Solid Edge / Siemens PLM software / IRON CAD /Auto- CAD

CO 2 : understand product symbols, weld symbols, pipe joints

CO 3 : Draw the detailed assembly drawings of various machine or engine components and miscellaneous machine components.

CO 4 : To motivate students to develop new innovative methods for measuring product Characteristics.

CO 5 : Improving skills to adopt modern methods in mechanical engineering as continuous improvement.

*****

II-Year-II Semester		L	T	P	C
		0	0	3	1.5
PYTHON PROGRAMMING LAB					

PRE-REQUISITES: Awareness of any IDE for any programming language

COURSE OBJECTIVES:

1) Experiment with scripting language
2) Evaluate expression evaluation, control statements
3) Use Data structures
4) Model Functions, Modules and packages
5) Outline OOP through Python and Exception Handling
6) Select required Python Standard Library for GUI

LIST OF EXPERIMENTS

Exercise 1 - Basics

a) Running instructions in Interactive interpreter and a Python Script
b) Write a program to purposefully raise Indentation Error and Correct it

Exercise 2 - Operations

a) Write a program to compute distance between two points taking input from the user (Pythagorean Theorem)
b) Write a program add.py that takes 2 numbers as command line arguments and prints its sum.

Exercise - 3 Control Flow

a. Write a Program for checking whether the given number is a even number or not.
b. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, 1/10
c. Write a program using for loop that loops over a sequence. What is sequence?
d. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

Exercise 4 - Control Flow - Continued

a. Find the sum of all the primes below two million.

   Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...

b. By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.

Exercise - 5 - DS

a. Write a program to count the numbers of characters in the string and store them in a dictionary data structure

b. Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.

Exercise - 6 DS - Continued

Write a program combine_lists that combines these lists into a dictionary.

Exercise - 7 Files

a. Write a program to print each line of a file in reverse order.

b. Write a program to compute the number of characters, words and lines in a file.

Exercise - 8 Functions

a. Arithmetic operations using Functions.

b. Find mean, median, mode for the given set of numbers in a list.

Exercise - 9 Functions - Continued

a. Write a function nearly_equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on

b. Write a function dups to find all duplicates in the list.

c. Write a function unique to find all the unique elements of a list.

Exercise - 10 - Functions - Problem Solving

a. Write a function cumulative_product to compute cumulative product of a list of numbers.

b. Write a function reverse to reverse a list. Without using the reverse function.

c. Write function to compute GCD, LCM of two numbers. Each function shouldn’t exceed one line.

Exercise 11 - Multi-D Lists

a. Write a program that defines a matrix and prints

b. Write a program to perform addition of two square matrices

c. Write a program to perform multiplication of two square matrices

Exercise - 12 - Modules

Demonstrate Modules in python with necessary example.

Exercise - 13 OOP

Class variables and instance variable and illustration of the self variable

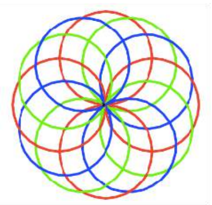
i) Robot

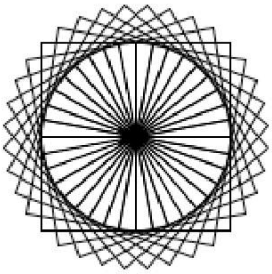
ii) ATM Machine

Exercise - 14

a) Matrix multiplication using numpy.

i) Inverse of a given matrix using numpy.





ii) Generate a matrix of size nxn using random.

b) Demonstrate Subplots, Lineplots& Bar plots using matplotlib.

COURSE OUTCOMES: After completing this course, Students will be able to-

CO1: Comprehend how software easily to build right out of the box.

CO2: Demonstrates the use of an interpreted language for problem solving through control statements including loops and conditionals.

CO3: Practice with data structures for quick programming solutions.

CO4: Demonstrates software building for real needs by breaking out code into reusable functions and modules.

CO5: Comprehend the software reliability through exception handling.

CO6: Use of python standard library for problem solving and Identifies the necessity of testing software

II-Year-II Semester		L	T	P	C
		0	0	2	1
SOCIALLY RELEVANT PROJECT					

PRE-REQUISITES: Nil

COURSE OBJECTIVES

1) To apply the concepts of basic sciences and fundamentals of engineering in the benefit for the society.
2) To increase the social consciousness in the students.
3) To understand practical social relevant technical problems.
4) To apply effort to solve social relevant technical problems.

Student can choose any one of the given below / any other socially relevant problem and work on it to produce a project document.

1) Water Conservation Related Works
2) Swatch Bharath (Internal External)
3) Helping police
4) Traffic monitoring
5) Teaching Rural Kids (Sarvasiksha Abhiyan)
6) Street light monitoring
7) Electricity Conservation
8) Solar panel utilization
9) E- policing & cyber solution
10) Pollution
11) Any social related

COURSE OUTCOMES:

Upon successfully completion of the social relevant project, the student will have:

1) Hands on learning to execute a project.
2) Social responsibility.
3) Training in team work / to work individually.
4) Improvement in communication skills.

<table>
<tr><td rowspan="2">III-Year-I Semester</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="6">DYNAMICS OF MACHINERY</td></tr>
</table>

PRE-REQUISITES:

1) Engineering Mathematics
2) Engineering Mechanics
3) Kinematics of Machinery

COURSE OBJECTIVES: The Students will acquire the knowledge

1) To solve frictional losses, torque transmission of mechanical systems.
2) To analyze dynamic forces of slider crank mechanism and design of flywheel
3) To analyze stabilization of sea vehicles, aircrafts and automobile vehicles and understand the working of various governors.
4) To understand the methods of balancing reciprocating and rotary masses.
5) To understand the concept of vibrations and its significance on engineering design.

UNIT -I

FRICTION:

BEARINGS: Pivot and collar bearings, uniform pressure, uniform wear, friction circle and friction axis: lubricated surfaces, boundary friction, film lubrication.

CLUTCHES: Friction clutches- single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutch.

BRAKES AND DYNAMOMETERS: Simple block brakes, internal expanding brake, bandbrake of vehicle. General description and operation of dynamometers: Prony, Rope brake, Epicyclic, Bevis Gibson and belt transmission.

UNIT -II

Static and dynamic force analysis of planar mechanisms.

TURNING MOMENT DIAGRAMS:

Dynamic force analysis of slider crank mechanism, inertia torque, angular velocity and acceleration of connecting rod, crank effort and turning moment diagrams – fluctuation of energy – fly wheels and their design.

UNIT -III

PRECESSION:

Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships, GOVERNERS:

Watt, porter and proell governors, spring loaded governors – Hartnell and Hartung- sensitiveness, isochronism and hunting.

UNIT -IV

BALANCING:

Balancing of rotating masses single and multiple – single and different planes, use analytical and graphical methods. Primary, secondary, and higher balancing of reciprocating masses- analytical and graphical methods, unbalanced forces and couples –examination of "V" multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing, hammer blow, swaying couple, variation of tractive effort.

UNIT -V

VIBRATIONS:

Free Vibration of spring mass system –Natural frequency-types of damping– damped free vibration, Simple problems on forced damped vibration-critical speeds-torsional vibrations.

TEXT BOOKS:

1) Theory of Machines / S.S Rattan/ Mc. Graw Hill

2) Mechanism and machine theory /Ashok G. Ambedkar/PHI Publications.

REFERENCES:

1) Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age

2) Theory of Machines / Shigley / MGH

3) Theory of Machines / Thomas Bevan / CBS Publishers

4) Theory of machines / Khurmi/S.Chand.

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) https://www.youtube.com/watch?v=ty9QSiVC2g0

2) https://www.youtube.com/watch?v=devo3kdSPQY

3) https://www.youtube.com/watch?v=m4UmBbS7mfI

4) https://www.youtube.com/watch?v=7nJ0mnHXfxw

COURSE OUTCOMES: Upon successful completion of this course the student should be able to:

1) Solve frictional losses, torque transmission of mechanical systems (Apply level, KL-3)

2) Determine dynamic forces of slider crank mechanism and design of flywheel

(Apply level, KL-3)

3) Judge the stabilization of sea vehicles, aircrafts and automobile vehicles and illustrate the working of various governors (Apply level, KL-3)

4) Execute the methods of balancing reciprocating and rotary masses (Apply level, KL-3)

5) Illustrate the concept of vibrations and its significance on engineering design (Understand level, KL-2)

III-Year-I Semester		L	T	P	C
		3	0	0	3
DESIGN OF MACHINE MEMBERS-II					

PRE-REQUISITES:

1) Engineering Mathematics
2) Mechanics of Solids
3) Design of Machine Members I

COURSE OBJECTIVES: The Students will acquire the knowledge

1) Understand to select the suitable bearing based on the application of the loads and predict the life of the bearing
2) Design of engine parts such as connecting rod, crank, crank shaft and engine parts such as piston, cylinder and cylinder liners
3) Design of curved beams with various cross sections and crane hooks
4) Design power transmission elements such as belts, chains, ropes and gear drives
5) Design of the machine tool elements such as levers and brackets

UNIT -I

BEARINGS:

Classification of bearings- applications, types of journal bearings –lubrication – bearing modulus – full and partial bearings – clearance ratio – heat dissipation of bearings, bearing materials – journal bearing design – ball and roller bearings – static loading of ball & roller bearings, bearing life.

UNIT -II

ENGINE PARTS I:

Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends.

Crankshaft: Cranks and crank shafts, strength and proportions of over hung and center cranks – crank pins, crank shafts.

UNIT -III

ENGINE PARTS II:

Pistons, forces acting on piston – construction design and proportions of piston, cylinder, cylinder liners.

UNIT -IV

DESIGN OF CURVED BEAMS:

Introduction, stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and t-section, design of crane hooks, c –clamps.

FLEXIBLE DRIVES:

Transmission of power by belt and rope drives, transmission efficiencies, belts – flat and v types – ropes - pulleys for belt and rope drives, materials, chain drives.

UNIT -V

SPUR & HELICAL GEAR DRIVES:

Spur gears- helical gears – load concentration factor – dynamic load factor, surface compressive strength – bending strength – design analysis of spur gears – estimation of centre distance, module and face width, check for plastic deformation, check for dynamic and wear considerations.

NOTE: Design data book is permitted for examination

TEXT BOOKS:

1) Machine Design/V.Bandari/TMH Publishers

2) Machine Design/ NC Pandya & CS Shaw/ Charotar publishers

3) Design Data Hand Book/S. Md. Jalaluddin/Anuradha Publications

4) Machine Design Data Book/V.B. Bhandari/McGraw Hill Education India

REFERENCES:

1) Machine Design: An integrated Approach / R.L. Norton / Pearson Education

2) Mech. Engg. Design / JE Shigley/Tata McGraw Hill education

3) Design of machine elements- spots/Pearson Publications

4) Machine Design-Norton/Pearson Publications

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) https://nptel.ac.in/courses/112/106/112106137/
2) https://freevideolectures.com/course/3493/vibration-of-structures/31
3) https://www.youtube.com/watch?v=qgqQxIe6QIw
4) https://www.youtube.com/watch?v=qgqQxIe6QIw
5) https://nptel.ac.in/content/storage2/courses/112105125/pdf/mod14les2.pdf

COURSE OUTCOMES: Upon successful completion of this course the student should be able to:

CO 1 : Select the suitable bearings based on the application of the loads and predict the life of the bearing (Apply level, KL-3)

CO 2 : Sketch the design procedure for engine parts such as connecting rod, crank, crank shaft and engine parts such as piston, cylinder and cylinder liners (Apply level, KL-3)

CO 3 : Apply the knowledge in designing the curved beams with various cross sections and crane hooks (Apply level, KL-3)

CO 4 : Design the power transmission elements such as belts, chains, ropes and gear drives (Apply level, KL-3)

CO 5 : Interpret machine tool elements such as levers and brackets (Understand level, KL-2)

III-Year-I Semester		L	T	P	C
		3	0	0	3
METAL CUTTING & MACHINE TOOLS					

PRE-REQUISITES :Production Technology, Metallurgy & Material Science.

COURSE OBJECTIVES:

1) The course provides students with fundamental knowledge and principles in material removal processes.
2) In this course, the students apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, and drill presses, Computer Numerical Control etc
3) To demonstrate the fundamentals of machining processes and machine tools.
4) To develop knowledge and importance of metal cutting parameters.
5) To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.
6) To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes.

UNIT -I

FUNDAMENTAL OF MACHINING:

Elementary treatment of metal cutting theory – element of cutting process – geometry of single point cutting tool, tool angles, chip formation and types of chips – built up edge and its effects, chip breakers, mechanics of orthogonal cutting –Merchant's force diagram, cutting forces, cutting speeds, feed, depth of cut, tool life, tool wear, machinability, economics of machining, coolants, tool materials and properties.

UNIT -II

LATHE MACHINES:

Engine lathe – principle of working, specification of lathe – types of lathe – work holders tool holders – box tools taper turning, thread turning – for lathes and attachments, Turret and capstan lathes.

UNIT -III

SHAPING, SLOTTING AND PLANNING MACHINES: Principles of working – principal parts – specifications, operations performed, machining time calculations.

DRILLING & BORING MACHINES: Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring Machines – fine Boring Machines – jig boring machine, deep hole Drilling Machine.

UNIT -IV

MILLING MACHINES: Principles of working – specifications – classification of Milling Machines – principal features of horizontal, vertical and universal Milling Machine, machining operations, types of cutters, geometry of milling cutters – methods of indexing, accessories to milling machines.

FINISHING PROCESSES: Theory of grinding – classification of grinding machines, cylindrical and surface grinding machines, tool and cutter grinding machines, different types of abrasives, bonds, specification and selection of a grinding wheel. Lapping,Honing & Broaching operations, comparison to grinding.

UNIT -V

JIGS & FIXTURES: Principles of design of jigs and fixtures and uses, classification of jigs & fixtures, principles of location and clamping, types of clamping & work holding devices, typical examples of jigs and fixtures.

CNC MACHINE TOOLS: CNC Machines, working principle, classification, constructional features of CNC machines, CNC controller, types of motion controls in CNC machines, applications of CNC machines.

TEXT BOOKS:

1) Manufacturing Processes / JP Kaushish/ PHI Publishers-2nd Edition

2) Manufacturing Technology Vol-II/P.N Rao/Tata McGraw Hill

REFERENCE BOOKS:

1) Metal cutting and machine tools /Geoffrey Boothroyd, Winston A.Knight/ Taylor & Francis

2) Production Technology / H.M.T. Hand Book (Hindustan Machine Tools).

3) Production Engineering/K.C Jain & A.K Chitaley/PHI Publishers

4) Technology of machine tools/S.F.Krar, A.R. Gill, Peter SMID/ TMH

5) Manufacturing Processes for Engineering Materials-Kalpakjian S & Steven R Schmid/PearsonPublications 5th Edition

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

CO 1 : Understand cutting mechanics to metal machining based on cutting force and power consumption.{Understand level, KL2}

CO 2 : Operate lathe, milling machines, drill press, grinding machines, etc {Operatelevel, KL3}

CO 3 : Operate Shaper, Slotter, Planer, Drill press, Boring machines, etc {Operatelevel, KL3}

CO 4 : Select appropriate Finishing processes and conditions for different metals {Select level, KL2}

CO 5 : Develop Jigs and Fixtures for simple parts and Apply the principles if CNC machines. {Develop level, KL3}

III-Year-I Semester		L	T	P	C
		3	0	0	3
FINITE ELEMENT METHODS					

PRE-REQUISITES :

Numerical Methods, Strength of materials, Basic solid mechanics and Heat Transfer

COURSE OBJECTIVES: After successfully completing this course, student able to

1) To introduce the concepts of Mathematical Modeling of Engineering Problems.
2) To learn basic principles of finite element analysis procedure.
3) To learn the theory and characteristics of finite elements that represent engineering structures.
4) To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses performed by others.
5) To learn to model complex geometry problems and solution techniques.

UNIT -I

Introduction: stress and equilibrium, strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, variational and weighted residual methods.

Finite Element Method: Discretization, types of elements, interpolation functions, local and global coordinates, steps in finite element method, applications of finite element method

UNIT -II

Analysis of Trusses: Finite element modeling, coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress, strain and support reaction calculations.

Analysis of Beams: Element stiffness matrix for Hermite beam element, derivation of load vector for concentrated and UDL, simple problems on beams.

UNIT -III

Axisymmetric loading: Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axisymmetric problems.

UNIT -IV

Higher order and isoparametric elements: One dimensional quadratic and cubic elements in natural coordinates, two dimensional four noded isoparametric elements and numerical integration.

UNIT -V

Steady state heat transfer analysis : one dimensional analysis of a fin and two dimensional analysis of thin plate, analysis of a uniform shaft subjected to torsion.

Dynamic Analysis: Formulation of finite element model, element consistent and lumped mass matrices, evaluation of eigen values and eigen vectors, free vibration analysis.

TEXT BOOKS:

1) Introduction to Finite Elements in Engineering / Chandraputla, Ashok and Belegundu / Prentice – Hall.
2) The Finite Element Methods in Engineering / SS Rao / Pergamon.

REFERENCE BOOKS:

1) Finite Element Method with applications in Engineering / YM Desai, Eldho & Shah /Pearson publishers.
2) An introduction to Finite Element Method / JN Reddy / McGrawHill.
3) The Finite Element Method for Engineers – Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. Byrom / John Wiley & sons (ASIA) Pte Ltd.
4) Finite Element Analysis: Theory and Application with Ansys, Saeed Moaveniu, Pearson Education.

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) https://nptel.ac.in/courses/112/106/112106135/
2) https://nptel.ac.in/courses/112/104/112104116/
3) https://nptel.ac.in/courses/112/104/112104115/
4) https://nptel.ac.in/courses/112/103/112103295/

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Formulate the different types mathematical Techniques used in FEM analysis {Understand level, KL2}

CO 2 : Solve the elements like Beam and Truss subjected to different loading conditions {Apply level, KL3}

CO 3 : Analyze 2-D structures with iso-parametric elements along with axisymmetric problems {Apply level, KL3}

CO 4 : Apply the finite element techniques for solving thermal problems {Apply level, KL3}

CO 5 : Develop consistent mass matrices for different elements by considering the mechanical vibrations {Apply level, KL3}

*****

III-Year-I Semester		L	T	P	C
		3	0	0	3
INTERNET OF THINGS					

COURSE OBJECTIVES:

1) To introduce the IoT related sensor, infrastructural and networking technologies.
2) To understand various modules and protocols used in IoT environment.
3) To understand the core technologies behind IoT.
4) To encourage analysis, design, and development of IoT applications.
5) To identify the real-world scenarios and apply the IoT solutions for a better solution.

COURSE SYLLABUS

UNIT-1:

INTRODUCTION

Definition and Characteristics of IoT – IoT Architectures-Challenges and Issues - Physical Design of IoT, Logical Design of IoT - IoT Functional Blocks, Security.

UNIT-2:

CONTROL UNITS

Communication modules – Bluetooth – Zigbee – Wi-Fi – GPS- IoT Application and Network Layer Protocols (IPv6, 6LoWPAN, RPL, CoAP, MQTT , AMQP, etc.), Wired Communication, Power Sources.

UNIT-3:

FOUR PILLARS OF IOT PARADIGM

RFID, Wireless Sensor Networks, SCADA (Supervisory Control and Data Acquisition), M2M - IoT Enabling Technologies – Big Data Analytics, Cloud Computing, Embedded Systems.

UNIT-4:

IOT SYSTEM DESIGN

Working principles of sensors – IoT deployment for Raspberry Pi /Arduino/Equivalent platform – Reading from Sensors, Communication: Connecting microcontroller with mobile devices –

communication through Bluetooth, wifi and USB - Contiki OS Cooja Simulator. Set up cloud environment –Cloud access from sensors.

UNIT-5: CASE STUDIES

Smart Cities: Smart Car Parking System, Weather Monitoring, Smart Buildings, Transportation and Logistics Management, IoT in Automobile Industries and Industry 4.0.

TEXT BOOKS

1) Dieter Uckelmann et.al, "Architecting the Internet of Things", Springer, 2011

2) Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A Hand-on Approach", Universities press, 2015.

REFERENCE BOOKS:

1) Charalampos Doukas , "Building Internet of Things with the Arduino", Create space, April 2002

2) Dr. Ovidiu Vermesan and Dr. Peter Friess, "Internet of Things: From research and innovation to market deployment", River Publishers 2014.

3) Contiki: The open source for IOT, www.contiki-os.org

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO1 :Identify the basic building blocks of Internet of Things. (Remember, understand, create)

CO2: Design and develop protocols and modules for IoT applications (Remember, understand, create, apply)

CO3: Understand and implement the technologies required for the development of IoT applications. (Remember, Understand, Evaluate, and Apply)

CO4: Implement applications based on sensors and other microcontroller boards. (Remember, Understand, and Apply)

CO5: Build cloud-based IoT applications in real-time. (Remember, Create, Understand, Evaluate and Apply**)**

III-Year-I Semester		L	T	P	C
		0	0	3	1.5
INTERNET OF THINGS LAB					

LIST OF EXPERIMENTS

1) Familiarization with concept of IoT, Arduino/Raspberry Pi and perform necessary software installation.
2) To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON/OFF motor.
3) To interface sensors* with Arduino/Raspberry Pi and write a program to displaysensors data on the computer screen.
4) To interface OLED with Arduino/Raspberry Pi and write a program to display sensor data on it.
5) To interface sensor with Arduino/Raspberry Pi and write a program to turn ON/OFF Relay when sensor data is detected.
6) To interface sensor with Arduino/Raspberry Pi and write a program to turn ON/OFF Solenoid valve when sensor data is detected.
7) To interface sensor with Arduino/Raspberry Pi and write a program to turn ON/OFF Linear Actuator when sensor data is detected.
8) To interface sensor with Arduino/Raspberry Pi and write a program to turn ON/OFF Starter Motor when sensor data is detected.
9) To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smart phone using Bluetooth.
10) To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn Actuators* ON/OFF when message is received from smart phone using Bluetooth.
11) Write a program on Arduino/Raspberry Pi to upload Sensor data to thingspeak cloud.
12) Write a program on Arduino/Raspberry Pi to retrieve sensors data from thingspeak cloud.
13) Develop IoT based smart lock system for Motor cycle/Car
14) Develop IoT based Smart water flow system
15) Develop IoT based home security system

COMPONENTS REQUIRED-

1) Arduino with cable
2) Raspberry Pi with cable and memory card
3) Node MCU
4) Sensors-IR, LDR, DHT11 sensor, Push button, Pressure senser, Temperature sensor, Vibration, Rotation, Location, Torque, Sound, Weight etc.
5) Actuators-LED, Buzzer, Relay Switch, Motors, Motor Drivers, OLED, Display, Linear Actuator, Solenoid Valve, Starter Motor etc.
6) Bluetooth Module, Wi-fi Module, Ethernet Module
7) Smart Phone 8. Computer 9. Power Supply-5V, 12V, 3.3V 10. Internet facility

THE STUDENTS WILL BE ABLE TO

CO1 Understand Internet of Things and its hardware and software components

CO2 Interface I/O devices, sensors & communication modules

CO3 Remotely monitor data and control devices

CO4 Design prototype of IoT based smart system

CO5 Develop IoT based projects for real life problem

<table>
<tr><td rowspan="2">III-Year-I Semester</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td colspan="6">THEORY OF MACHINES LAB</td></tr>
</table>

COURSE OBJECTIVES: The Students will acquire the knowledge

To analyze gyroscope, frequency of free and forced vibration and study static and dynamic balancing and also whirling of shafts.

LIST OF EXPERIMENTS:

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 analyse the motion of a motorized gyroscope when the couple is applied along its spin axis.
4) To determine the frequency of undamped free vibration 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) To find the moment of inertia of a flywheel.
8) To plot follower displacement vs cam rotation 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

COURSE OUTCOMES: Upon successful completion of this course the student should be able to:

CO 1 : Analyse the motion of a motorized gyroscope when the couple is applied along its spin axis **(Analyse level, KL-3)**

CO 2 : Test the frequency of undamped and damped free vibration of an equivalent spring mass system **(Analyse level, KL-4)**

CO 3 : Compute the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation **(Apply level, KL-3)**

CO 4 : Analyse the static and dynamic balancing using rigid blocks, moment of inertia of a flywheel and whirling speed of shaft (**Analyse KL-4)**

III-Year-I Semester		L	T	P	C
		0	0	3	1.5
MACHINE TOOLS LAB					

PRE-REQUISITES: Production Technology Lab, Metallurgy & Material Science Lab.

COURSE OBJECTIVES:

1) The students are required to understand the parts of various machine tools and operate them.
2) They are required to understand the different shapes of products that can be produced on these machine tools.

ALL THE EXPERIMENTS ARE MANDATORY:

1) Introduction of general purpose machines -lathe, drilling machine, milling machine, shaper, planning machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.
2) Step turning and taper turning on lathe machine
3) Thread cutting and knurling on lathe machine.
4) Drilling and tapping
5) Shaping and planning
6) Slotting
7) Milling
8) Cylindrical surface grinding
9) Grinding of tool angles.

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO1: Understand different Machine tools by their terminology and working principle.(Understand Level, KL-2)

CO2: Develop different part features to the desired quality (Develop Level, KL-6)

Reference books: Lab Manual

III-Year- II Semester		L	T	P	C
		3	0	0	3
MICRO ELECTRO MECHANICAL SYSTEMS (MEMS)					

PRE-REQUISITES : -

COURSE OBJECTIVES: After successfully completing this course, student able to

1) To understand the standard micro fabrication techniques and working principles of mechanical sensors and actuators

1. To understand the fundamental principles of thermal sensors and actuators
2. To learn the fundamental principles of magnetic sensors and actuators and optic applications in MEMS
3. To understand Applications of RF MEMS and micro fluid actuation methods
4. To teach applications MEMS in chemical and biological systems.

UNIT -I

INTRODUCTION Definition of Mems, mems history and development, micro machining, lithography principles &methods .structural and sacrificial materials. Thin film deposition, impurity doping, etching, surface micro machining .wafer bonding .LIGA

MECHANICAL SENSORS AND ACTUATORS: Principles of sensing and actuation: beam and cantilever, capacitative ,piezo electric ,strain, pressure flow, pressure measurement by micro phone ,MEMS gyroscopes ,shear mode piezo actuator ,gripping piezo actuator ,inchworm technology

UNIT -II

THERMAL SENSORS AND ACTUATORS: Thermal energy basics and heat transfer processes ,thermisters, thermo devices, thermo couple, micro machined thermo couple probe ,peltier effect heat pumps, thermal flow sensors, micro hot plate gas sensors. mems thermo vessels, pyro electricity, shape memory alloys (SMA),U-shaped horizontal and vertical electro thermal actuator ,thermally activated mems relay micro spring thermal actuator data storage cantilever .

UNIT -III

MAGNETIC SENSORS AND ACTUATORS: Magnetic materials for mems and properties ,magnetic sensing and detection ,magneto resistive sensor , more on hall effect ,magneto diodes ,magneto transistor ,mems magnetic sensor ,pressure sensor utilizing moke mag mems actuators by directional micro actuator feedback circuit integrated magnetic actuator ,large force reluctance actuator ,magnetic probe based storage device .

MICRO-OPTO –ELECTRO MECHANICAL SYSTEMS:MOEMS technology ,properties of light ,light modulators ,beam splitter ,micro lens ,micro mirrors, digital micro mirror device(DMD),light detectors ,grating light valve (GLV),optical switch .wave guide and tuning shear stress measurement

UNIT -IV

RADIO FREQUENCY (RF) MEMS: RF-based communication systems .RF MEMS, Mems inductors, varactors, tuner/filter resonator clarification of tuner, filter resonator, mems switches, phase shifter.

MICROFLUIDIC SYSTEMS: Applications considerations on micro scale fluid, fluid actuation methods, dielectro phoresis (DEP),electro wetting ,electro thermal flow, thermo capillary effect electro osmosis flow, opto electro wetting (OEW),tuning using micro fluidics ,typical micro fluidic channel ,micro fluid dispenser, micro needle, molecular gate ,micro pumps

UNIT -V

CHEMICAL AND BIO MEDICAL MICRO SYSTEMS: Sensing mechanism &principle membrane transducer materials ,chem. Lab on chip (CLOC), chemo resisters ,chemo capacitors ,chemo transistors, electronic nose(E nose),mass sensitive chemo sensors, fluro scence detection ,calorimetric spectroscopy

TEXT BOOKS:

1) MEMS, Nitaigour Premchand Mahalik,TMH Publishing co.

REFERENCE BOOKS:

1) Foundation of MEMS .Chang Liu .Prentice Hall Ltd.
2) Introductory MEMS, Thomas M Adams, Richard A Layton, Springer International Publishers.
3) MEMS design and fabrication by Mohamed gad -el -hak CRC
4) MEMS and NEMS, Sergey Edwrd Lyshevski, CRC Press, Indian Edition.
5) Mems and Micro systems: Design and manufacture .Tai-ran Hsu.TMH Publishers
6) BIO-Mems (Micro Systems) Gerald Urban, Springer.

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) http://www.csa.com/discoveryguides/mems/gloss_f.php
2) https://www.mems-exchange.org/MEMS/applications.html
3) https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-777j-design-and-fabrication-of-microelectromechanical-devices-spring-2007/lecture-notes/

III-Year- II Semester		L	T	P	C
		3	0	0	3
OPTIMIZATION METHODS					

PRE-REQUISITES:

1) Basic Engineering mathematical calculations.

COURSE OBJECTIVES:

1) Formulate a design task as an optimization problem

2) Solve unconstrained optimization problems

3) Formulate constrained optimization problems and solve using corresponding methods

4) Solve geometric problems using special methods

5) Solve multi objective optimization problems with evolutionary methods

UNIT I

INTRODUCTION TO LPP

Concept of optimization – classification of optimization – Examples of linear programming problems – formulation simplex methods– solution of the transportation problem – assignment – shortest route

UNIT II

UNCONSTRAINED OPTIMIZATION

Maximization and minimization of convex functions. Necessary and sufficient conditions for local minima – speed and order of convegence – unibariate search – steepest and desent methods- metcher reeves method -conjugate gradient method.

UNIT III

CONSTRAINED OPTIMIZATION

Necessary and sufficient condition – equality constraints, inequality constraints -kuhu – tucker conditions – gradient projection method – penalty function methods – cutting plane methods of sibel directions.

UNIT IV:

GEOMETRIC PROGRAMMING:

Evolutionary Optimization algorithm: Genetic algorithms, simulated annealing, Anti colony optimization, Particle swarm optimization.

UNIT V:

MULTI-OBJECTIVE OPTIMIZATION

Terminology and concepts, the concepts of Pareto optimality and Pareto optimal set, formulation of multi-objective optimization problem, NSGA.

TEXT BOOKS:

1) Rao S.S,"Optimization – Theory and applications", Wiley Easter Ltd., 1979.
2) Kalyanmoy Deb, Multi-Objective Optimization using Evolutionary Algorithms, Wiley, 2001.

REFERENCE BOOKS

1) Jasbir Arora, Introduction to Optimum Design, Academic Press, 2004
2) Kalyanmoy Deb, Multi-Objective Optimization using EvolutionaryAlgorithms,Wiley,2001

COURSE OUTCOMES : Upon successful completion of the course, the student will be able to

CO 1 : Design task as an optimization problem are formulated { APPLY LEVEL KL 3}

CO 2 : Unconstrained optimization problems are solved { APPLY LEVEL KL 3}

CO 3 : Constrained optimization problems and solve using corresponding methods are formulated { APPLY LEVEL KL 3}

CO 4 : Geometric problems using special methods are solved { APPLY LEVEL KL 3}

CO 5 : Multi objective optimization problems with evolutionary methods are solved

{ APPLY LEVEL KL 3}

III-Year- II Semester		L	T	P	C
		3	0	0	3
OPERATIONS MANAGEMENT					

PRE-REQUISITES:

1) Basic knowledge related towards management.
2) Basic mathematical calculations.

COURSE OBJECTIVES:

1) This course aims to improve students understanding of the concepts, principles, problems, and practices of operations management. After completing this course, students should be able to:
2) To develop an understanding of and an appreciation for the operations management function in any organization.
3) To understand the importance of product and service design decisions and its impact other design decisions and operations.
4) To understand the importance of material planning and productivity in an organization.
5) To obtain an understanding of quality management practice in organizations and how total quality management and six-sigma facilitate organizational effectiveness.
6) To understand the relationship of the various planning practices of capacity planning, aggregate planning, project planning and scheduling.

UNIT – I

INTRODUCTION TO OPERATIONS MANAGEMENT

Definition and its importance-History - Contribution of Henry Ford, Deming, Cross by, Taguchi-Functions and roles in operations management- Nature of International Operations Management.-The Relationship of Operations Management w.r.t. other departments-strategies-levels-principles-current priorities and recent trends-Automation - Services and Manufacturing: Integration and differences - Competitiveness Strategy and productivity -Supply Chain Management

UNIT – II

PROCESS SELECTION, FACILITY LOCATION AND FACILITY LAYOUT:

Process Selection - Types of manufacturing Processes- Overview of qualitative and quantitative methods- Product Design – Influencing factors

Facility Location – Theories, Steps in Selection, Factors affecting location, Location Models.

Facility Layout- Principles, Types, planning tools and techniques-Factors affecting layout.

UNIT – III

MATERIALS MANAGEMENT

Materials Management – Objectives, Planning, Budgeting and Control. Purchasing – Objectives, Functions, Policies, Vendor rating and Value Analysis. Stores Management – Nature, Layout, Classification and Coding. Inventory – Objectives, Costs and control techniques. Overview of JIT.

UNIT – IV

QUALITY ASSURANCE AND CONTROL

Inspection, Statistical process control, Control charts(X-R, n, p, c, np), acceptance sampling concept, risks, cost of quality control; ISO Quality Systems: ISO:9000, ISO:14000, Total Quality Control - concept, KAIZEN, six sigma concept.

UNIT – V

PROJECT PLANNING

Project Management – Scheduling Techniques, PERT, CPM, Crashing CPM networks .

TEXT BOOKS:

1) Aswathappa K and Shridhara Bhat K, Production and Operations Management, Himalaya Publishing House, 6th Edition, 2010.
2) Pannerselvam R, Production and Operations Management, Prentice Hall India, 3 rd Edition, 2013.
3) Norman Gaither and Gregory Frazier, Operations Management, South Western Cengage Learning, 2006.

REFERENCE BOOKS

1) Kanishka Bedi, Production and Operations Management, Oxford University Press, 2007.
2) Russel and Taylor, Operations Management, Wiley, 7 th Edition, 2010.
3) Chary S. N, Production and Operations Management, Tata McGraw Hill, 5 th Edition, 2008.

4) Chase Jacobs, Aquilano & Agarwal., Operations Management, Tata McGraw Hill, 11th edition, 2006.

5) Mahadevan B, Operations Management Theory and practice, Pearson Education, 2 nd edition, 2010.

E- RESOURCES & OTHER DIGITAL MATERIAL

1) https://www.vssut.ac.in/lecture_notes/lecture1429900757.pdf

2) https://ebooks.lpude.in/management/mba/term_3/DMGT501_OPERATIONS_MANAGEMENT.pdf

3) http://www.himpub.com/documents/Chapter911.pdf

COURSE OUTCOMES : Upon successful completion of the course, the student will be able to

CO 1 : Understanding of and an appreciation for the operations management function in any organization is observed.{Understand level, KL2}

CO 2 : The importance of product and service design decisions and its impact other design decisions and operationsis understood.{Understand level, KL2}

CO 3 : The importance of material planning and productivity in an organization is clearly explained.

{Understand level, KL2}

CO 4 : The quality management practice in organizations and how total quality management and six-sigma facilitate organizational effectiveness is explained.{Understand level, KL2}

CO 5 : The relationship of the various planning practices of capacity planning, aggregate planning, project planning and scheduling are clearly explained. {Understand level, KL2}

III-Year- II Semester		L	T	P	C
		3	0	0	3

NANO TECHNOLOGY

PRE-REQUISITES:

1) Basic knowledge on materials.

UNIT -I

INTRODUCTION AND CLASSIFICATION

Summary of electronic properties of atoms and solids, effects of Nano meter length scales, fabrication methods, preparation, safety and storage issues.

UNIT -II

Nano Structures

Importance of Nano-technology, Bottom-up and Top-down approaches, Zero Dimensional Nano-structures - Nano particles through homogenous nucleation and heterogeneous nucleation; One Dimensional Nano-structures - Nano wires and Nano rods, Spontaneous growth, Evaporation and condensation growth, Two dimensional Nano-structures - Fundamentals of film growth. Physical vapour Deposition (PVD) and Chemical Vapour Deposition (CVD):

UNIT -III

Carbon Nano Structures

DLCs, Fullerenes, C60, C80 SWNT and MWNT; Properties: Mechanical, Optical and Electrical properties.

Thermo Electric Materials

Concept of phonon, Thermal conductivity, Specific heat, Exothermic & Endothermic processes.

Nano Semiconductors: Nano scale electronic devices including CMOS, Potentiometric sensors etc., MRAM devices

UNIT -IV

Nano sensors

Introduction to sensors. Characteristics and terminology - Fundamentals of sensors, Sensors for aerospace and defense. Organic and inorganic Nano sensors. Sensor for bio-medical applications, Bioelectronics, Nanoparticle-biomaterial hybrid systems for sensing applications. Gas sensor. Biosensors: Principles, DNA and nucleotide-based biosensors, Protein-based biosensors,

UNIT -V

Application of Nanotechnology

Consumer goods, Cosmetics, Nano catalyst, paints, food and agriculture industries, Nanotechnology for waste reduction and improved energy efficiency, nanotechnology based water treatment strategies. Nano-toxicology. Use of Nano-particles for environmental remediation and water treatment.

TEXT BOOKS:

1) Encyclopedia of Nanotechnology- Hari Singh Nalwa

2) Introduction to Nano technology by Charles P. Poole Jr and Frank J. Owens, Wiley-Inter science, 2003

REFERENCE BOOKS

1) Springer Handbook of Nanotechnology - Bharat Bhusan

2) Handbook of Semiconductor Nanostructures and Nanodevices Vol 1-5- A. A. Balandin, K. L.Wang.

3) Nanostructures and Nanomaterials - Synthesis, Properties and Applications - Cao, Guozhong.

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

1) Know the fundamentals, properties and fabrication methods of Nano components

2) Know the structures of zero, one and two dimensional Nano components

3) Know the structures of carbon, thermal and semiconductor materials

4) Have the knowledge of Nano sensors and their applications

5) Apply the Nano technology in different engineering and other fields.

III-Year- II Semester		L	T	P	C
		3	0	0	3
HEAT TRANSFER					

PRE-REQUISITES: Thermodynamics.

COURSE OBJECTIVES:

1) To develop the fundamental principles and laws of heat transfer and to explore the implications of these principles for system behaviour.
2) To formulate the models necessary to study, analyze and design heat transfer systems through the application of these principles.
3) To develop the problem-solving skills essential to good engineering practice of heat transfer in real-world applications

UNIT -I

Basics of Heat Transfer: Thermodynamics and Heat Transfer, Application areas of heat Transfer, Engineering Heat Transfer, Modes and mechanisms of heat transfer, Basic laws governing heat transfer.

Heat Conduction –Basic Equation: Fourier's law of heat conduction, Thermal conductivity of materials, General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates, steady, unsteady and periodic heat transfer, initial and boundary conditions.

One- Dimensional, Steady State, Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres with constant and variable thermal conductivity, Composite systems, Electrical analogy, Thermal Resistance, Overall heat transfer coefficient, Critical radius of insulation for cylinder and sphere, heat conduction with internal heat generation.

UNIT -II

Heat Transfer from Extended surface (fins): Analysis of long fin, fin with insulated tip and short fin, fin efficiency and effectiveness, Application to error measurement of temperature in a thermometer well.

Transient Heat Conduction: Systems with negligible internal resistance , Lumped heat analysis, Significance of Biot and Fourier Numbers, Systems with finite surface and internal resistance using Heisler Chart, Concept of Semi-infinite body.

UNIT -III

Dimensional Analysis: Introduction, Buckingham Pi Theorem applied to Forced and Natural convection Significance of Non-Dimensional numbers.

Forced Convection: Introduction, Applications, convective heat transfer coefficient, External Flow-Laminar and Turbulent Flow over a Flat plate –Internal Flow through Circular pipe , Laminar and Turbulent Flows-Entry length and fully developed flow , Reynolds Colburn analogy.

Natural Convection: Introduction, Applications, Development of Hydrodynamic and Thermal boundary layer along Vertical plate- Empirical correlations for Vertical plate, Vertical Cylinder, Horizontal Plate and Horizontal Cylinder-Natural convection cooling in electronic equipment, Heat pipe.

UNIT -IV

Boiling and Condensation: Applications of Boiling Heat transfer phenomena, Pool Boiling, Boiling regimes, Calculations on Nucleate boiling, Critical Heat Flux, Condensation-Film wise and Drop wise condensation, laminar film wise condensation on vertical plate horizontal cylinders using empirical correlate.

Heat Exchangers: Introduction, Classification of heat exchangers, Overall heat transfer coefficient, Fouling factor, LMTD method of Heat exchanger analysis, Correction for LMTD for use with Multi pass and Cross flow Heat Exchangers, Effectiveness - NTU method of Heat Exchanger Analysis-Applications of Heat Exchangers.

UNIT -V

Thermal Radiation: Introduction, Applications of Thermal Radiation, Nature of Thermal Radiation, Emissive Power, Absorption, Reflection and Transmission, Concept of Black body, Laws of Black Body Radiation, Radiation from Non-black Surfaces, Emissivity, Kirchhoff 's law , Radiation heat exchange between two black isothermal surfaces, shape factor, Heat exchange between non-black infinite parallel plates, Radiation shields.

Content Beyond Syllabus: ***Natural convection cooling in electronic equipment, Heat pipe.***

DATA HAND BOOK:

1) C.P. Kothandaraman and Subramanian Heat and Mass Transfer Data Book, New Age International Publications, 7th Edition, Reprint 2012

NOTE: Heat and Mass Transfer Data Hand Book by C.P. Kothandaraman and Subramanian-New Age Publications is to be allowed in Examination.

TEXT BOOKS:

1) R.C.Sachdeva - Fundamentals of Engineering Heat and Mass Transfer —New Age Science Publishers, 3nd Edition, 2009.
2) Yunus. A. Cengel, Heat & Mass Transfer-A Practical Approach – Tata McGraw Hill, 4th Edition, 2012

REFERENCE BOOKS

1) M.Necati Ozisik, Heat Transfer- A basic Approach,4th Edition, McGraw-Hill book company, 1985.

2) J.P.Holman, Heat transfer - Tata McGraw-Hill, 9th Edition, 2010.

3) P.K.Nag, Heat and Mass Transfer- TMH 2nd Edition, 2007.

4) P.S.Ghoshdastidar Heat Transfer - Oxford Higher Education 6th Edition 2011.

5) C.P.Kothandaraman and Subramanian, Heat and Mass Transfer, New Age International Publication's 7th Edition 2010.

E- RESOURCES & OTHER DIGITAL MATERIAL

1) https://nptel.ac.in/courses/112/101/112101097/
2) https://nptel.ac.in/courses/112/101/112101001/
3) https://nptel.ac.in/courses/112/101/112101002/

COURSE OUTCOMES : Upon successful completion of the course, the student will be able to

CO 1 : Understand the basic heat transfer principles and their practical relevance in Planes, Cylinders and Spherical components. {Understand level, KL2}

CO 2 : Analyze steady and unsteady state heat transfer concepts and fins.{Analyze level, KL4}

CO 3 : Formulate the expressions to solve free and forced convection problems related to external and internal flows.{Apply level, KL3}

CO 4 : Apply the concepts of heat transfer in boiling, condensation and Design the heat exchanger for engineering applications. {Apply level, KL3}

CO 5 : Apply the concept of heat transfer in radiation thermal systems.{Apply level,KL3}

III-Year- II Semester		L	T	P	C
		3	0	0	3
MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS					

PRE-REQUISITES:

1) Basic knowledge related towards an organization.
2) Basic mathematical calculations.

COURSE OBJECTIVES:

The objective of this course is to inculcate basic knowledge to students relating to concepts of Managerial Economics and Accounting to make them effective business decision makers. Other course educational objectives of this course:

1) To equip the students with the basic inputs of managerial economics and demand concepts.
2) To understand the concepts of production and cost for various business decision.
3) To understand the different types of market, market structures & pricing strategies and their applications in business decision making and to know the different forms of Business organization and the concept of Business Cycles.
4) To understand the fundamental of accounting and analysis of accounting statements for managerial decision making.
5) To understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

UNIT -I

INTRODUCTION TO MANAGERIAL ECONOMICS AND DEMAND ANALYSIS:

Definition of Managerial Economics

Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of 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.

UNIT -II

Theory of Production and Cost Analysis:
Production Function – Isoquant and Isocost, MRTS, Least Cost Combination of Inputs - Laws of Returns to scale - Internal and External Economies of Scale, Cost Analysis: Cost concepts, Cost & output relationship in short run & long run - Break-even Analysis (BEA)-Determination of Break-Even Point - Significance and limitations.

UNIT -III

Introduction to Markets, Pricing Policies & Types of Business Organization and Business Cycles:

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, and Internet Pricing: Flat Rate Pricing, Usage sensitive pricing and Priority Pricing. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – Business Cycles: Phases of Business Cycles.

UNIT -IV

Introduction to Financial Accounting & Analysis:

Financial Accounting and analysis: Accounting –significance -- Book Keeping-Double entry system –Journal- Ledger- Trial Balance- Final Accounts with simple adjustments.
Financial Statement Analysis through ratios: Ratio-analysis of financial statement using different ratios (Liquidity -Profitability- Solvency -Activity ratios).

UNIT -V

Capital and Capital Budgeting:

Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (payback period, accounting rate of return) and modern methods (Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index).

TEXT BOOKS:

1) Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011.

2) Dr. N. Appa Rao, Dr. P. Vijay Kumar: ‘Managerial Economics and Financial Analysis’, Cengage Publications, New Delhi – 2011.

3) Prof. J.V. Prabhakara rao, Prof. P. Venkatarao. 'Managerial Economics and Financial Analysis', Ravindra Publication.

REFERENCE BOOKS

1) V. Maheswari : Managerial Economics, Sultan Chand.
2) Suma Damodaran : Managerial Economics, Oxford 2011.
3) Dr. B. Kuberudu and Dr. T. V. Ramana : Managerial Economics & Financial Analysis, Himalaya Publishing House 2011.
4) Vanitha Agarwal : Managerial Economics, Pearson Publications 2011.
5) Sanjay Dhameja : Financial Accounting for Managers, Pearson.
6) Maheswari: Financial Accounting, Vikas Publications.
7) S. A. Siddiqui & A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012.

REFERENCE BOOKS

1) V. Maheswari : Managerial Economics, Sultan Chand.
2) Suma Damodaran : Managerial Economics, Oxford 2011.
3) Dr. B. Kuberudu and Dr. T. V. Ramana : Managerial Economics & Financial Analysis, Himalaya Publishing House 2011.
4) Vanitha Agarwal : Managerial Economics, Pearson Publications 2011.
5) Sanjay Dhameja : Financial Accounting for Managers, Pearson.
6) Maheswari: Financial Accounting, Vikas Publications.
7) S. A. Siddiqui & A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012.

E- RESOURCES & OTHER DIGITAL MATERIAL

1) www.managementstudyguide.com
2) www.tutorialspoint.com

COURSE OUTCOMES

1) To equipped with the knowledge of estimating the Demand and demand elasticity for a product.{Understand level, KL2}

2) The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.{Understand level, KL2}

3) To understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.{Understand level, KL2}

4) To prepare Financial Statements and the usage of various Accounting tools for analysis {Apply level, KL3}

5) To evaluate various investment project proposals with the help of capital budgeting techniques for decision making {Apply level,KL3}

<table>
<tr><td rowspan="2">III-Year- II Semester</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="6">COMPOSITE MATERIALS</td></tr>
</table>

COURSE OBJECTIVES

1) To understand various matrices and reinforcements used in composites
2) To know about polymer matrix composites, metal matrix composites and ceramic matrix composites
3) To understand the manufacturing processes and applications of composites
4) To introduce post processing operations of composites

UNIT – I

Composite: Introduction, definition, characteristics, functions and classification of composites based on structure and matrix. Smart composites, advantages and limitations, history,industrial scene and applications Interfaces: wettability and bonding interface in composites

UNIT – II

Fibers: Introduction, types of fibers, natural fibers, glass fiber fabrication, structure, properties and applications boron fiber fabrication, structure, properties and applications carbon fiber, Ex-Pan carbon fiber Ex cellulose carbon fiber, and Ex-Pitch carbon fiber. Carbon fiber, structure, properties and applications aramid fiber fabrication, structure, properties and applications whiskers: characteristics, properties and applications

UNIT – III

Polymer matrix composites (PMC): Thermoset, thermoplastic and elastomeric polymers properties, characteristics and applications as matrix materials processing of polymer matrix composites: hand methods, Lay up method, spray up method moulding methods, pressure bagging and bag moulding methods, pultrusion and filament winding process.

UNIT – IV

Metal matrix composites (MMC): Classification of metals, intermetallics, alloys and their potential role as matrices in composites properties, characteristics and applications of metals as matrix materials production techniques: powder metallurgy, diffusion bonding, meltstirring, squeeze casting, liquid infiltration under pressure, spray code position, in-situ process.

UNIT – V

Ceramic matrix composites (CMC): Classification of ceramics and their potential role as matrices, properties, characteristics and applications of ceramics as matrix materials conventional techniques: cold pressing and sintering, hot pressing, reaction bonding hot pressing and reaction bonding new techniques: liquid infiltration, pultrusion, lanxide process,in-situ chemical technique, sol-gel technique

TEXT BOOKS:

1) K. K. Chawla, Composite Materials: Science and Engineering, Springer, 3e,2013.
2) F.L.Matthews & R.D.Rawlings, Composite Materials, Engineering and Sciences, Chapman &hall, London,1994

REFERENCES BOOKS:

1) Hand Book of Composites, George Lubin. Van Nostrand, Reinhold Co.1982
2) P.K.Mallick, Fiber-reinforced composites, Monal Deklar Inc., New York,1988.
3) Mel M. Schwartz, Composite Materials: Properties, Non-destructive testing and Repair, PH, N.Jersey
4) L.J. Broutman and R.M. Krock, Modern Composite Materials, Addison-Wesley,1967.
5) David A Colling & Thomas Vasilos, Industrial Materials: Polymers, Ceramics and Composites, vol.2, Prentice Hall, N. Jersey,1995

EXPECTED OUTCOMES

1) The students will be able to gain knowledge about composites, reinforcements

III-Year- II Semester		L	T	P	C
		3	0	0	3

REFRIGERATION AND AIR CONDITIONING

PRE-REQUISITES: Engineering Thermodynamics.

COURSE OBJECTIVES:

1) To provide a fundamental of Refrigeration and Air Conditioning.
2) To accustom with various methods of Refrigeration systems.
3) To impart knowledge about the comfort air conditioning and cooling load design and estimation.

UNIT -I

FUNDAMENTALS OF REFRIGERATION: Introduction- Necessity and applications, unit of refrigeration and C.O.P-Heat Engine, Refrigerator and Heat pump-Types of Refrigeration systems, and its Applications.

REFRIGERANTS: Classification of refrigerants- Desirable properties-Nomenclature-Commonly used refrigerants- Ozone friendly refrigerants –Green house effect, global warming potential, Ozone depletion potential.

AIR REFRIGERATION SYSTEM: Introduction-Air refrigeration system working on Reversed Carnot cycle – Air refrigeration system working on Bell Coleman cycle- COP- Open and Dense air systems, Applications.

UNIT -II

VAPOUR COMPRESSION REFRIGERATION SYSTEM: Working principle-Simple vapour compression refrigeration cycle – COP- Representation of cycle on T-s and P-h charts-Effect of Sub cooling and Superheating -Actual Vapour compression cycle and its applications.

VCR SYSTEM COMPONENTS: Compressors-Classification-Working -Condensers –Classification-Working-Evaporators –Classification-Working, Expansion devices –Types-Working

UNIT -III

VAPOUR ABSORPTION REFRIGERATION SYSTEM: Description and working of Aqua-Ammonia system- Calculation of maximum COP- Lithium Bromide- Water system-Electrolux Refrigerator, Applications.

STEAM JET REFRIGERATION SYSTEM: Principle of working –Analysis- Applications.

NON CONVENTIONAL REFRIGERATION SYSTEMS- Thermo electric Refrigeration, Vortex tube refrigeration, Adiabatic demagnetization Refrigeration

UNIT -IV

PSYCHROMETRY: Introduction - Psychrometric properties and relations- Psychrometric chart Psychrometric processes-Adiabatic mixing of two air streams, Sensible, Latent and Total heat– Sensible Heat Factor and Bypass Factor for cooling coil and heating coil.

HUMAN COMFORT: Thermodynamics of Human body-Factors affecting the human comfort- Effective temperature – Comfort chart-Air stratification.

UNIT -V

AIR CONDITIONING SYSTEMS: Introduction-Components of Air conditioning system- Classification of Air conditioning systems-Central and Unitary systems- Summer, Winter and Year round systems- Cooling load estimation.

DESIGN OF AIR CONDITION SYSTEMS: Summer air conditioning –ADP-System with Ventilated and re-circulated air with and without bypass factor- RSHF, GSHF and ESHF.

Content beyond the Syllabus:*Ozone friendly refrigerants –Green house effect, global warmingpotential,ElectroluxRefrigerator.*

TEXT BOOKS:

1) C. P. Arora. , Refrigeration and air conditioning - TMH, 2nd Edition, 2000.
2) R. Dossat, Principles of Refrigeration - - Pearson 4th Edition 2001

REFERENCE BOOKS

1) S. C. Arora, Domkundwar, A course in refrigeration and air conditioning-DhanapatRai& sons 5th Edition 1997.
2) Manohar Prasad, Refrigeration and Air conditioning, New Age international, 2003.
3) Basic Refrigeration and Air-Conditioning- Ananthanarayanan, TMH.

E- RESOURCES & OTHER DIGITAL MATERIAL

1) https://nptel.ac.in/courses/112/107/112107208/
2) https://nptel.ac.in/courses/112/105/112105128/
3) https://nptel.ac.in/courses/112/105/112105129/

COURSE OUTCOMES : Upon successful completion of the course, the student will be able to

CO 1 : Describe the various methods of refrigeration systems, identify the desirable refrigerants and also compute the performance of Air refrigeration system. {Apply level, KL3}

CO 2 : Understand the working of VCR system componentsandalso Evaluate the performance of Vapour Compression Refrigeration System.{Apply level, KL3}

CO 3 : Describe thevapour absorption refrigeration system, steam jet refrigeration system and the non conventional refrigeration systems.{Understand level,KL2}

CO 4 : Analyze the Psychrometric processes used in Air Conditioning systems along with the human comfort. {Analyze level, KL4}

CO 5 : Design of Air Conditioning loads for industrial applications. {Apply level,KL3}

III-Year- II Semester		L	T	P	C
		3	0	0	3

ADVANCED MANUFACTURING PROCESSES

PREREQUISITES: Material Science, Basic Manufacturing Processes.

COURSE OBJECTIVES:

1) To make acquainted the various surface hardening processes.
2) To make acquainted the various surface treatment methods.
3) To make acquainted the various processing of ceramics and composites.
4) To know about the applications of advanced manufacturing processes (E Manufacturing, micro machining, nano manufacturing)

UNIT -I

Introduction: Types of advanced manufacturing processes; Evolution, need, and classification of advanced machining processes, Conventional manufacturing vs Advanced manufacturing, Reasons for using Advanced Manufacturing processes.

Surface hardening: Mechanical hardening of the surface, carburizing, carbonitriding, cyaniding, nitriding, ion nitriding, boronizing, laser hardening, thin film coating (PVD, CVD). (5 hrs)

UNIT -II

Surface treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, ceramic and organic methods of coating, economics of coating, Electro forming, Ion implantation, diffusion coating.

UNIT -III

Surface Treatment: Thermal spraying, Chemical vapor deposition, Electroplating, Electroless plating, Anodizing, Painting, Diamond coating and cladding.

UNIT -IV

Processing of ceramics: Applications, characteristics, classification. Processing of particulate ceramics, Powder preparations, consolidation, Drying, sintering, Hot compaction, Area of application, finishing of ceramics.

Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

UNIT -V

E-Manufacturing, Nano manufacturing techniques, micromachining, High Speed Machining and hot Machining-basic principles, working, applications and advantages.

TEXT BOOKS:

1) Manufacturing Engineering and Technology by Kalpakijian, Addison Wesley, 1995.

2) Advanced Machining Processes by V. K. Jain, Allied Publications.

REFERENCE BOOKS:

1) Process and Materials of Manufacturing by R. A. Lindburg, 4th edition, PHI 1990.

2) Introduction to Manufacturing Processes by John A Schey, Mc Graw Hill.

3) Advanced Methods of Machining by J. A Mc Geough, Springer.

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Understand the types of advanced manufacturing processes and various surface hardening processes{Understand level, KL2}

CO 2 : Understand the types of surface treatment (surface coating processes, thin film coating methods) {Understand level, KL2}

CO 3 : Understand the types of surface treatment methods like chemical vapour deposition, diamond coating, cladding etc. {Understand level, KL2}

CO 4 : Understand various processing of ceramics and composites. {Understand level, KL2}

CO 5 : Understand the types of advanced manufacturing processes like E Manufacturing, micromachining, high speed machining etc. {Understand level, KL2}

III-Year- II Semester		L	T	P	C
		3	0	0	3
STATISTICAL QUALITY CONTROL					

PRE-REQUISITES:

1) Basic knowledge related towards the term "quality".
2) Basic Engineering Statistics I (or equivalent)

COURSE OBJECTIVES:

This course will present the theory and methods of quality monitoring including process capability, control charts, acceptance sampling, quality engineering, and quality design.The objectives include

1) To understand the basic concepts of quality monitoring.
2) To understand the statistical underpinnings of quality monitoring.
3) To learn various available statistical tools of quality monitoring.
4) To learn the statistical and economical design issues associated with the monitoring tools.
5) To demonstrate the ability to design and implement these tools.

UNIT -I

INTRODUCTION

Quality Dimensions – Quality definitions – Inspection - Quality control – Quality Assurance – Quality planning - Quality costs – Economics of quality – Quality loss function

UNIT -II

CONTROL CHARTS Chance and assignable causes of process variation, statistical basis of the control chart, control charts for variables- X , R and S charts, attribute control charts - p, np, c and u- Construction and application.

UNIT -III

SPECIAL CONTROL PROCEDURES

Warning and modified control limits, control chart for individual measurements, multi-vary chart, X - chart with a linear trend, chart for moving averages and ranges, cumulative-sum and exponentially weighted moving average control charts.

UNIT -IV

STATISTICAL PROCESS CONTROL

Process stability, process capability analysis using a Histogram or probability plots and control chart. Gauge capability studies, setting specification limits.

UNIT -V

ACCEPTANCE SAMPLING

The acceptance sampling fundamental, OC curve, sampling plans for attributes, simple, double, multiple and sequential, sampling plans for variables.

TEXT BOOKS:

1) Introduction to Statistical Quality Control, 7th Edition by Douglas C. Montgomery, 2013, John Wiley & Sons, Inc., New York.
2) A Text Book of Statistical Quality Control: Guidelines for Quality Engineers, ASIN : 3846590908 LAP LAMBERT Academic Publishing

REFERENCE BOOKS

1) Engineering Statistics by Douglas C. Montgomery, George C. Runger, and Norma F. Hubele, John Wiley & Sons, Inc., New York.
2) Grant E.L. and Leavensworth, Statistical Quality Control, TMH, 2000.

E- RESOURCES & OTHER DIGITAL MATERIAL

1) https://onlinecourses.nptel.ac.in/noc20_mg18/preview

COURSE OUTCOMES : Upon successful completion of the course, the student will be able to

CO 1 : Understand the application of Data Analysis and Decision making in quality monitoring. {Understand level, KL2}

CO 2 : Design empirical projects, collect and evaluate data in order to make technical decisions {Understand level, KL2}

CO 3 : Apply Problem-Solving methods that address technological problems involving quality assurance as encountered in science and technology. {Apply level, KL3}

CO 4 : Make informed decisions based on information available using various Process Control Monitoring tools and techniques.{Apply level, KL3}

CO 5 : Analyse and interpret Control Charts in order to improve the productivity and quality of products. {Apply level,KL3}

III-Year- II Semester		L	T	P	C
		3	0	0	3
ADVANCED MECHANICS OF SOLIDS					

PRE-REQUISITES:

1) Engineering Mathematics
2) Mechanics of Solids

COURSE OBJECTIVES: The Students will acquire the knowledge

1) Determine stress, strain and deformations for statically in-determinate members.
2) Determine and analyse stresses and strains for pressure vessels & rotating discs.
3) Understand the concept to determine stresses in curved beams.
4) Evaluate shear centre for symmetric sections.
5) Determine the contact stresses for spheres and cylinders.

UNIT -I

STATICALLY INDETERMINATE BARS:

Analysis of bars of composite sections, Temperature stresses in composite sections.

STATICALLY INDETERMINATE BEAMS:

Types of beams, fixed beams, Analysis by the differential equations of the Deflection curve, Macaulay's Method, Moment Area Method.

UNIT -II

CONTINUOUS BEAMS: Clapeyron's theorem of three moments, Beams with overhang and fixed ends, Beams with constant and varying moments of inertia.

ENERGY METHODS: Strain energy, Castigliano's theorem, statically indeterminate beams, Applications of Castigliano's theorem.

UNIT -III

THICK CYLINDRICAL AND SPHERICAL PRESSURE VESSELS: Stresses in a thick cylindrical shell, Stresses in compound thick cylinders, Initial difference in radii at the junction of the compound cylinder for Shrinkage, Stresses in thick spherical shells.

CENTRIFUGAL STRESSES:

Introduction, Rotating Ring, Rotating Disc, Rotating Disc of uniform strength.

UNIT -IV

CURVED BEAMS:

Stresses in Beams of small and large initial curvature, The Winkler-Bach theory, Stresses in Crane Hook with trapezoidal cross-section.

SHEAR CENTER:

Shear centre, determination of shear centre for channel section, determination of shear centre for I – section.

UNIT -V

CONTACT STRESSES:

Hertz contact stresses: Determination of maximum contact pressure and stresses when two spheres are in contact, two cylinders are in contact, cylinder in contact with flat surface and sphere in contact with flat surface.

Stress concentration: Introduction, factors affecting stress concentration, theoretical stress concentration factor, determination of stress concentration or stress intensity factors, critical stress intensity factor or fracture toughness for plates subjected to in plane axial and transverse loads.

TEXT BOOKS:

1) Egor P. Popov, "Mechanics of Materials" Second edition, Pearson Publisher, 2015

2) Dr. Sadhu Singh,"Strength of Materials", Ninth edition, Khanna Publishers, 2007.

REFERENCE BOOKS:

1) R.K. Rajput,"Strength of Materials",First Edition, S.Chand & Company, 2006.

2) S.S.Rattan, "Strength of Materials", Second Edition,Tata McGraw Hill Education Private Limited, 2012.

3) Surendra Singh,"Strength of Materials", First Edition, S.K.Kataria & Sons.

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) https://nptel.ac.in/courses/112/101/112101095/

2) https://www.youtube.com/watch?v=_2d8YsXwm7M

3) https://nptel.ac.in/content/storage2/courses/105106049/pdfassignments/main.pdf

COURSE OUTCOMES: **Upon successful completion of this course the student should be able to**

1) Solve the stress, strain and deformations for statically in-determinate members (Apply level, KL3)
2) Determine the stresses and strains for pressure vessels & rotating discs (Apply level, KL-3)
3) Execute the concept to determine stresses in curved beams (Apply level, KL-3)
4) Determine shear centre for symmetric sections (Apply level, KL-3)
5) Understand the concepts of the contact stresses of spheres and cylinders and also the concept of stress concentration (Understand level, KL-2)

III-Year- II Semester		L	T	P	C
		3	0	0	3
POWER PLANT ENGINEERING					

PRE-REQUISITES : Engineering Thermodynamics, Engineering Physics, Engineering Chemistry.

COURSE OBJECTIVES:

1) To make the student learn and understand about various sources of energy, working of thermal power plants and combustion process
2) To familiarize the student with the functioning of Diesel and gas power
3) To learn about the power is produced from Hydroelectric and Nuclear power plants.
4) Able to learn about combined operations of different power plants and the power plant instrumentation and control
5) To make students learn about power plant economics and environmental considerations.

UNIT -I

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 equipments, types of coals, coal handling, choice of handling equipment, coal storage, ash handling systems.

COMBUSTION: properties of coal – overfeed and underfeed fuel beds, travelling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, dust collectors, Dust collection and its disposal – Mechanical type –Electrostatic Precipitator, cooling towers and heat rejection, corrosion and feed water treatment, dearation.

UNIT -II

INTERNAL COMBUSTION AND GAS TURBINE POWER PLANTS:

DIESEL POWER PLANT: Plant layout with auxiliaries – fuel supply system, air starting equipment, super charging. Advantages and Disadvantages of Diesel plants over Thermal plants.

GAS TURBINE PLANT: Introduction – classification - Principles of working of closed and open cycle gas turbines construction – layout with auxiliaries, Combined cycle power plants and comparison.

UNIT -III

HYDRO ELECTRIC POWER PLANT: Water power – hydrological cycle / flow measurement– drainage area characteristics – hydrographs – storage and pondage – classification of dams and spill ways.

HYDRO PROJECTS AND PLANT: Classification – plant operation and pumped storage plants.

NUCLEAR POWER PLANT:Nuclear fuel – breeding and fertile materials – nuclear reactor– Components of Reactor– reactor operation,

TYPES OF REACTORS: Pressurized water reactor, boiling water reactor, sodium-graphite reactor, fast breeder reactor, radiation hazards and shielding – radioactive waste disposal.

UNIT -IV

COMBINED OPERATIONS OF DIFFERENT POWER PLANTS:

Introduction, advantages of combined working, load division between power stations, storage type hydro-electric plant in combination with steam plant, run-of-river plant in combination with steam plant, pump storage plant in combination with steam or nuclear power plant, co-ordination of hydro-electric and gas turbine stations.

POWER PLANT INSTRUMENTATION AND CONTROL: Importance of measurement and instrumentation in power plant, measurement of water purity, gas analysis, O2 and CO2 measurements, measurement of smoke and dust, measurement of moisture in carbon dioxide circuit, nuclear measurements.

UNIT -V

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,Performance and Operating Characteristics of Power Plant, Effluents from power plants and Impact on environment – pollutants and pollution standards – methods of pollution control.

Content beyond Syllabus:*Performance and Operating Characteristics of Power Plant*

TEXT BOOKS:

1) A course in Power Plant Engineering - Arora and Domkundwar/Dhanpatrai & Co.
2) Power Plant Engineering - P.C.Sharma / S.K.Kataria Pub.

REFERENCE BOOKS

1) Power Plant Engineering - P.K.Nag/ II Edition /TMH.
2) .Power station Engineering – ElWakil / McGrawHill.
3) An Introduction to Power Plant Technology - G.D. Rai/Khanna Publishers

E- RESOURCES & OTHER DIGITAL MATERIAL

1) https://nptel.ac.in/courses/112/107/112107291
2) http://nptel.ac.in/courses/112106133/1

3) http://nptel.ac.in/courses/112106133/2

4) http://nptel.ac.in/courses/112106133/

5) http://nptel.ac.in/courses/112106133/4

6) http://nptel.ac.in/courses/112106133/5

COURSE OUTCOMES : Upon successful completion of the course, the student will be able to

CO 1 :Describe sources of energy and Understand the working of steam power plants. {Understand level, KL2}

CO 2 :Understand the working of Internal combustion and Gas Turbine power plants.{Understand level, KL2}

CO 3 :Describe the basic working principles of Hydel power and Nuclear power plants. {Understand level, KL2}

CO 4 :Understand aboutcombined operations of different power plants and the power plant instrumentation and control.{Understand level, KL2}

CO 5 :Apply thepower plant economics for estimation of unit power cost and also Understand the impact of effluents on environment. {Apply level,KL3}

III-Year- II Semester		L	T	P	C
		3	0	0	3
DESIGN FOR MANUFACTURING & ASSEMBLY					

PRE-REQUISITES: Basics of design procedure, Basics of manufacturing processes.

COURSE OBJECTIVES:

1) Understand the design rules and considerations with reference to various manufacturing processes.
2) To discusses capabilities and limitations of each manufacturing process in relation to part design and cost.
3) To examine DFM principles including how the design affects manufacturing cost, lean manufacturing, six sigma, etc.

UNIT -I

Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design. Design for the life cycle total product life of consumer goods-design considerations.

UNIT -II

Machining processes: Overview of various machining processes-general design rules for machining dimensional tolerance and surface roughness.Design for machining – ease –redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT -III

Metal casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

UNIT -IV

Metal joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines- pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints.

Forging:Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

UNIT -V

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing- component design for blanking.

Plastics: Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding – design guidelines for machining and joining of plastics.

Content beyond Syllabus: Designof components using NX software.

TEXT BOOKS:

1) Design for manufacture / John cobert / Adisson Wesley. 1995
2) Design for Manufacture / Boothroyd/CRC Press
3) Design for manufacture/ James Bralla/McGrawHill Edition

REFERENCE BOOKS

1) ASM Hand book Vol.20

COURSE OUTCOMES : Upon successful completion of the course, the student will be able to

CO 1 : Understand the Design guide lines for manufacturing and Product Life Cycle. {Understand level, KL2}

CO 2 : Understand the design rules for Machining and apply the design recommendations for machined parts. {Understand level, KL2}

CO 3 : Understand the casting design and choose the best casting process for a specific product.{Understand level, KL2}

CO 4 : Identify the effect of thermal stresses in weld joints. {Identify level, KL2}

CO 5 : Apply the sheet metal processes and their formation mechanisms to design components and machining and joining of plastics. {Apply level, KL3}

III-Year- II Semester		L	T	P	C
		3	0	0	3
MECHATRONICS					

PRE-REQUISITES:Material Science, Basics of Manufacturing Processes.

COURSE OBJECTIVES:

The main objective of this course is to introduce the integrative nature of Mechatronics. To describe the different components and devices of mechatronics systems.

UNIT -I

Mechatronics systems – Elements & levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT -II

Solid state electronic devices - PN junction diode, BJT, FET, DIAC, TRIAC and LEDs. Analog signal conditioning, operational amplifiers, noise reduction, filtering. (10 hrs)

UNIT -III

Hydraulic and pneumatic actuating systems - Fluid systems, Hydraulic systems, and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems. Mechanical actuating systems and electrical actuating systems – basic principles and elements.

UNIT -IV

Digital electronics and systems - digital logic control, micro processors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT -V

System and interfacing and data acquisition – Data Acquisition Systems, Analog to Digital and Digital to Analog conversions; Digital Signal Processing – data flow in DSPs, block diagrams, typical layouts, Interfacing motor drives. Design of mechatronics systems & future trends.

TEXT BOOKS:

1) MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran, GK Vijaya Raghavan & MS Balasundaram/WILEY India Edition.

REFERENCE BOOKS

1) Mechatronics /Smaili A, Mrad F/ Oxford Higher Education, Oxford University Press
2) Mechatronics Source Book / Newton C Braga/Thomson Publications,Chennai.
3) Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
4) Mechatronics System Design / Devdas shetty/Richard/Thomson.
5) Mechatronics/M.D.Singh/J.G.Joshi/PHI
6) Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition / W. Bolton/Pearson, 2012
7) Mechatronics – Principles and Application / Godfrey C. Onwubolu/Elsevier, Indian print

COURSE OUTCOMES: **Upon successful completion of the course, the student will be able to**

CO 1 : Understand Different elements of mechatronics systems and types along with different types of sensors and transducers.{Understand level, KL2}

CO 2 : Understand Different types of solid state electronic devices like PNP, NPN junction diode, FET along with signal conditioning.{Understand level, KL2}

CO 3 : Understand Different types of actuating systems like mechanical, electrical, hydraulic & pneumatic and their elements.{Understand level, KL2}

CO 4 : Understand Different types of controllers/ processors used in mechatronics system like micro controllers, computers.{Understand level, KL2}

CO 5 : Understand The significance of system interfacing, data aquisition and data flow along with future trends of mechatronics system. {Understand level, KL2}

<table>
<tr><td rowspan="2">III-Year- II Semester</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td colspan="6" align="center">HEAT TRANSFER LAB</td></tr>
</table>

PRE-REQUISITE: Heat Transfer

OBJECTIVES:

1) Define the fundamental concepts to students in the area of heat transfer and its applications.
2) Recognize the practical significance of various parameters those are involved in different modes of heat transfer.
3) Apply the knowledge of heat transfer in an effective manner for different Applications

ANY TEN EXPERIMENTS OF THE FOLLOWING:

1) Determination of overall heat transfer co-efficient of a composite slab
2) Determination of heat transfer rate through a lagged pipe.
3) Determination of heat transfer rate through a concentric sphere
4) Determination of thermal conductivity of a metal rod.
5) Determination of efficiency of a pin-fin
6) Determination of heat transfer coefficient in natural and forced convection
7) Determination of effectiveness of parallel and counter flow heat exchangers.
8) Determination of emissivity of a given surface.
9) Determination of Stefan Boltzman constant.
10) Determination of heat transfer rate in drop and film wise condensation.
11) Determination of critical heat flux.
12) Determination of Thermal conductivity of liquids and gases.

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Analyze theheat transfer through lagged pipe, Insulating powder and Drop and Film wise condensation (Analyze Level, KL-4)

CO 2 : Experiment the Thermal conductivity of a given metal Rod. (Analyze Level,KL-4)

CO 3 : Compute the heat transfer coefficients in forced convection, free convection and also determine effectiveness of heat exchangers and Pin Fin. (Apply Level)

CO 4 : Test Emissivity, Stefan Boltzmann Constant and Critical Heat flux (Analyze Level, KL-4)

<table>
<tr><td rowspan="2">III-Year- II Semester</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td colspan="6">SIMULATION LAB</td></tr>
</table>

PRE-REQUISITES : Finite Element Methods, Any CAD software.

COURSE OBJECTIVES:

1) To give exposure to software tools needed to Analyze engineering problems.
2) To expose the students to different applications of simulation and analysis tools.

ANY TEN EXPERIMENTS OF THE FOLLOWING:

1) Determination ofForce and stress analysis using link elements in Trusses, cables etc.
2) Determination ofStress and deflection analysis in beams with different support conditions.
3) Determination ofStress analysis of flat plates and simple shells.
4) Determination ofStress analysis of axi-symmetric components.
5) Determination ofHarmonic, transient and spectrum analysis of simple systems.
6) Determination ofVibration analysis of spring-mass systems.
7) Determination ofModal analysis of beams.
8) Determination ofThermal stress analysis of cylindrical shells.
9) Determination ofThermal stress and heat transfer analysis of plate.
10) MAT LAB basics, dealing with matrices, Graphing-functions of one variable and two variables..
11) Use of MATLAB to solve simple problems in vibration.
12) Mechanism Simulation using multi body dynamic software.

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Compute the deflection and stress in 1D and 2D problem. (ComputeLevel, KL-3)

CO 2 : Examine the effect of various load acting on 1D beam in real time problem.(Examine Level, KL-3)

CO 3 : Determine the effects due to harmonic loading on structures.(Determine Level, KL-3)

CO 4 : Examine the modal analysis for beam under various boundary conditions.(Examine Level, KL-3)

CO 5 : Examine the thermal effects on 2D structure.(Examine Level, KL-3)

CO 6 : Apply numeric techniques and computer simulations to solve engineering-related problems.
(Apply Level, KL-3)

<table>
<tr><td rowspan="2">III-Year- II Semester</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>3</td></tr>
<tr><td colspan="6">MANAGEMENT SCIENCE</td></tr>
</table>

PREREQUISITES: Basic Sciences and Humanities

COURSE OBJECTIVE:

1) To familiarize with the process of management, principles, and basic concepts of Organization.
2) To understand the tools of operations and Materials Management.
3) To provide conceptual knowledge on functional management like Human resource management and Marketing management.
4) To impart knowledge on project management.
5) To provide basic insight into selected contemporary management practices and Strategic Management.

UNIT -I

Introduction to Management:

Concept –nature and importance of Management –Generic Functions of Management – Principles and Types of Management –Evolution of Management thought- Theories of Motivation – Decision making process-Designing organization structure- Principles of organization – Organizational typology.

UNIT -II

Operations Management:

Work study- Statistical Quality Control- Control charts (P-chart, R-chart, and C-chart) Simple problems- Material Management: Need for Inventory control- EOQ, ABC analysis (simple problems) and Types of ABC analysis (HML, SDE, VED, and FSN analysis), Justin- Time (JIT) system, Total Quality Management (TQM), Six sigma, Supply chain management.

UNIT -III

Functional Management:

Concept of HRM, HRD and ER (Employee Relations) - Functions of HR Manager- Compensation Management plans – Job Evaluation and Merit Rating - Marketing Management: Functions of Marketing – Marketing strategies based on product Life Cycle, Channels of distributions.

UNIT -IV

Project Management:

(PERT/CPM): Development of Network – Difference between PERT and CPM Identifying Critical Path- Probability- Project Crashing (Simple Problems).

UNIT -V

Strategic Management:

Vision, Mission, Goals, Strategy – Elements of Corporate Planning Process – Environmental Scanning – SWOT analysis- Steps in Strategy Formulation and Implementation, Generic Strategy Alternatives, Basic concepts of MIS, ERP, Capability Maturity Model (CMM) Levels, Balanced Score Card.

CONTENT BEYOND SYLLABUS:

1) Globe Structure
2) Six Sigma

TEXT BOOKS:

1) Management Science, Aryasri, Tata McGraw Hill, 2014.
2) Dr. P. Vijaya Kumar & Dr. N. Appa Rao, 'Introduction to *Management Science'* Cengage, Delhi, 2012.
3) G Srinivasa Rao: 'Management Science', The Hi-Tech Publishers, 2004.

REFERENCE BOOKS:

1) Principles of Marketing: A South Asian Perspective, Kotler Philip, Gary Armstrong, Prafulla Y. Agnihotri, and EshanulHaque , 17th Edition, Pearson Education/ Prentice Hall of India, 2018.
2) Human Resource Management: Gary Dessler, 14th Edition, pearson 2015.
3) Production and Operations Management: S N Chary, TMH, 2019, 6e.
4) Project Planning and Control with PERT and CPM: Dr. B. C. Punmia, K. K Khandelwal, Laxmi Publication, 2017, 4th Edition.
5) Strategic Management: John A Pearce, Richard B Robinson, TMH 12th Edition, 2017.

Web links:

1) www.managementstudyguide.com
2) www.tutorialspoint.com
3) www.lecturenotes.in

COURSE OUTCOMES : Upon successful completion of the course, the student will be able to

CO 1 : Apply management and motivation theories to renovate the practice of management.

CO 2 : Explain concepts of quality management and use process control charts, concepts and tools of quality engineering in the design of products and process controls.

CO 3 : Appraise the functional management challenges associated with high levels of change in the organizations.

CO 4 : Identify activities with their interdependency and use scheduling techniques of project management PERT/CPM.

CO 5 : Develop global vision and management skills both at strategic level and interpersonal level.

<table>
<tr><td rowspan="2">IV-Year- I Semester</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>3</td></tr>
<tr><td colspan="6">MECHANICAL VIBRATIONS</td></tr>
</table>

PRE-REQUISITES:

1) Engineering Mechanics
2) Dynamics of Machinery

COURSE OBJECTIVES:Upon successful completion of the course, the student will be able to

1) Analyze the various 1-D periodic responses of a vibrating system with and without damping
2) To learn to derive the equations of motion and solution for Two and multi degree freedom systems by the application of analytical methods
3) To understand the numerical methods for quick estimation of 1st natural frequency of multi degree freedom systems.
4) Have the knowledge of the various physical vibration measuring instruments.
5) Learn to solve vibrations problems of continuous systems.

UNIT -I

Single degree of Freedom systems: Undamped and damped free vibrations, forced vibrations, coulomb damping, Response to harmonic excitation, rotating unbalance and support excitation, Vibration isolation and transmissibility.

UNIT -II

Vibration Measurement: Vibrometers, velocity meters & accelerometers

Two degree of freedom systems: Principal modes – undamped and damped free and forced vibrations; undamped vibration absorbers.

UNIT -III

Multi degree of freedom systems: Introduction Modeling of Continuous systems as Multi degree of Freedom systems, Using Newton's second law to derive equations of motion, Influence Coefficients. Potential and kinetic energy expressions in matrix form; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi – rotor systems and geared systems; Discrete-Time systems.

UNIT -IV

Numerical Methods: Rayleigh's, stodola's, Matrix iteration, Rayleigh-Ritz Method and Holzer's methods.

UNIT -V

Application of concepts: Free vibration of strings – longitudinal oscillations of bars-transverse vibrations of beams- Torsional vibrations of shafts. Critical speeds without and with damping, secondary critical speed.

CONTENT BEYOND SYLLABUS

piezo electric sensors and actuators for active control, semi active control of automotive suspension systems.

TEXT BOOKS:

1) S.S.Rao,MechanicalVibrations,5/e,PearsonEducationInc.,2011.
2) G. K. Grover,Mechanical Vibrations, 8/e, Nem Chand & Bros.

REFERENCE BOOKS

1) L.Meirovich, Elements of Vibration Analysis, 2/e.TataMcGrawHill,2007.
2) J.S.RaoandK.Gupta,IntroductoryCourseonTheoryandPracticeofMechanicalV i brations,2/e,NewAgeInternational,1999

E-RESOURCES & OTHER DIGITAL MATERIAL

1) https://nptel.ac.in/courses/112/103/112103112/
2) https://nptel.ac.in/courses/112/103/112103111/

COURSE OUTCOMES

CO 1 : Interpret various 1-D periodic responses of a vibrating system with and without damping. (KL-3)

CO 2 : Solve equations of motion for two degree freedom systems by the application of analytical methods. (KL-3)

CO 3 : Solve equations of motion for multi degree freedom systems by the application of analytical methods. (KL-3)

CO 4 : Apply various numerical methods for estimation of natural frequency of multi degree freedom systems. (KL-3)

CO 5 : Apply the knowledge of the various physical vibration measuring instruments and their applications in real life vibration data acquisition. (KL-3)

IV-Year- I Semester		L	T	P	C
		3	1	0	3
CAD/CAM					

PREREQUISITES: Basics of computer, Parametric designing, manufacturing processes

COURSE OBJECTIVES:

1) To understand the basic fundamentals of computer aided design and manufacturing.
2) To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc.
3) To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication.
4) To learn the part programming, importance of group technology, computer aided process planning.
5) To learn about the computer aided quality control & elements of computer integrated manufacturing systems.

UNIT -I

Introduction to CAD/CAM, product cycle, CAD / CAM Hardware, basic structure.

COMPUTER GRAPHICS: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 2D and 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT -II

GEOMETRIC MODELING:Requirements, geometric models, geometric construction models, curve representation methods, parametric representation of various curves: cubic spline, Bezier curves. Surface representation methods, Solid modelling.

UNIT -III

PART PROGRAMMING FOR NC MACHINES: NC, NC modes, NC elements, CNC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming. Direct Numerical Control, Adaptive Control.

UNIT -IV

GROUP TECHNOLOGY: Part family, coding and classification, production flow analysis, types and advantages. Computer aided processes planning – importance, types. FMS- Introduction, Equipment, Tool management systems, Layouts, FMS Control

UNIT - V

COMPUTER INTEGRATED MANUFACTURING SYSTEMS:

Types of manufacturing systems, machine tools and related equipment, material handling systems, material requirement planning, computer control systems, human labor in manufacturing systems, CIMS benefits.

COMPUTER AIDED QUALITY CONTROL: Terminology used in quality control, use of computers in Quality control. Inspection methods- contact and noncontact types, computer aided testing, integration of CAQC with CAD/CAM.

TEXT BOOKS:

1) CAD / CAM Principles and Applications/PN Rao / McGraw-Hill
2) Automation, Production systems & Computer integrated Manufacturing/ M.P. Groover/Pearson Education

REFERENCE BOOKS:

1) Mastering CAD / CAM / Ibrahim Zeid / McGraw-Hill
2) Principles of Computer Aided Design and Manufacturing / Farid Amirouche Pearson
3) Computer Numerical Control Concepts and programming / Warren S Seames / Thomson learning, Inc
4) Product manufacturing and cost estimation using CAD/CAE/ Kuang Hua Chang/Elsevier Publishers

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

CO 1 : Understand the role of computers in design and manufacturing with transformationsofgeometric model {Understand level, KL2}

CO 2 : Illustrate various entities of wire frame, surface, and solid models {Understand level, KL2}

CO 3 : Distinguish between a CNC machine and a conventional machine {Understand level, KL2}

CO 4 : Formulate manufacturing cell based on similar manufacturing attributes of parts {Understand level, KL2}

CO 5 : Understandthe benefits of computer aided quality control & Manufacturing systems {Understand level, KL2}

<table>
<tr><td rowspan="2">IV-Year- I Semester</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>3</td></tr>
<tr><td colspan="6">RENEWABLE ENERGY SOURCES</td></tr>
</table>

PREREQUISITES: Nil

COURSE OBJECTIVES:

1) The course aims to highlight the significance of alternative sources of energy, processes and provides the theory and working principles of probable sources of renewable energy systems that are environmentally friendly.
2) The students are expected to identify the new methodologies / technologies for effective utilization of renewable energy sources.
3) This course envisages the new and renewable source of energy, available in nature and to expose the students on sources of energy crisis and the alternatives available, also stressup on the application of non-conventional energy technologies.

UNIT-I

SOLAR RADIATION: Role and potential of renewable sources, the solar energy option, Environmental impact of solar power, Solar energy utilization in India, structure of the sun, the solar constant, sun-earth relationships, extraterrestrial and terrestrial solar radiation, the celestial vault and basic earth angles, determination of solar time, solar radiation on tilted surface, instruments for measuring solar radiation and sunshine, solar radiation data, numerical problems, A basic Photovoltaic system for power generation,Solar cell modules,types of solar cells, Solar cell production,Applications

UNIT-II

SOLAR ENERGY COLLECTION: Liquid flat plate collector, Selective absorber coatings, selection of materials, classification of concentrating collectors, its working and orientation systems.

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, Buildings and other solar thermal applications: Air heaters, energy -efficient buildings, passive solar systems, active solar systems, integrated energy-efficient buildings, crop driers, space cooling, water desalination, solar cookers, central power tower concept and solar chimney.

UNIT-III

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

BIO-MASS: Properties, principles of production, classification fixed dome-floating type, comparison, site selection, Plant models in India: floating gas holder- KVIC, fixed dome - Janata type, pragati model, deenbandhu model, constraints for implementation, Factors affecting, Waste Recycling Plants.

UNIT-IV

GEOTHERMAL ENERGY: Origin and Distribution of Geothermal Energy, Types of Geothermal Resources- Hydrothermal Resources, Geopressured Resources, Hot Dry Rock Resources, Magma Resources, Types of wells,potential in India.

OCEAN ENERGY: OTEC: Principles, utilization, setting of OTEC plants, thermodynamic cycles. Tidal Energy: Origin and Potential, conversion techniques: types of basins Wave Energy: Origin and Potential, conversion techniques: Heaving Float type, pitching type, Heaving and Pitching type, Oscillating water column type, Surge devices.

UNIT-V

Direct Energy Conversion: Need for DEC, limitations, principles of DEC. Thermoelectric generators, Seebeck, Peltier and Joule Thompson effects, figure of merit, materials, applications, Thermionic Generator.

Fuel cells: Principle, Faraday's laws, thermodynamic aspects, Performance limiting factors of fuel cells- Types of fuel cells.

MHD Power: MHD Generator-Open and Closed Systems, applications of direct energy conversion systems.

TEXT BOOKS:

1) Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/ TMH
2) Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006
3) Green Manufacturing Processes and Systems - J. Paulo Davim/Springer 2013

REFERENCE BOOKS:

1) Alternative Building Materials and Technologies - K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Rao/New age international

2) Principles of Solar Engineering - D.Yogi Goswami, Frank Krieth& John F Kreider / Taylor & Francis 3. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd
3) Renewable Energy Technologies -Ramesh & Kumar /Narosa
4) Nonconventional Energy Source- G.D Roy/Standard Publishers
5) Renewable Energy Resources-2 nd Edition/ J.Twidell and T. Weir/ BSP Books Pvt.Ltd
6) Fuel Cell Technology -Hand Book / Gregor Hoogers / BSP Books Pvt. Ltd
7) Solar Energy Utilization by GD Rai, Khanna Publications

E- RESOURCES & OTHER DIGITAL MATERIAL

1) https://onlinecourses.nptel.ac.in/noc21_ch11/preview
2) https://nptel.ac.in/courses/103103206
3) https://nptel.ac.in/courses/121106014

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

CO 1 : To understand the physics of solar radiation,the principles and working of measuring solar radiation. {Understand level, KL2}

CO 2 : To comprehend solar energy storage, buildings and other solar thermal applications{Understand level, KL2}

CO 3 : To acknowledge the principles and working of wind and biomass energy conversion systems. {Understand level, KL2}

CO 4 : To capture and apply other forms of energy sources like Geo-thermal energy & Ocean energy. {Understand level, KL2}

CO 5 : To understand the principles of Direct Energy Conversion,Fuel cells & MHD Power. {Understand level, KL2}

IV-Year- I Semester		L	T	P	C
		3	1	0	3
PRODUCTION PLANNING AND CONTROL					

PREREQUISITES: Basic sciences and humanities

COURSE OBJECTIVES:

1) To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
2) To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT -I

INTRODUCTION:

Objectives and benefits of planning and control-Functions of production control-Types of production- job- batch and continuous-Product development and design-Marketing aspect - Functional aspects- Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration-Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

UNIT -II

WORK STUDY:

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

UNIT -III

PRODUCT PLANNING AND PROCESS PLANNING:

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning- Steps in process planning-Quantity determination in batch production-Machine capacity, balancing-Analysis of process capabilities in a multiproduct system.

UNIT -IV

PRODUCTION SCHEDULING:

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance – Flow production scheduling- Batch production scheduling-Product sequencing – Production Control systems- Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting- Manufacturing lead time-Techniques for aligning completion times and due dates.

UNIT -V

INVENTORY CONTROL AND RECENT TRENDS IN PPC:

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system - Ordering cycle system-Determination of Economic order quantity and economic lot size- ABC analysis - Recorder procedure-Introduction to computer integrated production planning systems-elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

TEXT BOOKS:

1) James. B. Dilworth, ”Operations management – Design, Planning and Control for manufacturing and services” Mcgraw Hill International edition 1992.

2) MartandTelsang, “Industrial Engineering and Production Management”, First edition, S. Chand and Company, 2000.

REFERENCE BOOKS:

1) Chary. S.N., “Theory and Problems in Production & Operations Management”, Tata McGraw Hill, 1995.

2) Elwood S.Buffa, and Rakesh K.Sarin, “Modern Production / Operations Management”, 8th Edition John Wiley and Sons, 2000.

3) Jain. K.C. & Aggarwal. L.N., “Production Planning Control and Industrial Management”, Khanna Publishers, 1990.

4) Kanishka Bedi, “Production and Operations management”, 2nd Edition, Oxford university press, 2007.

5) Melynk, Denzler, “Operations management – A value driven approach” Irwin Mcgraw hill.

6) Norman Gaither, G. Frazier, “Operations Management” 9th Edition, Thomson learning IE, 2007

7) Samson Eilon, “Elements of Production Planning and Control”, Universal Book Corpn.1984

8) Upendra Kachru, “Production and Operations Management – Text and cases” 1st Edition, Excel books 2007

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : To understand the overview of optimization techniques, concepts of design space, constraint surfaces and objective function. {Understand level, KL2}

CO 2 : To formulate real-life problems with Linear Programming models using graphical and simplex methods. { Knowledge level, KL1}

CO 3 : To formulate real-life transportation, assignment and travelling salesman problems to find the optimum solution using transportation algorithms and to find out probability of expected completion time using PERT-CPM networks. {Apply level, KL3}

CO 4 : To apply dynamic programming and integer programming to optimize multi stage decision problems. {Apply level, KL3}

CO 5 : To determine the level of game theory and simulation modelling that a business must maintain to ensure smooth operation. {Understand level, KL2}

IV-Year- I Semester		L	T	P	C
		3	1	0	3

AUTOMATION IN MANUFACTURING

PREREQUISITES: Production technology, Metal cutting and machine tools

COURSE OBJECTIVES:

1) To study the types and strategies and various components in Automated Systems.
2) To understand the automated flow lines, line balancing, material storage and retrieval and inspection

UNIT -I

INTRODUCTION: Types and strategies of automation, pneumatic and hydraulic components, circuits, automation in machine tools, mechanical feeding and tool changing and machine tool control.

UNIT -II

AUTOMATED FLOW LINES: Methods of part transport, transfer mechanism, buffer storage, control function, design and fabrication considerations.

Analysis of automated flow lines – General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines

UNIT -III

ASSEMBLY SYSTEM AND LINE BALANCING: Assembly process and systems, assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT -IV

AUTOMATED MATERIAL HANDLING and STORAGE SYSTEMS: Types of equipment, functions, analysis and design of material handling systems, conveyor systems, automated guided vehicle systems. Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT -V

ADAPTIVE CONTROL SYSTEMS: Introduction, adaptive control with optimization, adaptive control with constraints, application of adaptive control in machining operations. Consideration of various parameters such as cutting force, temperatures, vibration and acoustic emission in the adaptive controls systems.

AUTOMATED INSPECTION: Fundamentals, types of inspection methods and equipment, Coordinate Measuring Machines, Machine Vision.

TEXT BOOKS:

1) Automation, Production Systems and Computer Integrated Manufacturing: M.P. Groover; PE/PHI.
2) Automation in Manufacturing by Anup Goel, A.Jacob Moses, Dr. Subhash L. Gadhave, Vinayak V. Gaikwad, E. Sathish; Technical publications.

REFERENCE BOOKS:

1) Computer Control of Manufacturing Systems by Yoram koren; Mc graw hill publications.
2) CAD / CAM/ CIM by Radhakrishnan; New age international publications.
3) Automation by W. Buckingham; Signet publications.

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Understand various automation strategies, mechanisms and its subcomponents {Understand level, KL2}

CO 2 : Understand various automated flow lines and its analysis {Understand level, KL2}

CO 3 : Solve the line balancing problems in the various flow line systems with and without use buffer storage. {Apply level, KL3}

CO 4 : Understand the different automated material handling, storage and retrieval systems and automated inspection systems. { Understand level, KL2}

CO 5 : Use of Adaptive Control principles and implement the same online inspection and control. {Apply level, KL3}

IV-Year- I Semester		L	T	P	C
		3	1	0	3
ADDITIVE MANUFACTURING					

PRE REQUISITES: **Knowledge of manufacturing processes**

COURSE OBJECTIVES:

1) To exploit technology used in additive manufacturing.
2) To understand importance of additive manufacturing in advance manufacturing process.
3) To acquire knowledge, techniques and skills to select relevant additive manufacturing process.
4) To explore the potential of additive manufacturing in different
5) To apply 3D printing technology for additive manufacturing.

UNIT -I

Introduction, History, Evaluation, Process, necessity, classification, Liquid 3D Printing, classification, materials used, applications, advantages and disadvantages of liquid 3D printing

UNIT -II

Solid 3D Printing, classification, materials used, applications, advantages and disadvantages of solid 3D printing

UNIT -III

Powder 3D Printing, classification, materials used, applications, advantages and disadvantages of powder 3D printing

Metal 3D Printing/AM classification, materials used, applications, advantages and disadvantages of metal 3D printing

UNIT -IV

Software for 3D printing, different data formats like.STL,CLI, RPI,STEP etc. file conversion, G code generation, medical data conversion.

UNIT -V

Applications of 3D Printing and additive manufacturing in rapid tooling and in different industries like aerospace, medical, automotive, jewellery, sports, bio-medical, fashion, agricultural etc.

TEXT BOOKS:

1) Rapid Prototyping by C. K. Chua, 5th edition, World scientific
2) Additive Manufacturing Technologies by Prof. Ian Gibson, 2nd edition, Springer

REFERENCE BOOKS:

1) Additive Manufacturing by C.P. Paul, Mc. Grawhill
2) Liou L.W. and Liou F.W., “Rapid Prototyping and Engineering applications: A tool box for prototype development”, CRC Press, 2007
3) Kamrani A.K. and Nasr E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006
4) Mahamood R.M., Laser Metal Deposition Process of Metals, Alloys, and Composite Materials, Engineering Materials and Processes, Springer International Publishing AG 2018

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1: The student shall be able to use liquid RP techniques by identifying the suitable applications

CO 2 : The student shall be able to use solid RP techniques by identifying the suitable applications

CO 3 : The student shall be able to use powder RP techniques by identifying the suitable applications

CO 4 : The student shall be able to use RP techniques by identifying the suitable software and data formats

CO 5 : The student shall be able to use RP techniques by identifying the suitable applications in different industries

IV-Year- I Semester		L	T	P	C
		3	1	0	3
AUTOMOBILE ENGINEERING					

PRE-REQUISITES: Thermodynamics, Internal Combustion Engines.

COURSE OBJECTIVES: After successfully completing this course, student able to

1) Describe the basic lay-out of an automobile, its components and enlist the emission standards of an automobile.
2) Describe various fuel supply systems in SI and CI engines & alternate fuels
3) Describe various electrical and transmission systems suitable for a given application.
4) Explain the principles of steering, suspension and braking systems.
5) Describe various automobile bodies & safety system.

UNIT -I

Introduction: Components of four-wheeler automobiles – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4-wheel drive – types of automobile engines.

Engine construction – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crankcase ventilation.

Engine service, reboring, decarburization, Nitriding of crankshaft.

Emission from Automobiles – Pollution standards, National and international – Pollution Control – Techniques – Noise Pollution & control.

UNIT -II

Fuel System:

S.I. Engine: Mechanical and electrical fuel pumps – compensating devices in carburetor – types of carburetors – air filters – Electronic petrol injection system-Multi-point fuel injection(MPFI) system. (5 hrs)

C.I. Engines: Fuel Filters, Air cleaners, Types of Governors.

Alternate Fuels: Liquid fuels-Gaseous fuels- Hydrogen engines-Natural gas-Compressed natural gas-Liquefied petroleum gas.

UNIT -III

Electrical System: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

Transmission System: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid flywheel – Gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box , overdrive, torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive universal joint, differential rear axles – types .

UNIT -IV

Front axle & Steering System: Front Axle, Types of stub axle, Wheel alignment, Steering geometry – camber, castor, kingpin rake, combined angle toe in, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

Suspension System: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber,Independent suspension system.

Braking System: Braking Requirements, Types of Brakes, Drum brakes and Disc Brakes, Hydraulic Brakes, Air brakes, Anti-lock braking systems.

UNIT -V

Automobile Body: Requirements-construction details- Power door locks-Remote entry-Materials for body work-Rust protection.

Safety System: Introduction, Safety Considerations, State of the art safety systems,safety systems - seat belt, air bags, bumper, antilock brake system (ABS), wind shield, suspension sensors, traction control, mirrors, central locking and electric windows, speed control, latest approach to automotive safety, Pedestrian protection.

Miscellaneous Topics:Automobile industry in India-Auto components industry in India-Auto policy-NATRIP-driving hints-basic road maneuvers-driving techniques for special situations.

Content beyond Syllabus

Automobile safety System: Antilock brake system (ABS), speed control,Pedestrian protection

TEXT BOOKS:

1) Automobile Engineering by Kripal Singh Vol. 1 & Vol. 2
2) Automobile Engineering by R.B.Gupta,, 8th edition, Tech India publication series, 2013.

REFERENCE BOOKS:

1) A System approach to Automotive Technology by Jack Erjavec YesDee publishing pvt Ltd.
2) Automobile Engineering by William Crouse
3) Automotive Mechanics by Heitner

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) https://nptel.ac.in/courses/107/106/107106088/
2) https://nptel.ac.in/courses/103103206

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

CO 1 : Acquire the basic knowledge of anatomy of an Automobile and its components.{Understand level, KL2}

CO 2 : Comprehend the fuel supply system in petrol and diesel engines. {Understand level, KL2}

CO 3 : Distinguish various electrical and transmission systems used in automobiles. {Understand level, KL2}

CO 4 : Compare various types of steering systems, suspension systems and braking systems. {Understand level, KL2}

CO 5 : Understand the basic knowledge of the body of an Automobile, its safety considerations and driving techniques.{Understand level, KL2}

IV-Year- I Semester		L	T	P	C
		3	1	0	3
OPTIMIZATION TECHNIQUES					

PREREQUISITES: Basic Sciences and Humanities

COURSE OBJECTIVE:

1) To understand the overview of optimization techniques, concepts of design space, constraint surfaces and objective function.
2) To formulate real-life problems with Linear Programming models using graphical and simplex methods.
3) To formulate real-life transportation, assignment and travelling salesman problems to find the optimum solution using transportation algorithms and to find out probability of expected completion time using PERT-CPM networks.
4) To apply dynamic programming and integer programming to optimize multi stage decision problems.
5) To determine the level of game theory and simulation modelling that a business must maintain to ensure smooth operation.

UNIT-I

Introduction to Classical Optimization Techniques

Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

Classical Optimization Techniques

Single variable Optimization, Multi variable Optimization with and without constraints, Multivariable Optimization with equality constraints - solution by method of Lagrange multipliers, Multivariable Optimization with inequality constraints - Kuhn – Tucker conditions.

UNIT-II

Linear Programming:Various definitions, statements of basic theorems and properties, Advantages, Limitations and Application areas of Linear Programming, Graphical method of Linear Programming problem.

Simplex Method –Phase I of the Simplex Method, Primal and Dual Simplex Method, Big –M method.

UNIT-III

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.

Network Analysis: Introduction, Project scheduling by CPM and PERT, Network diagram representations, Rules to construct Network diagrams, Time estimates in network analysis-EST, EFT, LST, LFT, float/slack and critical path, Time estimates and Probability considerations in PERT, Crashing in PERT

UNIT-IV

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.

Integer Programming: Pure and mixed integer programming problems, Solution of Integer programming problems – Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-one programming.

UNIT-V

Game theory: Theory of Games: Introduction – Terminology, Solution of games with saddle points and without saddle points, 2×2 games, dominance principle, m X 2 & 2 X n games, Graphical method.

Simulation Modelling Introduction, Definition and types, Limitations, Various phases of modelling, Monte Carlo method, Applications, advantages and limitations of simulation10 hrs

TEXT BOOKS:

1) Engineering optimization: Theory and practice"-by S.S.Rao, New Age International (P) Limited.
2) Operations Research: An Introduction" by H A Taha, 5th Edition, Macmillan, New York.
3) Operations Research by P K GUPTA AND D S HIRA BY SCHAND PUBLICATIONS, 7E

REFERENCE BOOKS

1) Optimization Methods in Operations Research and systems Analysis" – by K.V. Mittal and C. Mohan, New Age, International (P) Limited, Publishers
2) Operations Research – by S.D.Sharma, KedarnathRamanath& Co
3) Linear programming, G. Hadley, Narosa Publishing House, New Delhi.

4) Industrial Engineering and Production Management, M. Mahajan, DhanpatRai& co

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : To understand the overview of optimization techniques, concepts of design space, constraint surfaces and objective function.(Understand level KL2)

CO 2 : To formulate real-life problems with Linear Programming models using graphical and simplex methods.(Understand level KL2)

CO 3 : To formulate real-life transportation, assignment and travelling salesman problems to find the optimum solution using transportation algorithms and to find out probability of expected completion time using PERT-CPM networks.(Understand level KL2)

CO 4 : To apply dynamic programming and integer programming to optimize multi stage decision problems.(Understand level KL2)

CO 5 : To determine the level of game theory and simulation modelling that a business must maintain to ensure smooth operation.(Understand level KL2)

IV-Year- I Semester		L	T	P	C
		3	1	0	3
SOFTWARE TESTING METHODOLOGIES					

PRE-REQUISITES: Basics of Programming Languages

COURSE OBJECTIVES: After successfully completing this course, student able to

1) To study fundamental concepts in software testing and discuss Various Software testing issues and solutions
2) To learn how to plan a test project, design test cases and data, Conduct Testing, manage Software problems and defects, and generate a test report.
3) To expose the advanced software testing concepts such as object-oriented Software testing methods, web-based and component-based software testing.
4) To understand software test automation problems and solutions
5) To learn how to write software test documents and communicate with Engineers in various forms

UNIT -I

Software Testing

Introduction, Evolution, Myths & Facts, Goals, Psychology, definition, Model for testing, Effective Vs Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, Software Testing Methodology.

Software Testing

Introduction, Evolution, Myths & Facts, Goals, Psychology, definition, Model for testing, Effective Vs Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, Software Testing Methodology.

UNIT -II

Dynamic Testing-Black Box testing techniques

Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table-based testing, Cause-Effect Graphing based testing, Error guessing.

White-Box Testing: need, Logic Coverage criteria, Basis Path testing, Graph matrices, Loop testing, data flow testing, mutation testing.

UNIT -III

Static Testing

Inspections, Structured Walkthroughs, Technical Reviews. Validation activities: Unit testing, Integration Testing, Function testing, system testing, acceptance testing. Regression testing: Progressives Vs regressive testing, Regression test ability, Objectives of regression testing, Regression testing types, Regression testing techniques.

UNIT -IV

Efficient Test Suite Management

Growing nature of test suite, Minimizing the test suite and its benefits, test suite prioritization, Types of test case prioritization, prioritization techniques, measuring the effectiveness of a prioritized test suite Software Quality Management: Software Quality metrics, SQA models. Debugging: process, techniques, correcting bugs.

UNIT -V

Automation and Testing Tools

need for automation, categorization of testing tools, selection of testing tools, Cost incurred, Guidelines for automated testing, overview of some commercial testing tools such as Win Runner, Load Runner, Jmeter and JUnit.

Test Automation using Selenium tool. Testing Object Oriented Software: basics, Object oriented testing, Testing web-based Systems: Challenges in testing for web-based software, quality aspects, web engineering, testing of web-based systems, Testing mobile systems

TEXT BOOKS:

1) Software Testing, Principles and Practices, Naresh Chauhan, Oxford
2) Software Testing, Yogesh Singh, CAMBRIDGE

REFERENCE BOOKS:

1) Foundations of Software testing, Aditya P Mathur, 2ed, Pearson
2) Software testing techniques – Baris Beizer, Dreamtech, second edition.
3) Software Testing, Principles, techniques and Tools, M G Limaye, TMH
4) Effective Methods for Software testing, Willian E Perry, 3ed, Wileye-

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

CO 1 : Identify and understand various software testing problems, apply software testing knowledge and engineering methods and solve these problems by designing and selecting software test models, criteria, strategies, and methods

CO 2 : Design and conduct a software test process for a software project

CO 3 : Analyze the needs of software test automation

CO 4 : Use various communication methods and skills to communicate with their teammates to conduct their practice-oriented software testing projects

CO 5 : Write test cases for given software to test it before delivery to the customer and write test scripts for both desktop and web-based applications

IV-Year- I Semester		L	T	P	C
		3	1	0	3
GREEN ENGINEERING SYSTEMS					

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

1) To make the student learn and understand the solar radiation and energy collection.
2) To familiarize the student with the solar energy storage applications and wind energy.
3) To learn about biomass, wind and ocean energy.
4) To make the student learn to understand electrical and mechanical systems.
5) To make students learn about energy efficient process and green buildings.

UNIT -I

INTRODUCTION:

SOLAR RADIATION: Role and potential of renewable sources, the solar energy option, Environmental impact of solar power, Solar energy utilization in India, structure of the sun, the solar constant, sun-earth relationships, extraterrestrial and terrestrial solar radiation, the celestial vault and basic earth angles, determination of solar time, solar radiation on tilted surface, instruments for measuring solar radiation and sunshine, solar radiation data, numerical problems, A basic Photovoltaic system for power generation,Solar cell modules,types of solar cells, Solar cell production,Applications.

SOLAR ENERGY COLLECTION: Liquid flat plate collector, Selective absorber coatings, selection of materials, classification of concentrating collectors, its working and orientation systems.

UNIT -II

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds.

SOLAR THERMAL APPLICATIONS: Air heaters, Space Cooling systems, heating systems, Solar dryers, water desalination, solar cookers, central power tower concept and solar chimney.

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

UNIT -III

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT -IV

ENERGY EFFICIENT SYSTEMS:

ELECTRICAL SYSTEMS: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management.

MECHANICAL SYSTEMS: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, Environmental friendly and Energy efficient compressors and pumps.

UNIT -V

ENERGY EFFICIENT PROCESSES: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.

GREEN BUILDINGS: Definition, features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste, Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings. Energy management.

TEXT BOOKS:

1) Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/ TMH

2) Non-Conventional Energy Resources/ Khan B.H/ Tata McGraw Hill, New Delhi, 2006

3) Green Manufacturing Processes and Systems, Edited / J. Paulo Davim/Springer 2013

REFERENCE BOOKS

1) Alternative Building Materials and Technologies / K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Rao/New age international

2) Principles of Solar Engineering / D.Yogi Goswami, Frank Krieth& John F Kreider / Taylor & Francis

3) Non-Conventional Energy / Ashok V Desai /New Age International (P) Ltd

4) Renewable Energy Technologies /Ramesh & Kumar /Narosa

5) Non-conventional Energy Source/ G.D Roy/Standard Publishers

6) Renewable Energy Resources-2nd Edition/ J.Twidell and T. Weir/ BSP Books Pvt.Ltd

7) Fuel Cell Technology –Hand Book / Gregor Hoogers / BSP Books Pvt. Ltd.

E- RESOURCES & OTHER DIGITAL MATERIAL

1) https://onlinecourses.nptel.ac.in/noc21_ch11/preview
2) https://nptel.ac.in/courses/103103206
3) https://nptel.ac.in/courses/121106014

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Understand about solar energy, Utilization of it, Principles involved in solar energy collection and conversion of it to electricity generation. {Understand level, KL2}

CO 2 : Describe the concepts involved in solar energy storage and wind energy conversion systems by studying its components, types and performance. {Understand level, KL2}

CO 3 : Comprehend about ocean energy and Geothermal energy, and the operational methods of their utilization. {Understand level, KL2}

CO 4 : Recognize the concepts involved in Mechanical systems and Electrical Systems in the energy efficient systems. {Understand level, KL2}

CO 5 : Understand about the Energy efficient process and Green buildings and the concepts involved in it. {Understand level, KL2}

IV-Year- I Semester		L	T	P	C
		3	1	0	3
INDUSTRIAL ROBOTICS					

PREREQUISITES: Nil

COURSE OBJECTIVES:

1) To understand the concepts of automation
2) To understand the concepts of robot kinematics, Dynamics, Trajectory planning.
3) Mathematical approach to explain how the robotic arm motion can be described.
4) To understand the functioning of sensors and actuators and their applications
5) To understand the applications of robotics in manufacturing

UNIT-I

INTRODUCTION: Automation and Robotics, types of automation, assembly automation equipment, material handling systems, feed systems, Automated Guided Vehicles, Automated storage and retrieval systems, Flexible Manufacturing Systems, Computer Aided Process Planning Systems, Computer Aided manufacturing. CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT-II

MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation – problems.

MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

UNIT-III

Differential transformation and manipulators, Jacobians – problems

Dynamics: Lagrange – Euler and Newton – Euler formulations – Problems.

UNIT-IV

General considerations in path description and generation. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages-description of paths with a robot programming language.

UNIT-V

ROBOT ACTUATORS AND FEED BACK COMPONENTS:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

ROBOT APPLICATIONS IN MANUFACTURING: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

TEXT BOOKS:

1) Industrial Robotics / Groover M P /Pearson Edu.
2) Robotics and Control / Mittal R K &Nagrath I J / TMH.

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Explain various robot configuration and components {Understand level, KL2}

CO 2 : Select appropriate actuators and sensors for a robot based on specific application {Understand level, KL2}

CO 3 : Carry out kinematic and dynamic analysis for simple serial kinematic chains {Apply level, KL3}

CO 4 : Perform trajectory planning for a manipulator by avoiding obstacles {Apply level, KL3}

CO 5 : Use knowledge of robotics for automation in manufacturing applications {Understand level, KL2}

IV-Year- I Semester		L	T	P	C
		3	1	0	3
ADDITIVE MANUFACTURING					

PRE REQUISITES : Nil

COURSE OBJECTIVES:

1) To exploit technology used in additive manufacturing.
2) To understand importance of additive manufacturing in advance manufacturing process.
3) To acquire knowledge, techniques and skills to select relevant additive manufacturing process.
4) To explore the potential of additive manufacturing in different
5) To apply 3D printing technology for additive manufacturing.

UNIT -I

Introduction, History, Evaluation, Process, necessity, classification, Liquid 3D Printing, classification, materials used, applications, advantages and disadvantages of liquid 3D printing

UNIT -II

Solid 3D Printing, classification, materials used, applications, advantages and disadvantages of solid 3D printing

UNIT -III

Powder 3D Printing, classification, materials used, applications, advantages and disadvantages of powder 3D printing

Metal 3D Printing/AM classification, materials used, applications, advantages and disadvantages of metal 3D printing

UNIT -IV

Software for 3D printing, different data formats like.STL,CLI, RPI,STEP etc. file conversion, G code generation, medical data conversion.

UNIT -V

Applications of 3D Printing and additive manufacturing in rapid tooling and in different industries like aerospace, medical, automotive, jewellery, sports, bio-medical, fashion, agricultural etc.

TEXT BOOKS:

1) Rapid Prototyping by C. K. Chua, 5th edition, World scientific
2) Additive Manufacturing Technologies by Prof. Ian Gibson, 2nd edition, Springer

REFERENCE BOOKS:

1) Additive Manufacturing by C.P. Paul, Mc. Grawhill
2) Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007
3) Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006
4) Mahamood R.M., Laser Metal Deposition Process of Metals, Alloys, and Composite Materials, Engineering Materials and Processes, Springer International Publishing AG 2018

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : The student shall be able to use liquid RP techniques by identifying the suitable applications

CO 2 : The student shall be able to use solid RP techniques by identifying the suitable applications

CO 3 : The student shall be able to use powder RP techniques by identifying the suitable applications

CO 4 : The student shall be able to use RP techniques by identifying the suitable software and data formats

CO 5 : The student shall be able to use RP techniques by identifying the suitable applications in different industries

IV-Year- I Semester		L	T	P	C
		3	1	0	3
METROLOGY AND INSTRUMENTATION					

PREREQUISITES: Introduction to Mechanical Engineering Sciences.

COURSE OBJECTIVES:

1) The methods of measurement of displacement, speed, acceleration, vibration, stress and strain, force, torque and power.
2) Inspection of engineering parts with various precision instruments
3) Design of part, tolerances and fits Principles of measuring instruments and gauges and their uses
4) Evaluation and inspection of surface roughness
5) Inspection of spur gear elements

UNIT-I

LIMITS AND FITS, Tolerance: Limits-Types of Limits, Fits-Types of Fits, Deviations, Tolerances, Hole and Shaft basis systems, Interchangeability, Selective assembly.

LIMIT GAUGES: Taylor's principle – design of go and nogo gauges; plug, ring, snap, taper, profile and position gauges.

UNIT-II

MEASUREMENT OF ANGLES AND TAPERS: Different methods – bevel protractor, sine bar- sine table, rollers and spheres used to measure angles and tapers- Tools maker's microscope and uses

SURFACE ROUGHNESS MEASUREMENT: Differences between surface roughness and surface waviness –Numerical assessment of surface finish-Ra, R.M.S. Rz, values, Method of measurement of surface finish – Profilograph,Talysurf, ISI symbols for indication of surface finish.

UNIT-III

FLATNESS MEASUREMENT: Measurement of flatness of surfaces- instruments used- straight edges- surface plates – auto collimator, optical projector, optical flats and their uses

INTRODUCTION: Basic principles of measurement – measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics – Types of errors.

UNIT-IV

MEASUREMENT OF DISPLACEMENT: Theory and construction of various transducers to measure displacement – piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers.

MEASUREMENT OF TEMPERATURE: Classification – ranges – various principles of measurement – expansion, electrical resistance – thermistor – thermocouple – pyrometers – temperature indicators.

UNIT-V

MEASUREMENT OF PRESSURE: Units – classification –Bourdon pressure gauges, Dead weight Piston Gauge, low pressure measurement – ionization pressure gauges, McLeod pressure gauge.

FLOW MEASUREMENT: Rotameter, magnetic, ultrasonic, turbine flow meter, hot – wire anemometer, laser Doppler anemometer (LDA).

MEASUREMENT OF SPEED: Mechanical tachometers – electrical tachometers – stroboscope.

TEXT BOOKS:

1) Engineering Metrology / R.K.Jain / Khanna Publishers.
2) Measurement Systems: Applications & design / D.S Kumar
3) Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers.
4) Engineering Metrology and Measurements / NV Raghavendra, L Krishna Murthy/ Oxford publishers.
5) Engineering Metrology / KL Narayana/Scitech publishers

REFERENCE BOOKS:

1) Measurement systems: Application and design/Doeblin Earnest. O. Adaptation/ TMH
2) Experimental Methods for Engineers / J.P.Holman/McGraw Hill
3) Instrumentation, measurement & analysis / B.C.Nakra&K.K.Choudhary/TMH
4) Engineering Metrology / Mahajan / Dhanpat Rai Publishers
5) Engineering Metrology / I.C.Gupta / Dhanpat Rai Publishers
6) Precision Engineering in Manufacturing / R.L.Murthy / New Age

WEB SOURCE REFERENCES

1) http://nptel.ac.in/courses/112106138/
2) http://ocw.mit.edu/courses/mechanical-engineering/2-830j-control-ofmanufacturing-processes-sma-6303-spring-20
3) https://www.edx.org/course/introduction-oil-country-tubular goodstenarisuniversity-pipe01x
4) https://www.youtube.com/watch?v=8DTt-f6wQxE

GAPS IN THE SYLLABUS –

1) Measurement of microscopic material\components

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

1) Modern measuring devices

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

CO 1 : Apply the concepts of basic measurements.{ Apply level, KL3}

CO 2 : Understand the measurement of Angles,tapers and surface roughness{Understand level, KL2}

CO 3 : Understand the measurement of flatness and basic fundamentals of instrumentation.{ Understand level, KL2}

CO 4 : Choose appropriate Instrument for measuring Displacement and Temperature. {Apply level, KL3}

CO 5 : Interpret Pressure,flow and Speed measurement. {Apply level, KL3}

IV-Year- I Semester		L	T	P	C
		0	0	3	1.5
METROLOGY AND INSTRUMENTATION LAB					

PREREQUISITES: Nil

COURSE OBJECTIVES:

1) Mechanical Measurements lab introduces the students with the theory and methods for conducting experimental work in the laboratory and calibration of various instruments for measuring pressure, temperature, displacement, speed, vibration etc.
2) The Metrology Lab course is designed for measuring and gauging instruments for inspection of precision linear, geometric forms, angular and surface finish measurements. The student can learn the measurements with and calibration of instruments.

Note: The students have to conduct at least 5 experiments from each lab.

INSTRUMENTATION CONTROL SYSTEMS LAB

1. Calibration of pressure gauge.
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge.
5. Calibration of thermocouple.
6. Calibration of capacitive transducer.
7. Study and calibration of photo and magnetic speed pickups.
8. Calibration of resistance temperature detector.
9. Study and calibration of a rotameter.
10. Study and use of a seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of Mcleod gauge for low pressure.

ENGINEERING METROLOGY LAB

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth vernier caliper for tooth thickness inspection and flange micrometer for checking the chordal thickness of spur gear.

4. Measurement using Mechanical comparator.

5. Measurements using Optical Projector.

6. Measurement of alignment using Autocollimator.

7. Angle and taper measurements with bevel protractor, Sine bar, rollers and balls.

8. Use of spirit level in finding the straightness of a bed and flatness of a surface.

9. Thread inspection with two wire/ three wire method & tool maker's microscope.

10. Surface roughness measurement with roughness measuring instrument.

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

CO 1 : Understand different instruments that are available for linear, angular, roundness and roughness measurements they will be able to select and use the appropriate measuring instrument according to a specific requirement. {Understand level, KL2}

CO 2 : Apply the different measurement tools and perform measurements in quality Inspection. {Understand level, KL2}

CO 3 : Students will be able to acknowledge proper measuring instruments and know requirements of calibration, errors in measurement etc. They can perform accurate measurements. {Understand level, KL2}

CO 4 : Understand devices for measurement of force and torque; strain and stress and temperature. {Understand level, KL2}

IV-Year- I Semester		L	T	P	C
		0	0	6	3
PROJECT 1					

Quality of Student Projects (25)

(Quality of the project is measured in terms of consideration to factors including, but not limited to, environment, safety, ethics, cost, type (application, product, research, review etc.) and standards. Processes related to project identification, allotment, continuous monitoring, evaluation including demonstration of working prototypes and enhancing the relevance of projects. Mentioned below are the Implementation details including details of POs and PSOs addressed through the projects with justification)

A. Identification of Projects and Allocation Methodology to Faculty Members:

1) Projects are done in the research areas such as Manufacturing, Machine Design, Thermal Engineering and Industrial Engineering.

2) Department will share the list of past 2 years' projects to the students in order to avoid duplicate projects.

3) If students are able to choose open problems and if the guide agrees, then the student can proceed further.

4) In case if a student is unable to select a problem, then faculty members will give a problem to the student for execution of the project work.

5) Project review committee based on students area of interest, will allocate the faculty members to students as guides.

B. Types and Relevance of the Projects and Their Contribution Towards Attainment of POs and PSOs:

Table 2.2.3.1. Sample data of student's project mapping with POs and PSOs.

S.No.	Name of candidates/ Team Leader	USN/Registration Number	Guide name	Project title	Mapping POs	Mapping PSOs
1	19BQ5A0327	Ronanki Chaitanya	Dr.K.Satyanarayana	Design and Fabrication of electrical powered bicycle.	PO4, PO5,PO7, PO8, PO10, PO11	PSO1, PSO2
2	18BQ1A0383	Pathan Rahamatulla T	Dr R Naveen	3D modeling, simulation and analysis of Whitworth quick return mechanis.	PO4, PO5, PO6, PO7, PO8, PO10, PO11	PSO2
3	19BQ5A0340	VissarapuVenkateswara Rao	Dr.T.Srinivasa Rao	Experimental Investigation on Vapour Compression Refrigeration System with Novel Subcooling technique by using Graphene nanorefrigerant.	PO4, PO5, PO7, PO8, PO10, PO11	PSO1
4	19BQ5A0325	Pothuri Mahesh Sai	Dr. MKM Farooqui	Structural analysis of vehicle body structure for improved ride and handling.	PO4, PO5, PO6, PO8, PO10, PO11	PSO1
5	18BQ1A0399	Shaik Arif	Dr.KVL Somasekhar	Integrated information system in manufacturing industry.	PO4, PO5, PO7, PO8, PO10, PO11	PSO1, PSO2

6	18BQ1A03A1	Shaik Husne Shabbir	Prof PVSM Kumar	Testing and validation of reconditioned batteries.	PO4, PO5, PO6, PO8, PO10, PO11	PSO2
7	18BQ1A0318	Budati Chandrika	Dr M Kedar Mallik	Topological optimization of samples produced from 3D printing.	PO4, PO5, PO6, PO8, PO10, PO11	PSO1
8	18BQ1A0338	Gollapudi Sai Kiran	Dr P Nageswara Rao	Performance evaluation of soya bean – TiO2 nano fluid in turning.	PO4, PO5, PO6, PO7, PO8, PO10, PO11	PSO2
9	19BQ5A0306	Chalapati Venkatesh	Dr. P. Venkateswara Babu	Modelling and structural analysis of automobile leaf spring.	PO4, PO5, PO6, PO7, PO8, PO10,PO11	PSO2
10	18BQ1A03A3	Shaik Riyaz	Mr. V. Kiran Kumar	Study on pitting corrosion characteristics of friction stir welded aluminum alloy.	PO4, PO5, PO6, PO7, PO8, PO10,PO11	PSO1, PSO2
11	19BQ5A0326	Rajolu Sudheer	Mrs M.LakshmiVinitha	Development of manually operated fertilizer spreader	PO4, PO5, PO6, PO7, PO8, PO10, PO11	PSO1
12	18BQ1A0350	Kaja Venkata S Srimanth	Mr D V Seshagiri Rao	Phase analysis of DMLS fabricated In718 in two different orientations.	PO4, PO5, PO6, PO7, PO8, PO10,PO11	PSO1

C. **Process for Monitoring and Evaluation:**

Continuous Monitoring:

1) Students have to submit a project abstract to the guide and the department coordinator.
2) Project guide/coordinator will give suggestions towards the improvement of the project work. Based on inputs, students have to start their work. In case, the student is doing a project outside the institute such as industry internships, he/she has to consult the guide towards implementation of the project.
3) Every month, the student has to give a presentation on the project work in front of the project review committee-Internal guide will be a member of the committee.
4) During the third review, the project review committee has to give permission to the student for submission of the report to the Department and the University.
5) Finally, an internal VIVA-VOCE examination is conducted by the review committee.

Table 2.2.3.2. Schedule of a project work.

S.No.	Item	Date
1	Abstract submission to guide	05-03-22
2	Review - I	24-03-2022
3	Review - II	21-04-2022
4	Review - III	13-05-22

5	Report submission to the Department library and the University	23-05-22
6	Internal VIVA-VOCE examination	25-05-22

Project Evaluation:

1) The dissertation will be evaluated by examiners- One internal examiner (guide) and one external examiner appointed by the University.
2) A copy of the student report will be sent to each Examiner by the University for Evaluation.
3) The external examiner shall be from a different institution.
4) The evaluation of the dissertation will be made independently by each examiner.
5) The project coordinator will follow evaluation rubrics, which is set by the Department.
6) The project work for internal marks are awarded for a maximum of 40 marks and for external marks awarded for a maximum of 140 marks.
7) The examiners will evaluate and send them to the Controller of Examinations.
8) Marks awarded by the Examiners will be the final.

D. **Process to Assess Individual and Team Performance:**

The rubrics are used to assess the individual and team performance of the students in the project.

Table 2.2.3.3. List of rubrics used for project work.

Parameters	**>70%**	**> 40 to 70%**	**< 40%**
Literature Search	Referred to more than TEN articles;appropriately summarized; includes recent references	Referred to more than SIX articles; appropriately summarized; NO recent references	NO references included

Problem statement	Problem statement is clear, can be implemented and tested, and addresses one of the Engineering Grand Challenge	Problem statement clear, NOT feasible for implementation, and does NOT address the Engineering Grand Challenge	Problem statement NOT clear
Contribution to society, concern for environment	The community that shall benefit clearly specified; ensures safety to environment	Community clearly specified; however safety measures not specified.	Hazard to society and to environment
Project scheduling and work delegation	Proposed and implemented Gantt chart included; with clear distribution of workload among the team members	Proposed Gantt chart included; without clear distribution of workload	Gantt chart NOT provided; NO distribution of workload
Identification of essential concepts Equipment/ component list	Clear list, description and justification of MOST essential Mathematical, Science, Engineering and Management Concepts included	Clear list, description and justification of MOST essential Mathematical, Science, Engineering and Management Concepts included	There is NO mention of anyof the essential Concepts
Effective utilization of the Modern Tool	Clear justification in selecting the TOOL/Components being used is provided	There is no justification for the tool/components being used	No modern tools used.
Design(s)	More than ONE design solution implemented, with comparison.	Only ONE design solution implemented.	NO design included.
Analyze the results	Included clear analysis, along with advantages and disadvantages	Included analysis, without the advantages and disadvantages	NO analysis
Budget Analysis	Budget analysis provided for most of the resources	Budget analysis restricted to finance	NO budget analysis included
Project Report	Well organized, clear objectives and outcomes for every chapter.	NOT well organized	NO design included
Originality score	Clear inference of the work with feature enhancement	No feature enhancement	No inference.

Oral Presentation	Clear presentation	Presentation is not clear	Very poor presentation.
Viva-Voce (Technical Knowledge)	Fair knowledge of MOST concepts related to the project	Demonstrates fair knowledge of SOME concepts	NO knowledge of any of the concepts
Performance in the Team	Contributes and cooperates in the team, and mentors/leads the team	Cooperates but does NOT contribute to the team	Does NOT cooperate

E. **<u>Quality of Completed Projects/Working Prototypes:</u>**

1) The quality of completed projects and working models are assessed based on the following factors.
2) Real time applications
3) Based on prize money and award received at the project exhibition.
4) Best projects suggested by the external examiners at time of evaluation of project work.
5) Usage of cost effective and environmental conditions methods of supported models.

Table 2.2.3.4. Sample working models for year 2021-22

S.No.	Name of candidates/Team Leader	USN/Registration Number	Guide name
1	19BQ5A0327	Ronanki Chaitanya	Design and Fabrication of electrical powered bicycle.
2	18BQ1A0359	Kola Sai Pavan	Modelling and thermal analysis of refrigeration condenser coil using aluminum and magnesium alloys.

3	18BQ1A0393	S R Chandra Kiran	Fabrication Of Sorting Robot For Picking Objects.
4	19BQ5A0325	Pothuri Mahesh Sai	Structural analysis of vehicle body structure for improved ride and handling.
5	18BQ1A0399	Shaik Arif	Integrated information system in manufacturing industry.
6	18BQ1A03A1	Shaik Husne Shabbir	Testing and validation of reconditioned batteries.
7	18BQ1A0318	Budati Chandrika	Topological optimization of samples produced from 3D printing.
8	18BQ1A0338	Gollapudi Sai Kiran	Performance evaluation of soya bean – TiO2 nano fluid in turning.
9	19BQ5A0326	Rajolu Sudheer	Development of manually operated fertilizer spreader

Table 2.2.3.5. Sample working models for year 2020-21

S.No.	**Name of candidates/Team Leader**	**USN/Registration Number**	**Guide name**

1	17BQ1A0315	Ch.Vasavi Annapurna	Ergonomics Impact Assessment In Manufacturing Industries(Kumar Pumps)
2	17BQ1A0304	Alapati Naga Sreevani	Modeling And Simulation Analysis Of Connecting Rod Of An I.C.Engine
3	18BQ5A0313	N ShanmukhaSrinivasaRao	Experimental Investigation On The Performance And Emission Characteristics Of C I Engine Fueled With Ternary Fuel Blends
4	18BQ5A0318	Sankuru Niteesh Kumar	The Study OnMultimaterial Fabrication And Testing Of Samples Using Fdm, A 3d Printing Technique
5	17BQ1A0328	GuntiPremswaroop	Fabrication And Testing Of Inconel718 Samples By Using Dmls
6	17BQ1A0308	Aradhyula. Madhuri Saisree	Analysis and implementation of impact of ergonomics in biomass power plant

Table 2.2.3.6. Sample working models for year 2019-20

S.No.	Name of candidates/Team Leader	USN/Registration Number	Guide name
1	16BQ1A0302	Akula Meghana	Design and analysis of a multi stored car parking system (prototype)

2	16BQ1A0350	Kuchipudi Vidya Sagar	Noise and vibration measurements and its control for a hair dryer
3	16BQ1A0323	EluriGopinadh Chowdary	Fabrication of vapour absorption refrigeration system by using eco friendlyrefrigrant
4	16BQ1A0336	Gurram Sai Krishna	Turn-key solution for a given component for battery housing of E-Bike
5	17BQ5A0305	Garikapati Sushma	Design of injection mould for caps used in tables
6	16BQ1A0361	Md. Asif Basha	Tribological analysis of bakeite and MS composite

F. Evidences of Papers Published /Awards Received by Projects, etc:

G. **Sample Papers Published by Students:**

Table 2.2.3.7. Sample papers published bystudents in the year 2020-21.

S.No.	Student name as Published in Journal	Name of the working model	Name of journal/ conference
1			
2			
3			

4			
5			

Table 2.2.3.8. Sample papers published by students in year 2019-20.

S.No.	Student name as Published in Journal	Name of the working model	Name of journal/ conference
1			
2			
3			
4			
5			

Table 2.2.3.9. Sample papers published by students in year 2018-19.

S.No.	Student name as Published in Journal	Name of the working model	Name of journal/ conference
1			
2			
3			
4			
5			

IV-Year- II Semester		L	T	P	C
		3	1	0	3
INDUSTRIAL ROBOTICS					

PREREQUISITES: Basics of CAD/CAM, Transformation techniques, Mathemathics.

COURSE OBJECTIVES:

1) To understand the concepts of automation
2) To understand the concepts of robot kinematics, Dynamics, Trajectory planning.
3) Mathematical approach to explain how the robotic arm motion can be described.
4) To understand the functioning of sensors and actuators and their applications
5) To understand the applications of robotics in manufacturing

UNIT – I

INTRODUCTION: Automation and Robotics, types of automation, assembly automation equipment, material handling systems, feed systems, Automated Guided Vehicles, Automated storage and retrieval systems, Flexible Manufacturing Systems, Computer Aided Process Planning Systems, Computer Aided manufacturing. CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic andPneumatic types of locomotion devices.

UNIT – II

MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation – problems.

MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

UNIT – III

Differential transformation and manipulators, Jacobians – problems

Dynamics: Lagrange – Euler and Newton – Euler formulations – Problems.

UNIT – IV

General considerations in path description and generation. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages-description of paths with a robot programming language.

UNIT – V

ROBOT ACTUATORS AND FEED BACK COMPONENTS:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

ROBOT APPLICATIONS IN MANUFACTURING: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

TEXT BOOKS:

1) Industrial Robotics / Groover M P /Pearson Edu.
2) Robotics and Control / Mittal R K &Nagrath I J / TMH.

REFERENCE BOOKS:

1) Robotics / Fu K S/ McGraw Hill.
2) Robotic Engineering / Richard D. Klafter, Prentice Hall
3) Robot Analysis and Control / H. Asada and J.J.E. Slotine / BSP Books Pvt.Ltd.
4) Introduction to Robotics / John J Craig / Pearson Edu.

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Identify various robot configuration and components {Understand level, KL2}

CO 2 : Select appropriate actuators and sensors for a robot based on specific application {Understand level, KL2}

CO 3 : Carry out kinematic and dynamic analysis for simple serial kinematic chains {Apply level, KL3}

CO 4 : Perform trajectory planning for a manipulator by avoiding obstacles {Apply level, KL3}

CO 5 : Use knowledge of robotics for automation in manufacturing applications {Understand level, KL2}

IV-Year- II Semester		L	T	P	C
		3	1	0	3
GAS DYNAMICS AND JET PROPULSION					

PRE-REQUISITES: Thermodynamics.

COURSE OBJECTIVES: After successfully completing this course, student able to

1) Understanding the compressible flow concepts and the use of gas tables.
2) Analyzing compressible flow behavior in constant area ducts with friction and heat transfer.
3) Analyzing the formation of short waves and its effect on flow parameters.
4) Classify the types of rocket engines, propellants and their performance parameters.

UNIT -I

Introduction to gas dynamics: control volume and system approaches acoustic waves and sonic velocity - mach number - classification of fluid flow based on mach number - mach cone-compressibility factor - general features of one dimensional flow of a compressible fluid - continuity and momentum equations for a control volume.

UNIT -II

Isentropic flow of an ideal gas: basic equation - stagnation enthalpy, temperature, pressure and density stagnation, acoustic speed - critical speed of sound- dimensionless velocity-governing equations for isentropic flow of a perfect gas - critical flow area - stream thrust and impulse function. Steady one dimensional isentropic flow with area change-effect of area change on flow parameters choking - convergent nozzle - performance of a nozzle under decreasing back pressure -De lavel nozzle - optimum area ratio effect of back pressure - nozzle discharge coefficients - nozzle efficiencies.

UNIT -III

Simple frictional flow: adiabatic flow with friction in a constant area duct-governing equations - fanno line limiting conditions - effect of wall friction on flow properties in an Isothermal flow with friction in a constant area duct-governing equations - limiting conditions. Steady one dimensional flow with heat transfer in constant area ducts- governing equations - Rayleigh line entropy change caused by heat transfer - conditions of maximum enthalpy and entropy.

UNIT -IV

Effect of heat transfer on flow parameters: Intersection of Fanno and Rayleigh lines. Shock waves in perfect gas- properties of flow across a normal shock - governing equations - Rankine Hugoniat equations - Prandtl's velocity relationship - converging diverging nozzle flow with shock thickness - shock strength.

UNIT -V

Propulsion: Aircraft propulsion: types of jet engines - energy flow through jet engines, thrust, thrust power and propulsive efficiency turbojet components-diffuser, compressor, combustion chamber, turbines, exhaust systems. Performance of turbo propeller engines, ramjet and pulsejet, scramjet engines. Rocket propulsion - rocket engines, Basic theory of equations - thrust equation - effective jet velocity - specific impulse - rocket engine performance - solid and liquid propellant rockets - comparison of various propulsion systems.

TEXT BOOKS:

1) Compressible fluid flow /A. H. Shapiro / Ronald Press Co., 1953
2) Fundamentals of compressible flow with aircraft and rocket propulsion/S. M. Yahya/New Age international Publishers
3) Fundamental of Gas dynamics-2 nd edition/ M J Zucker/ Wiley publishers

REFERENCE BOOKS:

1) Elements of gas dynamics / HW Liepman& A Roshko/Wiley
2) Aircraft & Missile propulsion /MJ Zucrow/Wiley
3) Gas dynamics / M.J. Zucrow& Joe D.Holfman / Krieger Publishers
4) Gas Dynamics by E.Rathakrishnan/Fourth edition/PHI learning

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) https://nptel.ac.in/courses/101106044
2) https://nptel.ac.in/courses/112106166

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Illustrate fluid flow systems. {Understand level, KL2}

CO 2 : Analyze the isotropic flow of an ideal gas and its parameter. {Analyze level, KL4}

CO 3 : Solve the simple frictional flow with heat transfer problems. {Apply level, KL3}

CO 4 : Analyze the impact of heat transfer on flow parameters. {Analyze level, KL4}

CO 5 : Performance evaluation of different propulsion systems. {Apply level, KL3}

IV-Year- II Semester		L	T	P	C
		3	1	0	3
NANO MATERIALS					

PREREQUISITES: Material Science, Basic Manufacturing Processes.

COURSE OBJECTIVES:

1) To understanding the Nanoscience and Applications
2) Understand the synthesis of nanomaterials and their application
3) Apply knowledge to develop Nanomaterial's

UNIT -I

Nanomaterials and their production: Introduction,Classification, nanoparticles, nanofibers, nanoplates,composites, Applications, Basics of Quantum Mechanics,Harmonic oscillator, magnetic Phenomena, band structure insolids, Mossbauer and Spectroscopy, optical phenomenabonding in solids, Anisotropy.

UNIT -II

SILICON CARBIDE: Application of Silicon carbide, nano materials preparation, Sintering of SiC, Xray Diffraction data, electron microscopy sintering of nano particles

NANO PARTICLES OF ALUMINA AND ZIRCONIA: Nano materials preparation, Characterization, Wear materials and nano composites.

UNIT -III

MECHANICAL PROPERTIES: Strength of nano crystalline SiC, Preparation for strength measurements, Mechanical properties, Magnetic properties,

UNIT -IV

ELECTRICAL PROPERTIES: Switching glasses with nanoparticles,Electronic conduction with nano particles

OPTICAL PROPERTIES: Optical properties, special properties and the coloured glasses

UNIT -V

Process of synthesis of nano powders, Electro deposition, Important Nano materials

INVESTIGAING AND MANIPULATING MATERIALS IN THE NANOSCALE: Electron microscopics, scanning probe microscopics, optical microscopics for nano science and technology, X-ray diffraction.

TEXT BOOKS:

1) Nano Materials- A.K.Bandyopadhyay/ New Age Publishers.
2) Nano Essentials- T.Pradeep/TMH
3) Nanoscience and Nanotechnology,By P. I. Varghese, T. Pradeep, Tata McGraw Hill Education, ISBN:9781259007323, 1259007324,2003

REFERENCE BOOKS:

1) Nanosciene and Nanotechnology, by Murthy, Raj, Shankar Rath, Murd, 1st edition - 2012, ISBN-13978- 8173717383, Orient Blackswan Private Limited - New Delhi,2012.
2) Introduction to Nanoscience and Nanotechnology by Chattopadhyay, Chattopadhyay K. K., A. N. Banerjee, ISBN:9788120336087, 8120336089, PHI Learning,2009.
3) Springer Handbook of Nanotechnology by Bharat Bhushan 2004.

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1: Understand the nanomaterials and their applications {Understand level, KL2}

CO 2 : Demonstrate the Characterizationof nano materials {Understand level, KL2}

CO 3 : Outline the mechanical properties of nanomaterials {Understand level, KL2}

CO 4 : Understand the Electro optic properties of nanomaterials. {Understand level, KL2}

CO 5 : Understand the manipulating of materials in the nanoscale {Understand level, KL2}

IV-Year- II Semester		L	T	P	C
		3	1	0	3
UNCONVENTIONAL MACHINING PROCESS					

PREREQUISITES: Basic Manufacturing Process

COURSE OBJECTIVES:

1) The course aims in identifying the classification of unconventional machining processes.
2) To understand the principle, mechanism of metal removal of various unconventional machining processes.
3) To study the various process parameters and their effect on the component machined on various unconventional machining processes.
4) To understand the applications of different processes.

UNIT -I

INTRODUCTION: Need for non-traditional machining methods-classification of modern machining processes – considerations in process selection, applications.

Ultrasonic machining – Elements of the process, mechanics of material removal, MRR process parameters, economic considerations, applications and limitations.

UNIT -II

ELECTRO – CHEMICAL MACHINING: Fundamentals of electro chemical 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, advantages and applications.

UNIT -III

THERMAL METAL REMOVAL PROCESSES: General principle and applications of Electric Discharge Machining, Electric Discharge Grinding and wire EDM – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface

UNIT -IV

Electron Beam Machining, Laser Beam Machining - Basic principle and theory, mechanics of material removal, process parameters, efficiency & accuracy, applications

UNIT -V

Plasma Machining: Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Abrasive jet machining, Water jet machining and abrasive water jet machining: Basic principles, equipment's, process variables, mechanics of material removal, MRR, application and limitations

TEXT BOOKS:

1) Fundamentals of Machining Processes-Conventional and non –conventional processes/Hassan Abdel – Gawad El-Hafy/CRC Press-2016.
2) Advanced Machining Processes- Vijay K Jain-Allied Publishers

REFERENCE BOOKS:

1) Modern Machining Process / Pandey P.C. and Shah H.S./ TMH.
2) New Technology / Bhattacharya A/ the Institution of Engineers, India 1984.
3) Non Traditional Manufacturing Processes / Benedict

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Compare non-traditional machining, classification, material applications in material removal process

CO 2 : Summarize the principle and processes of Ultrasonic Machining Process.

CO 3 : Understand the principles, processes and applications of Electro Chemical Machining.

CO 4 : Identify the principles, processes and applications of Thermal Metal removal process, EBM.

CO 5 : Understand the principles, processes and applications of Plasma Machining and Jet Machining.

IV-Year- II Semester		L	T	P	C
		3	1	0	3
CONDITION MONITORING					

PRE-REQUISITES: Dynamics of Machinery Mechanical Vibrations

COURSE OBJECTIVES: Upon successful completion of the course, the student will be able to

1) Understand and apply maintenance schemes in industries.
2) Monitor condition of rotating machinery using signature, temperature and corrosion analysis.
3) Understand and apply the thermography techniques.
4) Apply oil analysis technique to diagnose the wear debris.
5) Understand modern technologies for effective plant maintenance.

UNIT-I

Introduction to maintenance and condition based maintenance, Definition, system approach, objectives, responsibilities of maintenance department, maintenance strategies, principles of maintenance, concepts of maintainability, availability and reliability, implementation of CBM, comparison of CBM with other maintenance techniques and case studies (overview). Introduction to condition monitoring, Basic concept, techniques - visual monitoring, temperature monitoring, vibration monitoring, lubricant monitoring, crack monitoring, thickness monitoring, noise and sound monitoring.

UNIT-II

Basic signal processing techniques Probability distribution and density, Fourier analysis, Hilbert Transform, Cepstrum analysis, Digital filtering, Deterministic / random signal separation, Time frequency analysis. Wavelet Transform Introduction to Wavelets, Continuous Wavelet Transform (CWT), Discrete Wavelet Transform (DWT), Wavelet Packet Transform (WPT),types of wavelets –Haarwavelets, Shannon wavelets, Meyer wavelets, Daubechies wavelets, Coifmann wavelets and applications of wavelets.

UNIT-III

Vibration Monitoring, Introduction, vibration data collection, techniques, instruments, transducers, selection, measurement location, time domain analysis, frequency domain analysis, time-frequency domain analysis and commonly witnessed machinery faults diagnosed by vibration analysis. Rotating and reciprocating machines, Vibration signals from rotating and reciprocating machines

– signal classification, signals, generated by rotating machines, signals generated by reciprocating machines.

UNIT-IV

Mechanical fault diagnosis, Wear monitoring and lubricant analysis - sources of contamination, techniques, Spectrometric, Oil Analysis Procedure (SOAP) and ferrography. Nondestructive testing techniques, Measurement of surface and subsurface flaws – liquid penetrant inspection, eddy current inspection, radiographic inspection, ultrasonic inspection.

UNIT-V

Condition monitoring of rolling element bearings and gear, Introduction, construction, types of faults, rolling element bearing diagnostics and gear diagnostics. Tool wear monitoring, Introduction, techniques and case studies.

Content beyond Syllabus

Shock pulse measurement, Kurtosis, Acoustic emission monitoring

TEXT BOOKS:

1) Rao J. S., Vibration Condition Monitoring, Narosa Publishing House, 2/e 2000.
2) Choudary K K., Instrumentation, Measurement and Analysis, Tata McGraw Hill.

REFERENCE BOOKS

1) Isermann R., Fault Diagnosis Application, Springer-Verlag Berlin, 2011.
2) Allan Davis, Hand book of Condition Monitoring, Chapman and Hall, 2000.
3) Amiya Ranjan Mohanty Machinery Condition Monitoring : Principles and Practices, CRC Press, 2017.
4) Robert Bond Randall, Vibration based Condition Monitoring: Industrial, Aerospace and Automotive Applications, Wiley Publications, 2011.

E-RESOURCES & OTHER DIGITAL MATERIAL

1) http://nptel.ac.in/courses/112103112/40

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

CO 1 : Understand the types of maintenance used and its significance, role of condition based maintenance in industries, familiarize with different condition monitoring techniques and its advantages in industries. (KL-2)

CO 2 : Implement the basic signal processing techniques. (KL-3)

CO 3 : Understand the role of vibration monitoring, its methodology and its use in condition monitoring of rotating and reciprocating machines. (KL-2)

CO 4 : Understand the significance of mechanical fault diagnosis and non-destructive testing techniques in monitoring and maintenance. (KL-3)

CO 5 : Interpret condition monitoring of rolling element bearing, gears and tool condition monitoring techniques in machining. (KL-3)

IV-Year- II Semester		L	T	P	C
		3	1	0	3
COMPUTATIONAL FLUID DYNAMICS					

PREREQUISITES: Partial Difference Equations, Fluid Mechanics, Heat transfer

COURSE OBJECTIVES:

1) The course aims at providing required numerical and software techniques for solving various engineering problems involving fluid flow & heat transfer.
2) To learn the basic governing equations of fluid dynamics.
3) To learn mathematical behavior of partial differential equations.
4) To learn the phenomena of various discretization techniques, techniques to solve the simple incompressible flow problems, and basic techniques to solve simple heat transfer problems.

UNIT-I

Introduction to Computational Fluid Dynamics and Principles of Conservation: Computational Fluid Dynamics: What, When, and Why?, CFD Applications, Numerical vs Analytical vs Experimental, Modeling vs Experimentation. Fundamental principles of conservation, Reynolds transport theorem, Conservation of mass, Conservation of linear momentum: NavierStokes equation, Conservation of Energy.

UNIT-II

Classification of Partial Differential Equations and Physical Behavior:Mathematical classification of Partial Differential Equation, Illustrative examples of elliptic, parabolic and hyperbolic equations Physical examples of elliptic, parabolic and hyperbolic partial differential equations.

UNIT-III

Finite Difference MethodIntroduction, Introduction of Finite Differences, Difference Equations, Explicit and Implicit Approaches, Errors and Stability Analysis, Grid Generation.

Finite Volume Method: Approximation of surface integrals, volume integrals, interpolation and differentiation practice.

UNIT-IV

Incompressible Fluid Flow: Introduction, Implicit Crank-Nicolson Technique, Pressure Correction Method, Computation of Boundary Layer Flows.

UNIT-V

Heat Transfer Finite Difference Applications in Heat conduction and Convection, Heat conduction -transient heat conduction in a plane wall, Two-Dimensional transient heat conduction, Finite difference application in convective heat transfer.

TEXT BOOKS:

1) Numerical heat transfer and fluid flow / Suhas V. Patankar/Butter-worth Publishers
2) Computational fluid dynamics - Basics with applications /John. D. Anderson / Mc Graw Hill

REFERENCE BOOKS:

1) Computational Fluid Flow and Heat Transfer/ Niyogi/Pearson Publications
2) Fundamentals of Computational Fluid Dynamics /Tapan K. Sengupta / Universities Press.
3) Computational fluid dynamics: An introduction, 3rd edition/John.F Wendt/Springer publishers

E- RESOURCES & OTHER DIGITAL MATERIAL:

1) https://nptel.ac.in/courses/112105045
2) https://onlinecourses.nptel.ac.in/noc21_me126/preview

COURSE OUTCOMES: Upon successful completion of the course, the student will be able

CO 1 : To understand the basic concepts of computational fluid dynamics. {Understand level, KL2}

CO 2 : To solve thepartial differential equations & to understand its physical behavior. {Apply level, KL3}

CO 3 : To Apply the Finite difference method & Finite volume method. {Apply level, KL3}

CO 4 : Understand and Solve the Incompressible fluid flow. {Apply level, KL3}

CO 5 : Compute the conduction and convection heat transfer problems. {Apply level, KL3}

IV-Year- II Semester		L	T	P	C
		3	1	0	3
NON - DESTRUCTIVE EVALUATION					

PREREQUISITES: Production technology

COURSE OBJECTIVES:

1) The students are to be exposed to the concepts of various NDE techniques using radiography, ultrasonic, liquid penetrates, magnetic patches and Eddy currents
2) They will learn basic principles of these methods and will be able to select a testing process
3) They will understand the advantages and disadvantages of these techniques.

UNIT -I

Introduction to non-destructive testing: Radiographic test, Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography

UNIT -II

Ultrasonic test: Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect,Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection – Effectiveness and Limitations of Ultrasonic Testing.

UNIT -III

Liquid Penetrant Test: Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing,

Eddy Current Test: Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current Testing Effectiveness of Eddy Current Testing

UNIT -IV

Magnetic Particle Test: Magnetic Materials, Magnetisation of Materials,Demagnetisation of Materials,Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardisation and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test

UNIT -V

Infrared And Thermal Testing: Introduction and fundamentals to infrared and thermal testing–Heat transfer –Active and passive techniques –Lock in and pulse thermography–Contact and non contact thermal inspection methods–Heat sensitive paints –Heat sensitive papers –-thermally quenched phosphors liquid crystals–IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures–Case studies.

NDE Applications- Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries

TEXT BOOKS:

1) Non destructive test and evaluation of Materials/J Prasad, GCK Nair/TMH Publishers
2) Ultrasonic testing of materials/ H Krautkramer/Springer
3) Non destructive testing/Warren, J Mc Gonnagle / Godan and Breach Science publishers
4) Nondestructive evaluation of materials by infrared thermography / X. P. V. Maldague, Springer-Verlag, 1st edition, (1993)

REFERENCE BOOKS:

1) Ultrasonic inspection training for NDT/ E. A. Gingel/Prometheus Press,
2) ASTM Standards, Vol 3.01, Metals and alloys
3) Non-destructive, Hand Book – R. Hamchand

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : The student shall be able to select an appropriate NDT technique as per requirement.

CO 2 : The student shall be able to set various process parameters and control the NDT process for the desired output parameters.

CO 3 : The student shall be able to find the internal flaws in the material by NDT and take measures to eliminate them.

CO 4 : The student shall be able to solve various problems encountered like leakage, cracks, blowholes etc with the manufacturing process by analyzing the data.

CO 5 : The student shall be competent enough to make use of modern tools and softwares for analyzing and solving real life problem

IV-Year- II Semester		L	T	P	C
		3	1	0	3
INDUSTRIAL HYDRAULICS AND PNEUMATICS					

PRE-REQUISITES: FMHM

COURSE OBJECTIVES: After successfully completing this course, student able to

1) Applying the working principles of fluid power systems and hydraulic pumps.
2) Applying the working principles of hydraulic actuators and control components.
3) Designing and develop hydraulic circuits and systems.
4) Applying the working principles of pneumatic power system and its components.
5) Solving problems and troubles in fluid power systems

UNIT -I

FLUID POWER PRINICIPLES AND HYDRAULIC PUMPS Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids - Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow - Friction loss – Work, Power and Torque- Problems, Sources of Hydraulic power : Pumping Theory-– Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of pumps – Fixed and Variable displacement pumps – Problems

UNIT -II

HYDRAULIC ACTUATORS AND CONTROL COMPONENTS Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Rotary actuators-Hydraulic motors - Control Components : Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Accessories : Reservoirs, Pressure Switches – Filters –types and selection- Applications – Fluid Power ANSI Symbols – Problems

UNIT -III

HYDRAULIC CIRCUITS AND SYSTEMS

Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump

Unloading, DoublePump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Deceleration circuits ,Sizing of hydraulic systems, Hydrostatic transmission, Electro hydraulic circuits,–Servo and Proportional valves – Applications- Mechanical ,hydraulic servo systems.

UNIT -IV

PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS

Properties of air –Air preparation and distribution – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit –classificationsingle cylinder and multi cylinder circuits-Cascade method –Integration of fringe circuits ,Electro Pneumatic System – Elements – Ladder diagram – timer circuits-Problems, Introduction to fluidics and pneumatic logic circuits

UNIT -V

TROUBLE SHOOTING AND APPLICATIONS

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Conditioning of hydraulic fluids Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for metal working, handling, clamping counter and timer circuits. – Low cost Automation – Hydraulic and Pneumatic power packs.

TEXT BOOKS:

1) Anthony Esposito, "Fluid Power with Applications", Prentice Hall, 2009.
2) James A. Sullivan, "Fluid Power Theory and Applications", Fourth Edition, Prentice Hall, 1997

REFERENCE BOOKS:

1) Jagadeesha. T., "Pneumatics Concepts, Design and Applications ", Universities Press, 2015.
2) Joshi.P., Pneumatic Control", Wiley India, 2008.
3) Majumdar, S.R., "Oil Hydraulics Systems – Principles and Maintenance",TataMcGraw Hill, 2001.
4) Shanmugasundaram.K., "Hydraulic and Pneumatic Controls". Chand & Co, 2006.
5) Srinivasan.R., "Hydraulic and Pneumatic Controls", Vijay Nicole Imprints, 2008.

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Apply the working principles of fluid power systems and hydraulic pumps.

CO 2 : Apply the working principles of hydraulic actuators and control components.

CO 3 : Design and develop hydraulic circuits and systems.

CO 4 : Apply the working principles of pneumatic power system and its components.

CO 5 : Solve problems and troubles in fluid power systems.

IV-Year- II Semester		L	T	P	C
		3	1	0	3
SAFETY ENGINEERING					

PREREQUISITES: Nil

COURSE OBJECTIVE : To impart knowledge on

1) To know the safety rules and regulations, standards and codes applicable for engineering industry.
2) To study various mechanical machines and their safety importance.
3) To understand the principles of machine guarding and operation of protective devices.
4) To know the working principle of mechanical engineering processes such as metal forming and joining process and their safety risks.
5) Developing the knowledge related to health and welfare measures in engineering industry.

UNIT -I

SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES: General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards.

UNIT -II

PRINCIPLES OF MACHINE GUARDING

Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction-guard opening. Selection and suitability: lathe-drilling-boring-milling-grinding-shaping- sawing-shearing presses-forge hammer-flywheels-shafts- couplings-gears-sprockets wheels and chains pulleys and belts-authorized entry to hazardous installations-benefits of good guarding systems.

UNIT -III

SAFETY IN WELDING AND GAS CUTTING:Gas welding and oxygen cutting, resistance welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases-colour coding – flashback arrestor – leak detection- pipe line safety-storage and handling of gas cylinders.

UNIT -IV

SAFETY IN COLD FORMING AND HOT WORKING OF METALS: Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot- operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes. Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes.

UNIT -V

SAFETY IN FINISHING, INSPECTION AND TESTING Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering and administrative controls, Indian Boilers Regulation. Health and welfare measures in engineering industry-pollution control in engineering industry-industrial waste disposal.

REFERENCE BOOK:

1) Philip Hagan "Accident Prevention Manual for Business and Industry", N.S.C. Chicago, 13th edition, 2009.

2) John V. Grimaldi and Rollin H.Simonds, "Safety Management", Richard D Irwin, 1994.

3) Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : To outline the safety rules, standards and codes in various mechanical engineering processes.

CO 2 : To explain various machine guarding systems for lathe, drilling, boring and milling machines.

CO 3 : To develop safe procedures for welding, gas cutting, storage and handling of gas cylinders.

CO 4 : To describe and suggest safety measures for cold forming and hot working of metals.

CO 5 : To specify the, safety and welfare measures to be taken during finishing, Inspection and testing of various mechanical processes.

IV-Year- II Semester		L	T	P	C
		3	1	0	3
BASICS OF FLUID MECHANICS AND HEAT TRANSFER					

PRE-REQUISITES: Nil

Course objectives:

1) Describe briefly the concepts of different fluid properties, present numerous examples related to variation of pressure in a fluid and measurement of pressure and illustrate the flow field.
2) Formulate and Analyze simple problems related to Bernoulli's equation, different flow measuring devices and pipe flows.
3) To develop the fundamental principles and laws of heat transfer and to explore the implications of these principles for system behavior.
4) To formulate the models necessary to study, analyze and design heat transfer systems through the application of these principles.
5) To develop the problem-solving skills essential to good engineering practice of heat transfer in real-world applications

UNIT -I

FLUID STATICS: Definition of fluid, differences between a solid and fluids, physical properties of fluids- specific gravity, viscosity, surface tension, capillarity, vapor pressure, Pascal's law for pressure at a point, pressure variation in a fluid at rest, Absolute, gauge, Atmospheric and vacuum pressures, measurement of pressure, Manometers- Piezometer, U-tube manometers.

FLUID KINEMATICS: Introduction, classification of flows, steady & un steady, uniform & non uniform, laminar & turbulent, rotational & irrotational flows, Stream line, path line, streak lines and stream tube, Stream function.

UNIT -II

FLUID DYNAMICS: Surface & body forces, Euler's & Bernoulli's equations for flow along a stream line, momentum equation and its applications on force on pipe bend, Measurement of flow: pitot tube, venture meter and orifice meter.

BOUNDARY LAYER CONCEPTS: Definition, thicknesses, characteristics along thin plate, Definition of displacement, momentum, energy thickness, separation of boundary layers, Fluid flow around submerged objects, concepts of drag and lift, expression for drag and lift, types of drag, Streamlined body and bluff body.

UNIT -III

Basics of Heat Transfer: Thermodynamics and Heat Transfer, Application areas of heat Transfer, Modes and mechanisms of heat transfer, Basic laws governing heat transfer.

Heat Conduction –Basic Equation: Fourier's law of heat conduction, Thermal conductivity of materials, steady, unsteady and periodic heat transfer, initial and boundary conditions.

One- Dimensional, Steady State, Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres with constant thermal conductivity, Composite systems, Electrical analogy, Thermal Resistance, Overall heat transfer coefficient.

Heat Transfer from Extended surface (fins): Analysis of long fin, fin with insulated tip and short fin, fin efficiency and effectiveness.

UNIT -IV

Forced Convection: Introduction, Applications, convective heat transfer coefficient, External Flow-Laminar and Turbulent Flow over a Flat plate – Internal Flow through Circular pipe, Laminar and Turbulent Flows-Entry length and fully developed flow, Reynolds Colburn analogy.

Natural Convection: Introduction, Applications, Development of Hydrodynamic and Thermal boundary layer along Vertical plate- Empirical correlations for Vertical plate, Vertical Cylinder, Horizontal Plate and Horizontal Cylinder.

UNIT -V

Boiling and Condensation: Applications of Boiling Heat transfer phenomena, Pool Boiling, Boiling regimes, Condensation-Film wise and drop wise condensation.

Heat Exchangers: Introduction, Classification of heat exchangers, Overall heat transfer coefficient, LMTD method of Heat exchanger analysis.

Thermal Radiation: Introduction, Applications of Thermal Radiation, Nature of Thermal Radiation, Emissive Power, Absorption, Reflection and Transmission, Concept of Black body, Laws of Black Body Radiation, emissivity, kirchoff's law.

TEXT BOOKS:

1) Hydraulics and Fluid mechanics including Hydraulic machinery MODI and SETH, Standard Book house publications.
2) Fluid Mechanics: Fundamentals and Applications by Y.A. Cengel& J.M. Cimbala, 6th Edn, McGrawHill

3) R.C.Sachdeva - Fundamentals of Engineering Heat and Mass Transfer — New Age Science Publishers, 3nd Edition, 2009.

4) Yunus. A. Cengel, Heat & Mass Transfer-A Practical Approach – Tata McGraw Hill, 4th Edition, 2012

REFERENCES:

1) Fluid Mechanics and Hydraulic Machines by R.K.Rajput, S.Chand Publications, Sixth Edition.

2) Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria& Sons, Nineth Edition

3) Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International, 2007.

4) M.NecatiOzisik, Heat Transfer- A basic Approach,4th Edition, McGraw-Hill book company, 1985.

5) J.P.Holman, Heat transfer - Tata McGraw-Hill, 9th Edition, 2010.

6) P.K.Nag, Heat and Mass Transfer- TMH 2nd Edition, 2007.

E- RESOURCES & OTHER DIGITAL MATERIAL

1) https://nptel.ac.in/courses/112/105/112105171/
2) https://nptel.ac.in/courses/112/105/112105183/
3) https://nptel.ac.in/courses/112/101/112101097/
4) https://nptel.ac.in/courses/112/101/112101001/
5) https://nptel.ac.in/courses/112/101/112101002/

COURSE OUTCOMES : Upon successful completion of the course, the student will be able to

CO 1 : Depict briefly the concepts of different fluid properties, Understand the variation of pressure in a fluid, measurement of pressure and also illustrate the flow field. {Understand level, KL2}

CO 2 : Apply the Bernoulli's equation for various flow measurement devices and also compute the losses in pipe flows and Estimate the lift and drag on different geometrical bodies {Apply level, KL3}

CO 3 : Understand the basic heat transfer principles and their practical relevance and Analyzesteady state heat transfer concepts and fins. {Analyze level, KL4}

CO 4 : Formulate the expressions to solve free convection problems related to external and internal flows and Applythe concepts of heat transfer in boiling, condensation {Apply level, KL3}

CO 5 : Design the heat exchanger for engineering applications and Apply the concept of heat transfer in radiation thermal systems. {Apply level, KL3}

IV-Year- II Semester		L	T	P	C
		3	1	0	3
TRADITIONAL & MODERN MACHINING					

PRE-REQUISITES: NiL

COURSE OBJECTIVES:

1) The course provides students with fundamental knowledge and principles in material removal processes.
2) In this course, the students apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, and drill presses,
3) The course aims in identifying the classification of unconventional machining processes.
4) To understand the principle, mechanism of metal removal of various unconventional machining processes.
5) To study the various process parameters and their effect on the component machined on various unconventional machining processes.
6) To understand the applications of different processes.

UNIT -I

FUNDAMENTAL OF MACHINING

Elementary treatment of metal cutting theory – element of cutting process – geometry of single point cutting tool, tool angles, chip formation and types of chips

LATHE MACHINES: Engine lathe – principle of working, specification of lathe – types of lathe – work holders tool holders – taper turning, thread turning. Turret and capstan lathes

UNIT -II

SHAPING, SLOTTING AND PLANNING MACHINES: Principles of working – principal parts –specifications, operations performed.

DRILLING & BORING MACHINES: Principles of working, specifications, types, operations performed –tool holding devices – twist drill nomenclature

UNIT -III

MILLING MACHINES: Principles of working – specifications – classification of Milling Machines

GRINDING: Theory of grinding – classification of grinding machines, cylindrical and surface grinding machines-different types of abrasives, bonds, specification and selection of a grinding wheel

UNIT -IV

Need for non-traditional machining methods-classification of modern machining processes.

ELECTRO – CHEMICAL MACHINING: Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing. advantages and applications

THERMAL METAL REMOVAL PROCESSES: General principle and applications of Electric Discharge Machining, Electric Discharge Grinding and wire EDM

UNIT -V

Electron Beam Machining, Laser Beam Machining - Basic principle and theory

Plasma Machining: Application of plasma for machining, metal removal mechanism, process parameters

Abrasive jet machining, Water jet machining: Basic principles, equipments, process variables, application and limitations

TEXT BOOKS:

1) Manufacturing Processes / JP Kaushish/ PHI Publishers-2nd Edition
2) Manufacturing Technology Vol-II/P.N Rao/Tata McGraw Hill
3) Modern Machining Process / Pandey P.C. and Shah H.S./ TMH.
4) Advanced Machining Processes/Vijay k Jain/ Allied Publishers

REFERENCES:

1) Metal cutting and machine tools /Geoffrey Boothroyd, Winston A.Knight/ Taylor & Francis
2) Production Technology / H.M.T. Hand Book (Hindustan Machine Tools).
3) New Technology / Bhattacharya A/ the Institution of Engineers, India 1984.
4) Non Traditional Manufacturing Processes / Benedict

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Understand the basic fundamentals of Machining by concept of single point cutting tool and lathe machine functionality

CO 2 : Create the rectangular cuts, holes and bores for the given component.

CO 3 : Develop the Milled and grind the component

CO 4 : Identify the machining process and understands the concept of chemical and thermal machining processes.

CO 5 : Understand the Beam machining and jet machining and identify the appropriate process for the applications.

IV-Year- II Semester		L	T	P	C
		3	1	0	3
PRODUCT DESIGN AND DEVELOPMENT					

PREREQUISITES: Material Science, Basic Manufacturing Processes

COURSE OBJECTIVES:

1) Demonstrate technical competency in practice.
2) Function effectively in an industrial and academic environments.
3) Engage in professional ethics and development.
4) Enrich their society and environment through their skills.

UNIT -I

Introduction to Product Development: Introduction, Need for developing products ,the importance of engineering design, Identifying customer needs, Creative thinking, creativity and problem solving, creative thinking methods-generating design concepts-systematic methods for designing, morphological methods-TRIZ- axiomatic design.

UNIT -II

Industrial Design: human factors design, user friendly design, design for serviceability, design for environment ,prototyping and testing ,cost evaluation, categories of cost, overhead costs ,activity based costing ,methods of developing cost estimates, manufacturing cost ,value analysis in costing.

UNIT -III

PRODUCT AND PROCESS ENGINEERING TOOLS: Tools for concept development,Tools for process improvement,statistical process control,bench marking and establishing engineering specifications,project management.

UNIT -IV

Materials Selection for Product Development:

Material behaviour and selection:Mechanism of Plastic deformation-yield stress and shear strength-Perfect and Real crystals- Effect of strain rate and temperature on plastic behaviour- Super plasticity, Selection of material for mechanical properties Strength, toughness and fatigue- Material selection for durability and surface wear and Corrosion resistance- Manufacturing characteristics of metals.

PROCESS MODELING: Basic analysis of process Forging, Drawing and sheet metal forming- machining- Turning- modern materials- micro alloyed and dual phase steel- High strength low alloy metals- Smart materials- Shape memory metals- Metallic Glasses- Nano Materials- Metal foams- Properties and applications for product design.

DEVELOPMENT IN MATERIALS PROCESSING: Micro fabrication technologies- Tool for micro fabrication- Diamond and high speed machining- LIGA micro fabrication process- Multilayer X-ray lithography.

UNIT -V

Quality Concepts in Product Development:Quality Function Deployment, design process- Identification of control factors, noise factors, developing the experimental plan- experimental design –testing noise factors Running the experiments.

FAILURE MODE EFFECT ANALYSIS: Basic methods: Refining geometry and layout, general process of product embodiment, Advanced methods: systems modeling, mechanical embodiment principles-FMEA method.

DESIGN FOR SIX SIGMA: Basis of SIX SIGMA –Project selection for SIX SIGMA- SIX SIGMA problem solving- SIX SIGMA in service and small organizations - SIX SIGMA and lean production –Lean SIX SIGMA and services.

TEXT BOOKS:

1) Product Design & Development, Karl t. Ulrich, Steven d. Eppinger, Tata Mcgraw-Hills3 rd Edition, 2003
2) Paul Degarmo, Black and Kohsher- Materials and processes in Manufacturing Wiley Student Edition- 9th Edition- 2005
3) Sami Franssile- Introduction to Micro Fabrication- John Wiley and Sons- UK 2004

REFERENCE BOOKS:

1) Product Design Techniques in Reverse Engineering and New Product Development, Kevin Otto & Kristin Wood, Pearson Education (LPE),
2) The Management and control of Quality-6 th edition-James R. Evens, William M Lindsay Pub:son south-western(www.swlearning.com) 2001.
3) Asbhay, Selection of Materials, El Sevier Publications, 2006
4) Fundamentals of Quality control and improvement 2nd edition, AMITAVA MITRA, Pearson Education Asia, 2002.

5) Product Design and Development, KARL T. ULRICH, STEVEN D. EPPINGER, TATA McGraw-HILL- 3rd Editions, 2003.

6) Product Design Techniques in Reverse Engineering and New Product Development, KEVIN OTTO & KRISTIN WOOD, Pearson Education (LPE), 2001.

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : Understand the basic concepts of engineering design and product development {Understand level, KL2}

CO 2 : Understand the effects of other human factors {Understand level, KL2}

CO 3 : understand and apply the various tools used for design development analysis and optimization. {Understand level, KL2}

CO 4 : Understand the behaviour of various metals and non-metals {Understand level, KL2}

CO 5 : Understand about the quality function deployment, design process {Understand level, KL2}

IV-Year- II Semester		L	T	P	C
		3	1	0	3
MATERIALS FOR ENGINEERING					

PREREQUISITES : Knowledge of physics and chemistry

COURSE OBJECTIVES:

1) The student shall be able to understand the properties of materials
2) The student shall be able to understand the process for testing the materials.
3) The student shall be able to understand the process of changing the properties of materials
4) The student shall be able to understand the properties applications of steels, cast irons and other non-ferrous metals
5) The student shall be able to understand the applications of composites and ceramics in engineering.

UNIT -I

Introduction, Classification, Mechanical properties of materials like stress, strain, hardness, creep, fatigue etc. space lattice, miller indices, amorphous and crystalline structure of materials

UNIT -II

Grain formation, size measurement, defects – point, line and surface defects, metallurgical and mechanical testing of materials, constitution of alloys and their necessity

UNIT -III

Phase diagrams, heat treatment – annealing, normalizing, hardening, tempering and surface treatments, TTT curves

UNIT -IV

Steels, cast iron, copper and its alloys, aluminium and its alloys, introduction to other metals like Zinc, Titanium etc.

UNIT -V

composite materials – classification, applications, pros and cons, ceramics – classification, applications, glasses, nano materials

TEXT BOOKS:

1) Introduction to Physical metallurgy by Sydney Avner, tata Mc Grawhill
2) Materials science by Rajput

REFERENCE BOOKS:

1) Materials science and engineering by Callister R Balasubramanian
2) Material science and metallurgy by Kodgiri

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : The student shall be able to understand the properties of materials

CO 2 : The student shall be able to understand the process for testing the materials.

CO 3 : The student shall be able to understand the process of changing the properties of materials

CO 4 : The student shall be able to understand the properties applications of steels, cast irons and other non-ferrous metals

CO 5 : The student shall be able to understand the applications of composites and ceramics in engineering.

IV-Year- II Semester		L	T	P	C
		3	1	0	3
ENTREPRENEURSHIP					

PREREQUISITES: NIL

Course Objective:

1) To impart the basics of entrepreneurship skills for better understanding of entrepreneurial scenario.
2) To familiarize the various components from I to E and promoting adaptability nature.
3) To aware of smallscale ventures and registrations and patents related for entrepreneurship and startups management.
4) To familiarize with significance of institutional support at various levels for determining the marketing strategies.
5) To familiarize the strategic perspectives in entrepreneurship.

UNIT -I

Entrepreneurial Perspectives Introduction to Entrepreneurship – Evolution - Concept of Entrepreneurship - Types of Entrepreneurs - Entrepreneurial Competencies, Capacity Building for Entrepreneurs. Entrepreneurial Training Methods - Entrepreneurial Motivations - Models for Entrepreneurial Development - The process of Entrepreneurial Development.

UNIT -II

New Venture Creation

Introduction, Mobility of Entrepreneurs, Models for Opportunity Evaluation; Types of loans for entrepreneurship and startups. Business plans – Purpose, Contents, Presenting Business Plan, Procedure for setting up Enterprises, Central level - Startup and State level - T Hub, Other Institutions initiatives.

UNIT -III

Small Scale Ventures, MSME in India and their challenges

Concept of micro, small and medium enterprises and startups. Scope and trends of small entrepreneurship and startups in India. Role of government in promoting small scale industries. Management of MSMEs and Sick Enterprises

Challenges of MSMEs, Preventing Sickness in Enterprises – Specific Management Problems; Industrial Sickness; Industrial Sickness in India – Symptoms, process and Rehabilitation of Sick Units.

UNIT -IV

Market growth for generating entrepreneurship opportunities

Entrepreneur's legal and regulatory systems, Intellectual property rights, patents, Copy rights and trademark and their protection. Managing Marketing and Growth of Enterprises Essential Marketing Mix of Services, Key Success Factors in Service Marketing, Cost and Pricing, Branding, New Techniques in Marketing, International Trade.

UNIT -V

Institutional Support to Entrepreneurship and Woman Entrepreneurship

Strategic perspectives in Entrepreneurship, Technology and Entrepreneurship, Training institutions "District Industry Centre (DIC), Entrepreneurship Development Institute of India (EDII)" Innovation council – Ministry of Human Resource Development (MHRD), Small Industries Development Bank of India (SIDBI), Industrial Development Bank of India (IDBI).

Women Entrepreneurs – Strategies to develop Women Entrepreneurs, Institutions supporting Women Entrepreneurship in India, Association of Lady Entrepreneurs of India (ALEAP)

TEXT BOOKS:

1) Entrepreneurship Development and Small Business Enterprises, Poornima M. Charantimath, 2e, Pearson, 2014.
2) P.Narayana Reddy, Entreprenurship, Cengage Learning, New Delhi,2010.
3) Steven Fisher, Ja-nae Duane, The startup equation – A visual guide book for building your startup, Indian edition, Mc Graw Hill Education India Pvt. Ltd. 2016

REFERENCE BOOKS:

1) Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.
2) Entrepreneurship, a South – Asian Perspective, D.F. Kuratko and T. V. Rao, 3e, Cengage, 2012.
3) The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2015.

4) Anajan Rai Chaudhuri, Managing new ventures, concepts and cases, Prentice Hall International, 2010

5) Rajeev Roy: Entreprenurship, Oxford university press, New Delhi, 2010.

COURSE OUTCOMES: Upon successful completion of the course, the student will be able to

CO 1 : The basics of entrepreneurship skills for better understanding of entrepreneurial scenario are understood.

CO 2 : The various components from I to E and promoting adaptability nature were made familiar.

CO 3 : Awareness on small scale ventures and registrations and patents related for entrepreneurship and startups was explained.

CO 4 : significance of institutional support at various levels for determining the marketing strategies was explained.

CO 5 : Strategic perspectives in entrepreneurshi(p are made familiar.

CONTENT BEYOND SYLLABUS

1) case studies of google,facebook mumbai dabbawala

IV-Year- II Semester		L	T	P	C
		0	0	12	6
PROJECT 2					

<u>Quality of Student Projects (25)</u>

(Quality of the project is measured in terms of consideration to factors including, but not limited to, environment, safety, ethics, cost, type (application, product, research, review etc.) and standards. Processes related to project identification, allotment, continuous monitoring, evaluation including demonstration of working prototypes and enhancing the relevance of projects. Mentioned below are the Implementation details including details of POs and PSOs addressed through the projects with justification)

A. Identification of Projects and Allocation Methodology to Faculty Members:

1) Projects are done in the research areas such as Manufacturing, Machine Design, Thermal Engineering and Industrial Engineering.
2) Department will share the list of past 2 years' projects to the students in order to avoid duplicate projects.
3) If students are able to choose open problems and if the guide agrees, then the student can proceed further.
4) In case if a student is unable to select a problem, then faculty members will give a problem to the student for execution of the project work.
5) Project review committee based on students area of interest, will allocate the faculty members to students as guides.

C. **<u>Types and Relevance of the Projects and Their Contribution Towards Attainment of POs and PSOs:</u>**

Table 2.2.3.1. Sample data of student's project mapping with POs and PSOs.

S.No.	Name of candidates/ Team Leader	USN/Registration Number	Guide name	Project title	Mapping POs	Mapping PSOs
1	19BQ5A0327	Ronanki Chaitanya	Dr. K.Satyanarayana	Design and Fabrication of electrical powered bicycle.	PO4, PO5,PO7, PO8, PO10, PO11	PSO1, PSO2
2	18BQ1A0383	Pathan Rahamatulla T	Dr R Naveen	3D modeling, simulation and analysis of Whitworth quick return mechanis.	PO4, PO5, PO6, PO7, PO8, PO10, PO11	PSO2
3	19BQ5A0340	Vissarapu Venkateswara Rao	Dr.T.Srinivasa Rao	Experimental Investigation on Vapour Compression Refrigeration System with Novel Subcooling technique by using Graphene nanorefrigerant.	PO4, PO5, PO7, PO8, PO10, PO11	PSO1
4	19BQ5A0325	Pothuri Mahesh Sai	Dr. MKM Farooqui	Structural analysis of vehicle body structure for improved ride and handling.	PO4, PO5, PO6, PO8, PO10, PO11	PSO1

5	18BQ1A0399	Shaik Arif	Dr.KVL Somasekhar	Integrated information system in manufacturing industry.	PO4, PO5, PO7, PO8, PO10, PO11	PSO1, PSO2
6	18BQ1A03A1	Shaik Husne Shabbir	Prof PVSM Kumar	Testing and validation of reconditioned batteries.	PO4, PO5, PO6, PO8, PO10, PO11	PSO2
7	18BQ1A0318	Budati Chandrika	Dr M Kedar Mallik	Topological optimization of samples produced from 3D printing.	PO4, PO5, PO6, PO8, PO10, PO11	PSO1
8	18BQ1A0338	Gollapudi Sai Kiran	Dr P Nageswara Rao	Performance evaluation of soya bean – TiO2 nano fluid in turning.	PO4, PO5, PO6, PO7, PO8, PO10, PO11	PSO2
9	19BQ5A0306	Chalapati Venkatesh	Dr. P. Venkateswara Babu	Modelling and structural analysis of automobile leaf spring.	PO4, PO5, PO6, PO7, PO8, PO10,PO11	PSO2
10	18BQ1A03A3	Shaik Riyaz	Mr. V. Kiran Kumar	Study on pitting corrosion characteristics of friction stir welded aluminum alloy.	PO4, PO5, PO6, PO7, PO8, PO10,PO11	PSO1, PSO2
11	19BQ5A0326	Rajolu Sudheer	Mrs M.Lakshmi Vinitha	Development of manually operated fertilizer spreader	PO4, PO5, PO6, PO7, PO8, PO10, PO11	PSO1

12	18BQ1A0350	Kaja Venkata S Srimanth	Mr D V Seshagiri Rao	Phase analysis of DMLS fabricated In718 in two different orientations.	PO4, PO5, PO6, PO7, PO8, PO10,PO11	PSO1

D. **Process for Monitoring and Evaluation:**

Continuous Monitoring:

1) Students have to submit a project abstract to the guide and the department coordinator.

2) Project guide/coordinator will give suggestions towards the improvement of the project work. Based on inputs, students have to start their work. In case, the student is doing a project outside the institute such as industry internships, he/she has to consult the guide towards implementation of the project.

3) Every month, the student has to give a presentation on the project work in front of the project review committee-Internal guide will be a member of the committee.

4) During the third review, the project review committee has to give permission to the student for submission of the report to the Department and the University.

5) Finally, an internal VIVA-VOCE examination is conducted by the review committee.

Table 2.2.3.2. Schedule of a project work.

S.No.	Item	Date
1	Abstract submission to guide	05-03-22

2	Review - I	24-03-2022
3	Review - II	21-04-2022
4	Review - III	13-05-22
5	Report submission to the Department library and the University	23-05-22
6	Internal VIVA-VOCE examination	25-05-22

Project Evaluation:

1) The dissertation will be evaluated by examiners- One internal examiner (guide) and one external examiner appointed by the University.
2) A copy of the student report will be sent to each Examiner by the University for Evaluation.
3) The external examiner shall be from a different institution.
4) The evaluation of the dissertation will be made independently by each examiner.
5) The project coordinator will follow evaluation rubrics, which is set by the Department.
6) The project work for internal marks are awarded for a maximum of 40 marks and for external marks awarded for a maximum of 140 marks.
7) The examiners will evaluate and send them to the Controller of Examinations.
8) Marks awarded by the Examiners will be the final.

E. **Process to Assess Individual and Team Performance:**

The rubrics are used to assess the individual and team performance of the students in the project.

Table 2.2.3.3. List of rubrics used for project work.

Parameters	**>70%**	**> 40 to 70%**	**< 40%**
Literature Search	Referred to more than TEN articles;appropriately summarized; includes recent references	Referred to more than SIX articles; appropriately summarized; NO recent references	NO references included
Problem statement	Problem statement is clear, can be implemented and tested, and addresses one of the Engineering Grand Challenge	Problem statement clear, NOT feasible for implementation, and does NOT address the Engineering Grand Challenge	Problem statement NOT clear
Contribution to society, concern for environment	The community that shall benefit clearly specified; ensures safety to environment	Community clearly specified; however safety measures not specified.	Hazard to society and to environment
Project scheduling and work delegation	Proposed and implemented Gantt chart included; with clear distribution of workload among the team members	Proposed Gantt chart included; without clear distribution of workload	Gantt chart NOT provided; NO distribution of workload
Identification of essential concepts Equipment/ component list	Clear list, description and justification of MOST essential Mathematical, Science, Engineering and Management Concepts included	Clear list, description and justification of MOST essential Mathematical, Science, Engineering and Management Concepts included	There is NO mention of anyof the essential Concepts
Effective utilization of the Modern Tool	Clear justification in selecting the TOOL/Components being used is provided	There is no justification for the tool/components being used	No modern tools used.
Design(s)	More than ONE design solution implemented, with comparison.	Only ONE design solution implemented.	NO design included.
Analyze the results	Included clear analysis, along with advantages and disadvantages	Included analysis, without the advantages and disadvantages	NO analysis

Budget Analysis	Budget analysis provided for most of the resources	Budget analysis restricted to finance	NO budget analysis included
Project Report	Well organized, clear objectives and outcomes for every chapter.	NOT well organized	NO design included
Originality score	Clear inference of the work with feature enhancement	No feature enhancement	No inference.
Oral Presentation	Clear presentation	Presentation is not clear	Very poor presentation.
Viva-Voce (Technical Knowledge)	Fair knowledge of MOST concepts related to the project	Demonstrates fair knowledge of SOME concepts	NO knowledge of any of the concepts
Performance in the Team	Contributes and cooperates in the team, and mentors/leads the team	Cooperates but does NOT contribute to the team	Does NOT cooperate

6) **Quality of Completed Projects/Working Prototypes:**

1) The quality of completed projects and working models are assessed based on the following factors.

2) Real time applications

3) Based on prize money and award received at the project exhibition.

4) Best projects suggested by the external examiners at time of evaluation of project work.

5) Usage of cost effective and environmental conditions methods of supported models.

Table 2.2.3.4. Sample working models for year 2021-22

S.No.	Name of candidates/Team Leader	USN/Registration Number	Guide name
1	19BQ5A0327	Ronanki Chaitanya	Design and Fabrication of electrical powered bicycle.

2	18BQ1A0359	Kola Sai Pavan	Modelling and thermal analysis of refrigeration condenser coil using aluminum and magnesium alloys.
3	18BQ1A0393	S R Chandra Kiran	Fabrication Of Sorting Robot For Picking Objects.
4	19BQ5A0325	Pothuri Mahesh Sai	Structural analysis of vehicle body structure for improved ride and handling.
5	18BQ1A0399	Shaik Arif	Integrated information system in manufacturing industry.
6	18BQ1A03A1	Shaik Husne Shabbir	Testing and validation of reconditioned batteries.
7	18BQ1A0318	Budati Chandrika	Topological optimization of samples produced from 3D printing.
8	18BQ1A0338	Gollapudi Sai Kiran	Performance evaluation of soya bean – TiO2 nano fluid in turning.
9	19BQ5A0326	Rajolu Sudheer	Development of manually operated fertilizer spreader

Table 2.2.3.5. Sample working models for year 2020-21

S.No.	Name of candidates/Team Leader	USN/Registration Number	Guide name
1	17BQ1A0315	Ch.Vasavi Annapurna	Ergonomics Impact Assessment In Manufacturing Industries(Kumar Pumps)
2	17BQ1A0304	Alapati Naga Sreevani	Modeling And Simulation Analysis Of Connecting Rod Of An I.C.Engine
3	18BQ5A0313	N Shanmukha SrinivasaRao	Experimental Investigation On The Performance And Emission Characteristics Of C I Engine Fueled With Ternary Fuel Blends
4	18BQ5A0318	Sankuru Niteesh Kumar	The Study On Multimaterial Fabrication And Testing Of Samples Using Fdm, A 3d Printing Technique
5	17BQ1A0328	Gunti Premswaroop	Fabrication And Testing Of Inconel718 Samples By Using Dmls
6	17BQ1A0308	Aradhyula. Madhuri Saisree	Analysis and implementation of impact of ergonomics in biomass power plant

Table 2.2.3.6. Sample working models for year 2019-20

S.No.	Name of candidates/Team Leader	USN/Registration Number	Guide name

1	16BQ1A0302	Akula Meghana	Design and analysis of a multi stored car parking system (prototype)
2	16BQ1A0350	Kuchipudi Vidya Sagar	Noise and vibration measurements and its control for a hair dryer
3	16BQ1A0323	Eluri Gopinadh Chowdary	Fabrication of vapour absorption refrigeration system by using eco friendly refrigrant
4	16BQ1A0336	Gurram Sai Krishna	Turn-key solution for a given component for battery housing of E-Bike
5	17BQ5A0305	Garikapati Sushma	Design of injection mould for caps used in tables
6	16BQ1A0361	Md. Asif Basha	Tribological analysis of bakeite and MS composite

H. Evidences of Papers Published /Awards Received by Projects, etc:

I. **Sample Papers Published by Students:**

Table 2.2.3.7. Sample papers published bystudents in the year 2020-21.

S.No.	Student name as Published in Journal	Name of the working model	Name of journal/ conference
1			
2			
3			
4			
5			

Table 2.2.3.8. Sample papers published by students in year 2019-20.

S.No.	Student name as Published in Journal	Name of the working model	Name of journal/ conference
1			
2			
3			
4			
5			

Table 2.2.3.9. Sample papers published by students in year 2018-19.

S.No.	Student name as Published in Journal	Name of the working model	Name of journal/ conference
1			
2			
3			
4			
5			