



B. TECH. FOUR YEARS

COURSE STRUCTURE AND SYLLABUS FOR MECHANICAL ENGINEERING (AR20)

(Applicable for the batches admitted from 2020-21)



DEPARTMENT OF MECHANICAL ENGINEERING ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AN AUTONOMOUS INSTITUTION AFFILIATED TO JNTUGV, VIZIANAGARAM)

**Approved By AICTE, New Delhi, Accredited By NBA, AICTE & NAAC, UGC, New Delhi,
Listed Under 2(F) & 12(B), UGC, New Delhi, TEQIP Participated College.
K.KOTTURU, TEKKALI,- 532 201, SRIKAKULAM DIST., AP**

VISION OF THE INSTITUTE

To evolve into a premier engineering institute in the country by continuously enhancing the range of our competencies, expanding the gamut of our activities and extending the frontiers of our operations.

MISSION OF THE INSTITUTE

Synergizing knowledge, technology and human resource, we impart the best quality education in Technology and Management. In the process, we make education more objective so that the efficiency for employability increases on a continued basis.

DEPARTMENT OF MECHANICAL ENGINEERING

Aditya Institute of Technology and Management established the Department of Mechanical Engineering (ME) in 2004 with an initial intake of 60 students and got approval for additional intake of another 60 seats in 2011-12. A Post Graduate Program (M. Tech) in Thermal Engineering was introduced in 2011-12 with an intake of 18 seats. The Department of ME feels proud to announce that this Institution has got accredited by NAAC. The college has got TEQIP funds in phase-II under sub-component 1.1. These two important additions surely enhance the prestige of the institution and in turn help students to improve their academic standards. Both the B. Tech and M. Tech programs were duly approved by the AICTE and Govt. of A.P. and permanently affiliated to JNTUGV, Vizianagaram. The Department has its UG Mechanical Engineering Program accredited thrice by NBA in 2013, 2017 and 2021. Further the UG B.Tech. intake has been enhanced to 180 in the year 2019. The Department has JNTUGV authorized research center with five research scholars pursuing their Ph.D. The Department is further equipped with skill oriented labs including Siemens-PLM authorized training centre and Applied Robot Control lab in association with European Centre for Mechatronics & Manufacturing, Germany. The State of art laboratories such as 3DX lab from Dassault Systemes, Automobile and Refrigeration-Air conditioning labs in association with AP State Skilled Development Center stand as assets to Department of Mechanical Engineering by which the skill-sets of students are being enhanced.

VISION OF THE DEPARTMENT

To emerge as one of the most preferred departments in the Southern region to produce professionally competent mechanical engineers.

MISSION OF THE DEPARTMENT

1. Provide students with a set of necessary knowledge, skills and attitude.
2. Develop the professional potential of students through comprehensive teaching and learning processes.
3. Inculcate life-long learning among the students to serve the profession and meet intellectual, ethical and career challenges.
4. Establish vital, state-of-the-art research facilities to provide its students and faculty with opportunities to create, interpret, apply and disseminate knowledge.

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1: Attain successful careers in Mechanical or allied Engineering disciplines.

PEO 2: Create new methods and processes to solve contemporary mechanical engineering problems.

PEO 3: Exhibit ethical and leadership qualities in their chosen professional careers.

PROGRAM OUTCOMES

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO 1 : Analyze and design mechanical components as per given specifications using Engineering and Design Analysis software tools.

PSO 2 : Evaluate thermal systems including IC engines, Refrigeration & Air - Conditioning, and Power generating systems.

PSO 3 : Apply traditional and modern to manufacture and assemble mechanical components with quality assurance.

Academic Regulations 2020 (AR20) for B. Tech

(Effective for the students admitted into I year from the Academic Year 2020-21 onwards)

1. Award of B.Tech Degree:

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

Registered for **160** credits and he/she must secure total **160** credits.

Students, who fail to complete their four-year course of study within **8** years or fail to acquire the **160** Credits for the award of the degree within **8** academic years from the year of their admission, shall forfeit their seat in B. Tech course and their admission shall stand cancelled.

2. Courses of study:

The following courses of study are offered at present with specialization in the B.Tech Course.

S. No.	Branch Code-Abbreviation	Branch
01	01-CE	Civil Engineering
02	02-EEE	Electrical and Electronics Engineering
03	03-ME	Mechanical Engineering
04	04-ECE	Electronics and Communication Engineering
05	05-CSE	Computer Science and Engineering
06	12-IT	Information Technology
07	42-CSM	CSE (Artificial Intelligence and Machine Learning)
08	44-CSD	CSE (Data Science)

And any other course as approved by the authorities of the University from time to time.

3. Credits (Semester system from I year onwards):

S. No	Course	Credits
1	Mandatory Course	0
2	Theory Course	3
3	Laboratory Course	1.5
4	Integrated Course	4.5
5	Interdisciplinary/Open Elective Course	3
6	Skill-Oriented/Skill-Advanced/Soft Skills Course	2
7	Internship	1.5/03
8	Project work	12

4. Interdisciplinary/Open Electives:

There are two interdisciplinary electives in II year II semester and III year I semester and one open elective in IV year I semester. The student can choose any one interdisciplinary elective/open elective courses offered in the respective semester. The pattern of Midterm examinations and End examinations of these courses is similar to regular theory courses and the valuation is purely internal.

5. MOOCs:

Explore all possibilities to run at least one subject in every semester from II year I semester onwards as a MOOCs.

6. NCC/NSS activities:

All undergraduate students shall register for NCC/NSS activities. A student will be required to participate in an activity for two hours in a week during II year I semester or II year II semester and evaluated during the II year II Semester. Grade shall be awarded as Satisfactory or Unsatisfactory in the mark sheet on the basis of participation, attendance, performance and behavior. If a student gets an unsatisfactory Grade, he/she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.

7. Evaluation Methodology:

The performance of a student in each semester shall be evaluated with a maximum of **100** marks for theory course, laboratory and other courses. The project work shall be evaluated for **200** marks.

Mandatory Courses:

Mandatory course is one among the compulsory courses and does not carry any Credits. The list of mandatory courses is shown below:

- Induction Program
- Constitution of India
- Environmental Science
- Human Values

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

Theory course (100 marks):

For theory course, the distribution shall be **40** marks for internal midterm evaluation and **60** marks for the External End Examinations. Out of **40** internal midterm marks, **25** marks are allotted for descriptive exam, **10** marks for two assignments (**5** marks for each assignment) or one case study (group-wise), and **5** marks for objective test.

Pattern for Internal Midterm Examinations (25 marks):

For theory courses of each semester, there shall be **2** Midterm exams. Each descriptive exam is to be held for **30** marks and will be scaled down to **25** marks, with the duration of **90** minutes.

For final calculation of internal marks, weightage of **70%** will be given to the student who performed well either in first Midterm or second Midterm and **30%** weightage will be given to other Midterm examination.

Midterm paper contains three descriptive type questions with internal choice. Each question carries **10** marks ($3 \times 10 = 30M$). The first Midterm examination will be conducted usually after 8 weeks of instruction or after completion of 50% syllabus (i.e. first 3 Units), and the second Midterm examination will be conducted usually at the end of instruction after completion of remaining 50% syllabus (i.e. remaining 3 Units).

Objective test (5 marks):

For theory courses of each semester, there shall be **2** Objective tests to be conducted along with Midterm exam. Each Objective test is to be held for **10** marks with the duration of **10** minutes and will be scaled down to **5** marks.

For final calculation of objective test marks, weightage of **70%** will be given to the student who performed well either in first objective test or second objective test and **30%** weightage will be given to other objective test.

Pattern for External End Examinations (60 marks):

The question paper shall have descriptive type questions for **60** marks. There shall be one question from each unit with internal choice. Each question carries **10** marks. Each course shall consist of six units of syllabus. The student should answer total **6** questions. ($6 \times 10M = 60M$)

Laboratory Course (100 marks):

For laboratory course, there shall be continuous evaluation during the semester for **40** internal marks and **60** semester end examination marks. Out of the **40** marks for internal, **25** marks for day-to-day evaluation, **5** marks for record and **10** marks to be awarded for internal laboratory written test. The end examination shall be conducted by the teacher concerned and external examiner from outside the college.

For the course Engineering Graphics and Design, the distribution shall be **40** marks for internal evaluation (**20** marks for day-to-day evaluation, and **20** marks for internal tests) and **60** marks for end examination.

For the award of marks for internal tests, weightage of **70%** will be given to the student who performed well either in first test or second test and **30%** weightage will be given to other test.

Integrated Course (100 marks):

Integrated courses are exclusively designed to provide a unique learning experience of layered learning where students have a chance to practice while learning. These courses are designed by blending both theory and laboratory components one over the other.

Assessment for **100** marks as given below:

Category	Marks	Assessment
Internal	20	Internal assessment of Laboratory carried out for 40 marks will be scaled down to 20 marks.
	20	Internal assessment of Theory carried out for 40 marks will be scaled down to 20 marks.
End examination	40	End examination of Laboratory carried out for 60 marks will be scaled down to 40 marks.
	20	End examination of Theory carried out for 60 marks will be scaled down to 20 marks.

For Integrated courses, the evaluation of Theory and Laboratory are carried out separately as per evaluation method given in 7.2 and 7.3.

A candidate shall be declared to have passed in integrated course if he/she secures a minimum of **40%** aggregate marks i.e. **40** out of **100** (Internal & Semester-end examination marks put together), subject to a minimum of **35%** marks i.e. **21** marks out of **60** in semester-end examination; in addition to that he/she has to secure minimum of **14** marks (out of **40**) in Laboratory end examination and minimum of **7** marks (out of **20**) in Theory end examination.

Skill Oriented/Skill Advanced Course (100 marks):

Out of a total of **100** marks for the Skill-Oriented/Skill-Advanced Course, **40** marks shall be for the internal evaluation and **60** marks for semester-end examination.

The internal evaluation shall be made on the basis of seminar given by each student on the topic of his/her Skill-Oriented/Skill-Advanced Course, which was evaluated by internal committee constituted by HOD.

The semester-end examination (Viva-Voce) shall be conducted by the committee, consists of an External examiner, Head of the department and Internal supervisor of the Skill- Oriented/Skill-Advanced Course.

Soft Skills (100 marks):

One Soft Skills course is there in III year II semester and Soft skills shall be evaluated for **100** marks. Evaluation pattern of Soft Skills course is similar to the Theory course and evaluation is purely internal.

Internship (100 marks):

All the students shall undergo Community Internship as well as Industrial Internship. Community Internship is for a minimum period of **2** weeks after II year II Semester and Industrial Internship is for a minimum period of **4** weeks after III year II Semester.

Self study report for the Community Internship after the II year II Semester shall be submitted and evaluated during the III year I Semester and Self study report for the Industrial Internship after the III year II Semester shall be submitted and evaluated during the IV year I Semester.

The Self study report will be evaluated for a total of **100** marks consisting of **40** marks for internal assessment and **60** marks for semester-end examination.

Internal assessment for **40** marks shall be done by: internal supervisor in case of community internship and internship supervisor in industry in case of internship in an industry based on day to day observation.

The semester-end examination (Viva-Voce) shall be conducted by the committee, consisting of an External examiner, Head of the department and Internal supervisor of the Internship.

Project (200 marks):

Out of a total of 200 marks for the Project, **80** marks shall be for Project Internal Evaluation and **120** marks for the semester-end Examination.

The Internal Evaluation shall be made on the basis of two seminars given by each student on the topic of his project which was evaluated by an internal committee. Out of **80** internal marks: **20** marks allotted for literature survey, **30** marks for results and analysis, **15** marks for first seminar (usually after 8 weeks) and **15** marks for second seminar (at the end of the semester).

The semester-end examination (Viva – Voce) shall be conducted by the committee, consisting of an External examiner, Head of the Department and Supervisor of the Project. The evaluation of project shall be made at the end of IV year.

Honors/Minor Programme:

The curriculum provides flexibility to enable the competent students to register for B. Tech. degree with Honors/Minor by earning additional 20 credits which are over and above 160 credits for the award of B. Tech. (Regular) degree. The students registered for B. Tech (Honors) shall not be permitted to register for Minor or vice versa.

He/She shall register Honors/Minor during II B.Tech II semester provided he/she secures ≥ 8 CGPA and clearing all the courses in single attempt till II B.Tech I semester. In case of students admitted through lateral entry, the CGPA compliance will be considered from II B.Tech I semester onwards.

If a student is detained due to lack of attendance, he/she shall not be permitted to register the courses of Honors/Minor.

All the students who maintain ≥ 8 CGPA are eligible to enroll for B. Tech with Honors/Minor; however, registration for Honors/Minor degree will be limited to maximum of 35% of the total intake in a particular batch of students.

The students shall have the scope to earn these additional 20 credits from II year II semester to IV year I semester and at any point of time if he/she wishes to withdraw from B. Tech (Honors/Minor) program, the additional credits acquired till that time will get lapsed and cannot be used to compensate with those 160 credits needed for the award of B.Tech degree.

To acquire 20 additional credits, the students shall register for four 4-credit courses under the list of the courses offered by the respective departments and acquire the balance 4 credits by taking two MOOCs NPTEL courses with not less than 8 weeks duration. The student can complete these two MOOCs NPTEL courses during II year II semester to IV year I semester and evaluated and included in the IV year II Semester grade memo.

For the award of B. Tech. degree with Honors the additional 20 credits shall be earned by taking the courses offered by the respective department of study in one domain. A set of four courses are offered under each of the domains preferably from the new emerging areas as recommended by the BoS.

For the award of B. Tech degree with Minor the additional 20 credits shall be earned by taking the inter-disciplinary courses offered preferably from the new emerging areas by other departments.

These additional courses offered by the program may change from time to time based on the demand and resources availability. The courses may be offered in different modes i.e. guided learning/taught courses/Blended mode or combination.

Evaluation methodology of Honors/Minor courses will be similar to the regular B.Tech theory course/laboratory course/integrated course. No Supplementary examination for the courses offered in B.Tech Honors/Minor Program. If a student fails in a course (offered under B.Tech Honors/Minor Program), that course will not be reflected in Grade Memo. The courses passed under Honors/Minor program will not be counted for CGPA/SGPA calculation.

The student who acquires 20 additional credits and maintained ≥ 8 CGPA and acquiring 160 credits in regular B.Tech course and clearing all the courses in single attempt will be awarded the B.Tech degree with Honors/Minor. Any student who fails to fulfill these conditions will automatically get deregistered for B. Tech (Honors)/B.Tech (Minor) without any notification.

Honors/Minor shall not be awarded under any circumstances without completing the regular B. Tech programme in which a student got admitted.

The student is not permitted to repeat any course offered by any department to fulfil credit requirement for Honors/Minor program.

8. Attendance Requirements:

A student shall be eligible to appear for the semester-end examinations, if he/she acquires a minimum of **75%** of attendance in aggregate of all the subjects.

Condonation of shortage of attendance in aggregate up to **10%** (**65%** and above and below **75%**) in each semester with genuine reasons shall be approved by a committee duly appointed by the college. The condonation approved otherwise can be reviewed by the College Academic Committee. A fee stipulated by the college shall be payable towards condonation of shortage of attendance.

Shortage of Attendance below **65%** in aggregate shall in NO case be condoned.

A Student will not be promoted to the next semester unless he satisfies the attendance requirement of the present semester. He/she may seek re-admission for that semester when offered next.

The overall attendance in each semester of regular B. Tech course and Honors/Minor course shall be computed separately.

A student shall maintain an attendance of 75% in each course of Honors/Minor to appear for semester end examination of Honors/Minor. Condonation of shortage of attendance up to **10%** (**65%** and above and below **75%**) in each course with genuine reasons shall be approved by a committee duly appointed by the college. A separate fee stipulated by the college shall be payable towards condonation of shortage of attendance in Honors/Minor.

A student detained due to lack of attendance in Honors/Minor course shall not be permitted to continue Honors/Minor programme, but he/she can continue regular B. Tech programme.

9. Minimum Academic Requirements:

Conditions for pass and award of credits for a course:

A candidate shall be declared to have passed in individual course if he/she secures a minimum of **40%** aggregate marks i.e. **40** out of **100** (internal & semester-end examination marks put together), subject to a minimum of **35%** marks i.e. **21** marks out of **60** in semester-end examination.

On passing a course of a programme, the student shall earn assigned credits in that Course.

Method of Awarding Letter Grades and Grade Points for a Course:

A letter grade and grade points will be awarded to a student in each course based on his/her performance as per the grading system given below.

Table: Grading System for B.Tech Programme

Marks Range	Level	Letter Grade	Grade Points
>= 90%	Outstanding	A+	10
80 – 89%	Excellent	A	9
70 – 79%	Very Good	B	8
60 – 69%	Good	C	7
50 – 59%	Fair	D	6
40 – 49%	Satisfactory	E	5
< 40%	Fail	F	0
-	Absent	AB	0

Calculation of Semester Grade Points Average (SGPA) for semester:

The performance of each student at the end of the each semester is indicated in terms of SGPA.

The SGPA is calculated as below:

$$SGPA = \frac{\Sigma(CR \times GP)}{\Sigma CR} \text{ (for all courses passed in a semester)}$$

Where CR = Credits of a Course

GP = Grade points awarded for a course

Calculation of Cumulative Grade Points Average (CGPA) and Award of Division for entire programme:

The CGPA is calculated as below:

$$CGPA = \frac{\Sigma(CR \times GP)}{\Sigma CR} \text{ (for the entire programme)}$$

Where CR = Credits of a course

GP = Grade points awarded for a course

- Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
- As per the AICTE regulations, conversion of CGPA into equivalent percentage as follows:

$$\text{Equivalent Percentage} = (CGPA - 0.75) \times 10$$

Award of Class:

Class Awarded	CGPA to be secured	Remarks
First Class with Distinction	≥ 7.75 (Without any supplementary appearance)	From the CGPA secured from 160 Credits
First Class	≥ 6.75	
Second Class	≥ 5.75 and < 6.75	
Pass Class	≥ 5.0 and < 5.75	

Supplementary Examinations:

Supplementary examinations will be conducted in every semester.

Conditions for Promotion:

- (i) A student will be promoted to second year if he/she satisfies the minimum attendance requirement.
- (ii) A student shall be promoted from II to III year only if he fulfills the academic requirement of total **50%** credits (if the number of credits is in fraction, it will be rounded off to a lower digit) from regular and supplementary examinations of I year and II year examinations, irrespective of whether the candidate takes the examination or not.
- (iii) A student shall be promoted from III year to IV year only if he fulfills the academic requirements of total **50%** credits (if number of credits is in fraction, it will be rounded off to lower digit) from regular and supplementary examinations of I Year, II Year and III Year examinations, irrespective of whether the candidate takes the examinations or not.

10. Course pattern:

- (i) The entire course of study is of four academic years and each year will have TWO Semesters (Total EIGHT Semesters).
- (ii) A student is eligible to appear for the end examination in a subject, but when absent for it or failed in the end examinations he/she may appear for that subject's supplementary examinations, when offered.
- (iii) When a student is detained due to lack of credits / shortage of attendance, he may be re-admitted when the semester is offered after fulfillment of academic regulations. Whereas the academic regulations hold well with the regulations he/she first admitted.

11. Minimum Instruction Days:

The minimum instruction days for each semester shall be **90**.

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

13. General:

- (i) Wherever the words “he,” “him,” “his,” occur in the regulations, they include “she,” “her,” “hers” as well.
- (ii) The academic regulation should be read as a whole for the purpose of any interpretation.
- (iii) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the principal is final.
- (iv) The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the college.

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT(AUTONOMOUS)

Approved by AICTE, Accredited by NBA & NAAC, Recognized under 2(f) and 12(b) of UGC

Permanently Affiliated to JNTUGV, Vizianagaram

K. Kotturu, Tekkali, Srikakulam-532201, Andhra Pradesh, India

Academic Regulations 2020 (AR20) for B. Tech (Lateral Entry Scheme)

(Effective for the students admitted into II year from the Academic Year 2021-22 onwards)

1. Award of B. Tech. Degree:

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

Registered for **121** credits and he/she must secure total **121** credits.

Students, who fail to complete their three-year course of study within **6** years or fail to acquire **121** Credits for the award of the degree within **6** academic years from the year of their admission shall forfeit their seat in B. Tech course and their admission shall stand cancelled.

2. Promotion Rule:

A lateral entry student will be promoted from II year to III year if he satisfies the minimum required attendance in II year.

A student shall be promoted from III year to IV year only if he fulfills the academic requirements of total **50%** of credits (if the number of credits is in fraction, it will be rounded off to lower digit) from the II Year and III Year examinations, irrespective of whether the candidate takes the examinations or not.

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

DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
1	If the student 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 student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
	If the student gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phone with any student or students in or outside the exam hall with respect to any matter	Expulsion from the examination hall and cancellation of the performance in that subject only. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	If the student has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year.
3	If the student impersonates any other student in connection with the examination	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student, who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all semester-end examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of the seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	If the student smuggles the answer book or additional sheet or takes out or arranges to send out the question paper or answer book or additional sheet during or after the examination	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all semester-end examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of the seat.
5	If the student uses objectionable, abusive or offensive language in the answer script 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	If the student 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 walkout or instigates others to walk out or threatens the officer-in charge or any person on duty in or outside the examination hall or causes any injury to any of his relatives either by words 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 relatives, or indulges in any other act of misconduct or mischief which results in damage or destruction of property in the examination hall or any part of the	In case of students of the college, they shall be expelled from examination hall 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 students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

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	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	
7	If the student leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of the seat.
8	If the student possesses any lethal weapon or firearm in the examination hall	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.
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 clauses 6, 7, 8	In case of student of the college, expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The 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	If the student comes in a drunken condition to the examination hall	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
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 student has already appeared including practical examinations and project work of that semester/year examinations.

ADITYA INSTITUTE OF TECHNOLOGY AN MANAGEMENT, TEKKALI
AR20 – COURSE STRUCTURE (1STB.Tech.)
(Proposed for Mechanical)

Year/Sem.	Category	Code	Theory/Lab	L	T	P	C
I B. Tech. (1st Sem)	MC	20MCT101	Induction Program	3 weeks			0
	HSSC	20HST101	English	3	0	0	3
	BSC	20BST101	Linear Algebra and Calculus	2	1	0	3
	BSC	20BST107	Chemistry	3	0	0	3
	ESC	20ESI102	Programming for problem solving	3	0	3	4.5
	ESC	20ESL103	Engineering Graphics & Design	1	0	4	3
	HSSC	20HSL101	Language Proficiency Lab	0	0	3	1.5
	BSC	20BSL102	Chemistry Lab	0	0	3	1.5
Total				12	1	13	19.5

Year/Sem.	Category	Code	Theory/Lab	L	T	P	C
I B. Tech. (2nd Sem)	MC	20MCT103	Constitution of India	2	0	0	0
	BSC	20BST102	Differential Equations	2	1	0	3
	BSC	20BST106	Engineering Physics	3	0	0	3
	PC	20MET101	Thermodynamics	3	0	0	3
	ESC	20EST101	Basic Electrical Engineering	3	0	0	3
	ESC	20ESL102	Workshop and Manufacturing practice	1	0	4	3
	BSC	20BSL101	Physics Lab	0	0	3	1.5
	ESC	20ESL101	Basic Electrical Engineering Lab	0	0	3	1.5
	PC	20MEL101	Computer Aided Drafting Lab	0	0	3	1.5
Total				14	1	13	19.5

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI
AR20 – COURSE STRUCTURE (2nd B.Tech.)
(Proposed for Mechanical)

Year/Sem.	Category	Code	Theory/Lab	L	T	P	C
II B. Tech. (1st Sem)	MC	20MCT202	Environmental Science	2	0	0	0
	BSC	20BST203	Complex Variables and Statistical Methods	3	0	0	3
	ESC	20EST203	Engineering Mechanics	3	0	0	3
	PC	20MET202	Materials Engineering	2	1	0	3
	PC	20MET203	Fluid Mechanics	3	0	0	3
	PC	20MET204	Applied Thermo Fluids-I	3	0	0	3
	PC	20MEL202	Fluid Mechanics and Hydraulic Machines Lab	0	0	3	1.5
	PC	20MEL203	Thermal Engineering Lab	0	0	3	1.5
	PC	20MEL204	Metallurgy and Materials Lab	0	0	3	1.5
	SC	20MES201	Skill Oriented Course – I	1	0	2	2
Total				17	1	11	21.5

Year/Sem.	Category	Code	Theory/Lab	L	T	P	C
II B. Tech. (2nd Sem)	MC	20MCS204	NCC/NSS	2	0	0	0
	ESC	20ESI204	Python Programming	3	0	3	4.5
	PC	20MET205	Applied Thermo Fluids-II	2	1	0	3
	PC	20MET206	Manufacturing Technology -I	3	0	0	3
	PC	20MET207	Strength of Materials	3	0	0	3
	OE	20IET21X	Interdisciplinary Elective – I	3	0	0	3
	PC	20MEL205	Production Technology Lab	0	0	3	1.5
	PC	20MEL206	Strength of Materials Lab	0	0	3	1.5
	SC	20MES202	Skill Oriented Course – II	1	0	2	2
Total				15	1	11	21.5
Community Internship 2 Weeks (Mandatory) during summer vacation							
Honors/Minor Courses : ROBOTICS							
II B. Tech. (2nd Sem)	HM	20ROT201	Introduction to Robotics and Mechatronics	4	0	0	4

R20 - B. Tech. - ME

Subject Code	Offered by Dept.	Interdisciplinary Elective – I	Offered for Dept.
20IET211	BS&H	Transform Theory	MECH/CIVIL
20IET212	BS&H	Numerical Methods	ECE/EEE
20IET213	BS&H	Introduction to Number Theory	CSE/IT
20IET214	CIVIL	Elements of building planning	MECH
20IET215	CIVIL	Remote Sensing	ECE/EEE/CSE/IT
20IET216	EEE	Mathematical Modeling and Simulation	ECE/MECH/CIVIL/CSE/IT
20IET217	MECH	Fundamentals of Material Science	ECE/EEE/CIVIL/CSE/IT
20IET218	ECE	Introduction to Electronic Measurements	EEE/MECH/CIVIL/CSE/IT
20IET219	CSE	UNIX Utilities	ECE/EEE/MECH/CIVIL
20IET21A	IT	Fundamentals of Data Structures	ECE/EEE/MECH/CIVIL
20IET21B	TPC	Advanced Coding – I	CSE/IT
20IET21C	TPC	Competitive Programming – I	ECE/EEE/MECH/CIVIL

R20 - B. Tech. - ME

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI

AR20 – COURSE STRUCTURE (3rd B.Tech.)

(Proposed for Mechanical)

Year/Sem.	Category	Code	Theory/Lab	L	T	P	C
III B. Tech. (1st Sem)	MC	20MCT305	Human Values	2	0	0	0
	PC	20MET308	Machine Design	3	0	0	3
	PC	20MET309	Kinematics & Dynamics of Machinery	3	0	0	3
	PC	20MET310	Manufacturing Technology -II	3	0	0	3
	PE	20MEE31X	Professional Elective – I	3	0	0	3
	OE	20IET32X	Interdisciplinary Elective – II	3	0	0	3
	PC	20MEL307	3D Modeling Lab	0	0	3	1.5
	PC	20MEL308	Machine Tools & Metrology Lab	0	0	3	1.5
	SC	20MES303	Skill Advanced Course – I	1	0	2	2
I/P	20MEP301	Community Internship	0	0	0	1.5	
Total				18	0	8	21.5
Honors/Minor Courses : ROBOTICS							
III B. Tech. (1st Sem)	HM	20ROI302	Kinematics and Dynamics of Robot Manipulator	3	0	2	4

Subject Code	Professional Elective – I
20 MEE311	CAD/CAM
20MEE312	Automobile Engineering
20MEE313	Composite Materials
20MEE314	Tribology

Subject Code	Interdisciplinary Elective – II	Offered for Department
20IET321	Fundamentals of Fuzzy Logic	All
20IET322	Geographical Information System	ECE/EEE/MECH/CSE/IT
20IET323	Renewable Energy Sources	ECE/MECH/CIVIL/CSE/IT
20IET324	Fundamentals of Robotics	ECE/EEE/CIVIL/CSE/IT
20IET325	Principles of Communications	EEE/MECH/CIVIL/CSE/IT
20IET326	JAVA Programming	ECE/EEE/MECH/CIVIL
20IET327	Introduction to DBMS	ECE/EEE/MECH/CIVIL
20IET328	Advanced Coding – II	CSE/IT
20IET329	Competitive Programming – II	ECE/EEE/MECH/CIVIL

R20 - B. Tech. - ME

Year/Sem.	Category	Code	Theory/Lab	L	T	P	C
III B. Tech. (2nd Sem)	HSSC	20HST302	Managerial Economics & Financial Analysis	3	0	0	3
	PC	20MET311	Heat and Mass Transfer	3	0	0	3
	PC	20MET312	Dynamic Systems & Mechanical Vibrations	3	0	0	3
	PE	20MEE32X	Professional Elective – II	3	0	0	3
	PE	20MEE32X	Professional Elective – III	3	0	0	3
	PC	20MEL309	Dynamics Lab	0	0	3	1.5
	PC	20MEL310	Heat Transfer Lab	0	0	3	1.5
	HSSC	20HSL302	Professional Communication Skills Lab	0	0	3	1.5
SC	20SSS301	Soft Skills	1	0	2	2	
Total				16	0	11	21.5
Industrial Internship 4 Weeks (Mandatory) during summer vacation							
Honors/Minor Courses : ROBOTICS							
III B. Tech. (2nd Sem)	HM	20ROI303	Robot Programming and Applications	3	0	2	4

Subject Code	Professional Elective – II
20MEE321	Robotics
20MEE322	Refrigeration and Air Conditioning
20MEE323	Tool Design
20MEE324	Fracture Mechanics

Subject Code	Professional Elective – III
20MEE331	Instrumentation and Control
20MEE332	Unconventional Machining Process
20MEE333	Computational Fluid Dynamics
20MEE334	Nano Materials

ADITYA INSTITUTE OF TECHNOLOGY AN MANAGEMENT, TEKKALI
AR20 – COURSE STRUCTURE (4th B.Tech.)
(Proposed for Mechanical)

Year/Sem.	Category	Code	Theory/Lab	L	T	P	C
IV B. Tech. (1st Sem)	PC	20MEI413	Finite Element Methods	3	0	3	4.5
	PC	20MET414	Project Management and Operation Research	3	0	0	3
	PE	20MEE44X	Professional Elective – IV	3	0	0	3
	PE	20MEE45X	Professional Elective – V	3	0	0	3
	OE	20OET41X	Open Elective	3	0	0	3
	SC	20MES404	Skill Advanced Course - II	1	0	2	2
	PC	20MEL411	Fluid Control Systems Lab	0	0	3	1.5
	I/P	20MEP402	Industrial Internship	0	0	0	3
Total				16	0	8	23
Honors/Minor Courses : ROBOTICS							
IV B. Tech. (1st Sem)	HM	20ROT404	Robot Vision and Image Processing	4	0	0	4

Subject Code	Professional Elective – IV
20MEE441	Industrial Hydraulics and Pneumatics
20MEE442	Non Conventional Energy sources
20MEE443	Total Quality Management
20MEE444	Manufacturing Process and Product life cycle Management
Subject Code	Professional Elective – V
20MEE451	Industrial Automation
20MEE452	Condition Monitoring
20MEE453	Power plant engineering
20MEE454	Additive Manufacturing

Subject Code	Offered by Dept.	Open Elective	Offered for Dept.
20OET411	MBA	HRD & Organizational behavior	All
20OET412	MBA	Project Management	All
20OET413	MBA	Entrepreneurial Development	All
20OET414	MBA	Digital Marketing	All
20OET415	CIVIL	Environmental impact assessment	All
20OET416	EEE	Energy Audit Conservation and Management	All
20OET417	MECH	Optimization Techniques	All
20OET418	CSE	Block chain Technologies	All
20OET419	IT	IT systems Management	All
20OET41A	CSM	API and Micro Services	All

R20 - B. Tech. - ME

Year/Sem.	Category	Code	Theory/Lab	L	T	P	C
IV B. Tech. (2nd Sem)	I/P	20MEP403	Project work	0	0	0	12
Total							12

Honors/ Minor Course : ROBOTICS							
	HM	20ROM405	MOOC Course - I				2
	HM	20ROM406	MOOC Course - II				2

Subject Code: 20HST101

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To enable students build vocabulary appropriate to their levels and to make students understand printed texts of different genres
- To enhance basic writing skills of the students in different forms of written communication
- To assist students implicitly synthesize the rules of grammar for the production of accurate sentences
- To help students learn rules of using punctuation marks and prepositions appropriately in writing
- To aid students acquire appropriate and adequate letter writing skills
- To get students develop reading skills and enhance their essay writing skills

COURSE OUTCOMES

- CO1:** Students will be able to comprehend printed texts of different genres more easily and they will be able to make appropriate word choice.
- CO2:** Students will be able to write short texts masterly.
- CO3:** Students will be able to construct grammatically correct sentences.
- CO4:** Students will be able to use punctuation marks and prepositions correctly in speech and writing.
- CO5:** Students will be able to communicate through letters and emails effectively.
- CO6:** Students will be able to comprehend unfamiliar passages, and will be able to write essays.

COURSE SYLLABUS

- UNIT-I :** *Father's Help* by R K Narayan
Synonyms and Antonyms — One-word substitutes
- UNIT-II :** *My Early Days* by A P J Abdul Kalam
Tense— Voice — *If* clauses
- UNIT-III :** *The Road Not Taken* by Robert Frost
Reported Speech—Degrees of Comparison — Simple, Compound, Complex Sentences
- UNIT-IV :** *Politics and the English Language* by George Orwell
Punctuation —Prepositions
- UNIT-V :** *Mother's Day* by J. B. Priestly
Letter Writing — E-mail Writing
- UNIT-VI :** *Chipko Movement*
ReadingComprehension—Essay Writing

SUGGESTED READINGS:

- On Writing Well.* William Zinsser. Harper Resource Book. 2001
- Practical English Usage.* Michael Swan. Oxford University Press. 1995.
- Study Writing.* Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- Hugging the Trees: The Story of the Chipko Movement.* Thomas Weber. Viking Publishers, New Delhi, 1988.

LINEAR ALGEBRA AND CALCULUS

Subject Code: 20BST101

L	T	P	C
2	1	0	3

COURSE OBJECTIVES:

- Understand the process of calculation of rank, solution of System of Linear Homogeneous and Non Homogeneous equations by Gauss Elimination method.
- Learn the process of calculating the Eigen values, Eigenvectors and Quadratic Forms.
- Understand the concepts of multiple integrals and their usage.
- Learn the properties of Gamma and Beta Functions, their relation and evaluation of improper integrals.
- Understand the concepts of gradient, divergence, curl of scalar and vector point functions.
- Understand and calculate Line Integral, Surface Integral, Volume Integral, concepts of Green's, Stokes and Gauss Divergence theorems in converting one integral form to another

COURSE OUTCOMES:

The student will be able to:

- CO1:** Calculate the rank and solve linear homogeneous and non homogeneous equations by Gauss Elimination method.
- CO2:** Calculate eigen values, eigen vectors and estimate the nature of the matrix.
- CO3:** Evaluate multiple integral in both Cartesian and polar coordinates.
- CO4:** Apply Beta and Gamma functions to solve improper integrals.
- CO5:** Calculate gradient, divergence, curl of a scalar and vector point functions and derive vector identities.
- CO6:** Solve a Line Integral, Surface Integral, Volume Integral, apply Green's, Stokes and Gauss Divergence theorems in converting one integral form to another.

UNIT-I: Linear System of Equations (8 hrs)

Matrices – Rank- echelon form – Normal form – System of Linear Homogeneous and Non Homogeneous equations – Gauss Elimination method- Applications- Matrix representation for a Graph- Current in an electrical circuit.

UNIT-II: Eigen Values, Eigen Vectors, Quadratic Forms (8 hrs)

Eigen values – Eigenvectors – Properties (an over view)-Diagonalization- Quadratic Forms- Reduction of Quadratic Forms to Canonical Form- Rank-Nature-Index-Signature.

UNIT-III: Multiple Integrals(8 hrs)

Double integral (Cartesian and polar form) -Change of order of integration -Change of variables (Cartesian to polar)- Triple integrals – Change of variables (Cartesian to spherical/cylindrical).

UNIT-IV: Special functions: (8 hrs)

Gamma and Beta Functions – Properties - Relation between Beta and Gamma functions- Evaluation of improper integrals.

UNIT-V: Vector Differential Calculus (8 hrs)

Scalar and Vector point functions- Vector differentiation - Directional derivatives – Gradient, Curl and Divergence- Vector identities.

UNIT-VI: Vector Integral Calculus (8 hrs)

Vector Integration –Line Integral, Surface Integral, Volume Integral – Green Theorem, Stokes Theorem and Gauss Divergence theorem (without proofs with simple illustrations only).

SUGGESTED TEXT BOOKS

1. **B.V. Ramana**, Higher Engineering Mathematics, 44th Edition, Tata McGraw Hill New Delhi, 2014.
2. **Dr.B.S.Grewal**, Higher Engineering Mathematics, 43nd Edition, Khanna Publishers, 2015.

REFERENCE BOOKS

1. **Erwin Kreyszig**, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. **G.B. Thomas and R.L. Finney**, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. **Veerarajan T.**, Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
 4. **D. Poole**, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. **N.P. Bali and Manish Goyal**, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

CHEMISTRY**Subject Code: 20BST107**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:*The students will become familiar and understand about:*

- Rationalise the importance of water for society and industrial needs.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- To become familiar in moulding methods of preparation of different types of plastic materials
- Rationalise organic reactions such as addition, substitution, elimination, rearrangement reactions.
- Rationalise reference electrodes and science of corrosion.
- Distinguish Renewable & Non-Renewable energy resources and rationalise about green chemistry, batteries.

COURSE OUTCOMES:*The course will enable the student to:*

- CO1:** Rationalise the importance of water for society and industrial needs.
- CO2:** Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- CO3:** Differentiate different moulding techniques of plastic materials
- CO4:** Rationalise organic reactions such as addition, substitution, elimination, rearrangement reactions.
- CO5:** Rationalise the science of corrosion.
- CO6:** Distinguish Renewable & Non-Renewable energy resources and rationalise about green chemistry, batteries.

UNIT-I:**Water Technology (9 lectures)**

Hardness of Water – Temporary and Permanent Hardness - Units of Hardness - Estimation of Hardness by EDTA Method - Problems on Temporary and Permanent Hardness - Disadvantages of Hard Water – Softening Methods of Hard Water- Zeolite or Permutit Process - Ion Exchange Process - Methods of Treatment of Water for Domestic Purposes – Sedimentation, Coagulation, Filtration, Disinfection - Sterilization, Chlorination, Break Point chlorination, Ozonisation.

UNIT-II:**Spectroscopy (8 lectures)**

Spectroscopy - Electronic Spectroscopy - Types of Electronic Transitions - Definition of Chromophore – Definition of Auxochrome – Absorption and Intensity Shifts - Introduction to I.R. Spectroscopy – Fingerprint Region – Introduction to NMR – Principle - Equivalent and Non-Equivalent Protons - Chemical Shift- Splitting – Coupling Constant.

UNIT-III:**Polymers and Plastics (7 lectures)**

Definitions of Polymer, Polymerization – Functionality – Degree of polymerization - Types of Polymerization (Addition and Condensation Polymerizations) - Plastics – Definition, Thermoplastics, Thermosetting Plastics – Compounding of Plastics – Moulding of Plastics into Articles (Compression, Injection, Transfer and Extrusion Moulding Methods) - Preparation, Properties and Engineering Uses of PVC and Bakelite.

UNIT-IV:**Organic Reactions (7 lectures)**

Types of Organic reactions: Addition - Electrophilic, Nucleophilic and Free radical - Substitution - Electrophilic, Nucleophilic (SN^1 and SN^2) and Free radical – Elimination (E_1 and E_2) – Rearrangement Reactions (Claisen, PinacolPinacolone Rearrangement).

UNIT-V:**Corrosion and Its Control (9 lectures)**

Definition of Corrosion – Theories of Corrosion (Chemical & Electrochemical) – Mechanism of Electrochemical Corrosion (Oxygen Absorption Type and Hydrogen Evolution Type) - Galvanic Series - Factors Influencing Corrosion – Corrosion Control Methods - Proper Designing, Modifying the Environment, Cathodic Protections – Sacrificial Anodic Protection and Impressed Current Cathodic Protection. Metallic (Anodic and Cathodic) Coatings – Methods of application on metals (Galvanizing and Tinning).

UNIT-VI:**Green Chemistry & Energy (8 lectures)**

Introduction to green chemistry – Definition and 12 principles of green chemistry.

Types of energy sources – Renewable & Non-Renewable - Introduction to solar energy – harnessing of solar energy – photo voltaic cells – Concentrated Solar power plants.

Introduction of Energy storage devices: Principle & mechanism of Batteries & Super capacitors, Types of Batteries (Alkaline & Lead-Acid) - Difference between Batteries and Super capacitors.

SUGGESTED TEXT BOOKS :

- (i) University chemistry, by B. H. Mahan
- (ii) Elementary organic spectroscopy: principles and applications, by Y. R. Sharma
- (iii) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
- (iv) “Engineering Chemistry”, P. C. Jain and Monica Jain, Dhanpat Rai Publications, Co., New Delhi, 2004, 16th Edition

REFERENCE BOOKS:

- (i) Fundamentals of Molecular Spectroscopy, by C. N. Banwell
- (ii) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
- (iii) Physical Chemistry, by P. W. Atkins
- (iv) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition.
- (v) Concise Inorganic Chemistry: Fifth Edition by J.D. Lee

PROGRAMMING FOR PROBLEM SOLVING
(Common to all Branches)

Subject Code: 20ESI102

L	T	P	C
3	0	3	4.5

COURSE OBJECTIVE

The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.

COURSE OUTCOMES

- CO1:** Understand the fundamentals of C programming
CO2: Choose the loops and decision making statements to solve the problem
CO3: Make use of pointers to access arrays, strings and implements different operations on arrays, and work with textual information, characters and strings.
CO4: Apply programming to write modular programs, user defined functions to solve real time problems and allocate memory using dynamic memory management functions.
CO5: Create user defined data types including structures and unions to solve problems.
CO6: Implement files operations in C programming for a given application and able to handle errors during program execution.

UNIT-I**Introduction to Programming**

Introduction to components of Computer system, Algorithm, Flow chart, Program development steps, C Tokens, Operator precedence, Structure of C program, Basic I/O statements.

Exercise Questions: 1

Ex 1: Write the C programs to calculate the following

- a) Area of triangle when sides are given.
- b) Program for Type Casting.
- c) Interchanging values of two variables.

Ex 2: Write the C programs to perform the following

- a) Read lower case character and convert into upper case.
- b) Find maximum of 3 values using conditional operator.
- c) Calculate area and perimeter of circle.

UNIT-II**Control Structures**

Decision statements: if, if-else, nested if and switch, **Iterative statements:** for, while, do while and nested loops **Branching:** Break, continue, goto.

Exercise Questions: 2

Ex 3: Write C programs for the following using decision making statements

- a) Program to find roots of quadratic equation.
- b) Find the Largest among 3 values.
- c) Calculate the grades of a student.

Ex 4: Write C programs for the following using Iterative Statements

- a) Arithmetical operations using switch-case.
- b) Read a number and display in reverse.
- c) Check for Armstrong number property

Ex 5:

- a) Generate Fibonacci series.
- b) Generate Prime numbers between two numbers.
- c) Write a program in C to display the pattern like right angle triangle using an asterisk

```
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* * * * *
```

UNIT- III

Arrays: Definition, Types: 1D, Multi Dimensional arrays, declaration, initialization, accessing elements, Matrix operations and String Handling.

Pointers: Definition, Declaration, Initialization, Pointer arithmetic, Pointer to pointer, arrays and pointers, Dynamic memory allocation

Exercise Questions: 3

Ex 6: Implement the following using arrays

- a) Largest and smallest from a list of elements.
- b) Program for Linear Search.
- c) Program for Bubble Sort.

Ex 7: Implement the following using arrays

- a) Matrix addition.
- b) Matrix Multiplication.
- c) Program using string handling functions

Ex 8: Implement the following using DMA Functions

- a) Find the sum and average of list of elements using DMA Functions
- b) Implementation of call by reference and call by value.

Ex 9:

- a) Implement C Program using any numerical methods

UNIT- IV

Functions: Definitions, Declaration, Types of Functions, Parameter passing, Passing Arrays to functions, Recursion, library functions, functions and pointers, and Storage classes,

Exercise Questions: 4

Ex 10:

- a) Factorial using recursion and non recursion.
- b) GCD using recursion and non recursion.
- c) To count the digits of a given number using recursion

UNIT- V

Structures: Definition, Declaration, Accessing the structure elements, Array of structures, Arrays with in structures, pointer to structure, passing structure to function, nested structures, and unions.

Exercise Questions: 5

Ex: 11

- a) Implementation of array of structure
- b) Demonstration of Union

UNIT- VI

Files: Definition, Types of files, Opening modes, File IO Functions, Random access functions, Preprocessor directives.

Exercise Questions: 6

Ex 12:

- a) Copy the contents of one file into another.
- b) Count the number of characters, words and lines in a file.

TEXT BOOKS

1. "The C – Programming Language", B. W Kernighan, Dennis M. Ritchie, 2nd Edition, PHI.
2. "A Structured Approach Using C" by Behrouz A. Forouzan, Richard F. Gilberg 3rd Edition
3. "Problem solving Through 'C'- User Friendly Approach", Dr. G.S.N Murty, S Vishnu Murty, First Edition, MANTECH Publications Pvt.Ltd., 2020

REFERENCES

1. "Let Us C", YashwantKantikar, 8th Ed., PBP Publications 2012.
2. "C Programming", E. Balagurusamy, Tata McGraw Hills,2011,New Delhi, India.

Web Links

1. <https://www.tutorialspoint.com> › Cprogramming › C – Home
2. <https://www.programiz.com/c-programming>

ENGINEERING GRAPHICS & DESIGN**Subject Code: 20ESL103**

L	T	P	C
1	0	4	3

COURSE OBJECTIVES:

- Able to develop drawing skills.
- To draw orthographic views from the given isometric view and vice versa
- To understand the fundamentals of computer aided design and drafting

COURSE OUTCOMES:**CO 1 :** Draw projection of points and straight lines in first angle projection.**CO 2 :** Project plane surfaces with respect to one reference plane.**CO 3 :** Develop a projections for a simple solids with respect reference plane.**CO 4 :** Convert orthographic views into isometric projections and vice-versa.**CO 5 :** Draw basic lines and profiles with commonly used operations in drafting software.**CO 6 :** Generate 2D drawings along with dimensioning in drafting software.**LIST OF EXERCISES:****PART-A: Conventional Engineering drawing**

- 1 Projections of points
- 2 Projections of straight lines inclined to one reference plane only.
- 3 Projections of planes inclined to one reference plane only.
- 4 Projections of simple solids inclined to one reference plane only.
- 5 Conversion of isometric views into orthographic views
- 6 Conversion of orthographic views into isometric views.

PART-B: Basic Computer aided engineering drawing (2-D drawings)

1. Commands – Axes, Coordinate points, Creation of lines, Polylines, Square, Rectangle, Polygons, Spines, Circles, Ellipse, Text.
2. Move, Copy, Offset, Mirror, Rotate, Trim, Extend, Break, Chamfer, Fillet, Curves.

Note: Six Exercises are to be completed by using AutoCAD software**TEXT BOOKS:**

1. Engineering Drawing, N. D. Bhatt, V. M. Panchal, Charotar Pub.
2. Engineering Drawing, K. L .Narayana, P.Kanniah, Scitech Pub.

REFERENCE BOOKS:

1. Engineering Drawing and Graphics, 2nd ed., K. Venugopal, New Age International Pub.
2. Fundamentals of Engineering Drawing, 11th ed., Luzadder, J. Warren, D.M. Jon, Prentice Hall India Pub.

LANGUAGE PROFICIENCY LAB**Subject Code: 20HSL101**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES

- To enable students develop neutralized accent
- To assist students utter words intelligibly
- To enhance the ability of students to speak spontaneously
- To help students converse aptly as the context demands
- To get students acquire perceptive abilities in professional conversations
- To aid students grasp and interpret information provided in graphs and tables

COURSE OUTCOMES

- CO1 :** Students will be able to recognize differences among various accents and speak with neutralized accent.
- CO2 :** Students will be able to pronounce words accurately with the knowledge of speech sounds and use appropriate rhythm and intonation patterns in speech.
- CO3 :** Students will be able to speak extemporaneously about anything in general.
- CO4 :** Students will be able to generate dialogues for various situations.
- CO5 :** Students will be able to present posters perceptively and concisely.
- CO6 :** Students will be able to comprehend and interpret data provided in graphs and tables.

COURSE SYLLABUS

UNIT-I : Listening Comprehension of Audio and Video clips of different accents

UNIT-II : Pronunciation—Intonation—Stress—Rhythm

UNIT-III : JAM— Narration of an Event

UNIT-IV : Situational Dialogues

UNIT –V : Poster Presentation

UNIT-VI : Interpretation of Data in Graphs and Tables

SUGGESTED READINGS:

*Communication Skills.*Sanjay Kumar and PushpaLata.OUP. 2011.

*Practical English Usage.*Michael Swan. OUP. 1995.

Speak Well. K. Nirupa Rani. Orient Blackswan, Hyderabad. 2012.

Strengthen Your Communication Skills. M. Hari Prasad. Maruthi Publications, Hyd. 2014.

Strengthen Your Steps. M. Hari Prasad. Maruthi Publications, Hyderabad. 2012.

*Technical Communication.*Meenakshi and Sangeetha.OUP. New Delhi. 2013.

CHEMISTRY LAB**Subject Code: 20BSL102**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:*The students will become familiar and understand about:*

- Measure molecular/system properties such as kinematic viscosity, acid number of lubricating oil, etc
- Measure molecular/system properties such as surface tension and viscosity.
- Measure molecular/system properties such as pH, conductance of solutions, redox potentials, etc
- Measure molecular/system properties such as chloride content, hardness of water, dissolved oxygen, etc.
- Synthesize a small polymer molecule and analyze a salt sample.
- Estimate iron (by colorimeter), partition coefficient, and adsorption of acetic acid by charcoal etc.

COURSE OUTCOMES:*The students will learn to:*

- CO1** : Measure molecular/system properties such as kinematic viscosity, acid number of lubricating oil, etc.
- CO2** : Measure molecular/system properties such as surface tension and viscosity.
- CO3** : Measure molecular/system properties such as pH, conductance of solutions, redox potentials, etc
- CO4** : Measure molecular/system properties such as chloride content, hardness of water, dissolved oxygen, etc.
- CO5** : Synthesize a small polymer molecule and analyze a salt sample.
- CO6** : Estimate iron (by colorimeter), partition coefficient, and adsorption of acetic acid by charcoal, etc.

LIST OF EXPERIMENTS: Choice of 10-12 experiments from the following:

1. Determination of surface tension and viscosity
2. Determination of Hardness of water sample by EDTA Method.
3. Conduct metric estimation of Acid by Base.
4. Conduct metric estimation of mixture of acids by base.
5. Potentiometric Titrations.
6. Synthesis of a polymer/drug.
7. Determination of acid value of an oil
8. Chemical analysis of a salt
9. Determination of Dissolved Oxygen present in the given water sample by Modern Winkler's Method
10. Colorimetric estimation of iron
11. pH metric titrations

12. Determination of the partition coefficient of a substance between two immiscible liquids.
13. Adsorption of acetic acid by charcoal Use of the capillary viscometers to demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg
14. Potentiometric Titration of a Chloride-Iodide Mixture.
15. Determination of Chloride content present in given water sample.
16. Determination of kinematic viscosity of given lubricating oil.

TEXT BOOKS:

1. "Practical Engineering Chemistry" by K.Mukkanti, etal. B.S.Publications, Hyderabad (2011).
2. "Lab Manual on Engineering Chemistry" by Sudharani, DhanpatRai Publications, Co., New Delhi., (2009).

REFERENCE BOOKS:

1. "Engineering Chemistry Lab Manual" by ShuchiTiwari (2010), SCITECH Publications.
2. "Vogel's Text Book of Quantitative Chemical Analysis", 6th Edition by G. J. Jeffery, J. Bassett, J. Mendham, R.C. Denney, Longman Scientific & Technical Publications, New York.
3. "A Text Book of Engineering Chemistry" by R. N. Goyal and H. Goel, Ane Books (P) Ltd.(2009).
4. "A Text Book on experiments and calculations Engineering" by S.S. Dara, S.Chand& Company Ltd. (2003).
5. "Instrumental methods of Chemical Analysis", Gurudeep R, Chatwal Sham, K. Anand, Latest Edition (2015), Himalaya Publications.

CONSTITUTION OF INDIA**Subject Code: 20MCT103**

L	T	P	C
2	0	0	0

COURSE OBJECTIVES:

- To help Students regulate their behavior in a social environment as Engineering Professionals.
- To make students aware of the impact of taking social, legal and Administrative decisions about their profession.
- To understand the political and constitutional parameters in work environment.
- To understand the need and strengths of our nation and adopt their knowledge for future career.

COURSE OUTCOMES:

By the end of this course the student will be able to:

CO 1 : Realize the rigidness of our Indian Politics and Administrative aspects.

CO 2 : A Student can understand our nation federalism.

CO 3 : Can assess different types of risk involved in misadministration.

CO 4 : Can create competitive advantage.

CO 5 : Summarizes the legal and Administrative establishments.

CO 6 : A student can infer financial aspects for betterment of the National Building.

UNIT – I**INTRODUCTION:**

Historical perspective of the constitution of India - Salient features of The Indian Constitution - Amendment Procedure of The Indian Constitution. 42nd amendment (Mini Constitution) - 44th amendment (1978 – Janatha Govt.)

UNIT – II**IMPORTANT FEATURES OF CONSTITUTION:**

Fundamental Rights (Article 12 to 35), Duties (51 A – 1976 emergency) and Directive principles (Article 36 to 51) of State Policy - Articles 14 to 18 - Articles 19 - Article 21

UNIT – III**PARLIMENTARY FORM OF GOVT. IN INDIA:**

President of India - Emergency provisions - National Emergency – Article 352 President Rules – Article 356 - Financial Emergency – Article 360 Prime Minister and Cabinet - Supreme Court of India (Indian Judiciary)

UNIT – IV**INDIAN FEDERALISM:**

Union – State relations; - Legislative , Administrative and Financial relations. Local self Govt. – Constitutional Schemes in India (73 & 74 Constitutional amendments)

UNIT – V

PARLIMENTARY COMMITTEES:

Public Accounts Committee - Estimates Committee - Committee on Public Undertakings. - Election commission of India (Article -324) - Comptroller and Auditor General (CAG) of India (Article – 148 to 150)

UNIT – VI

FINANCE COMMISSION:

Finance Commission (Article – 280) – Neethi Aayog (Planning Commission) and - Political Parties.

TEXT BOOKS:

1. Introduction to Indian Constitution by D.D Basu, Lexis Nexis Butterworth wadhwa Nagapur, 2008.
2. Politics in India by Rajini Kothari, Orient LongMan, 2005.
3. The Indian Constitution by Madhav Khosla by Oxford University Press India, 2012.

DIFFERENTIAL EQUATIONS**Subject Code: 20BST102**

L	T	P	C
2	1	0	3

COURSE OBJECTIVES:

- To solve the first order Ordinary Differential equations and apply to Orthogonal trajectories, Newton's Law of Cooling and Law of Growth (Decay).
- To solve second and higher order ordinary differential equations.
- Derive the Fourier series expansion of one variable functions.
- Understand Taylor's, Maclaurin's series expansion and rules of calculating extreme value of two or more variable functions.
- Learn the methods of solving first order quasi-linear (Lagrange) partial differential equations and first order non-linear partial differential equations.
- Understand the method of solving a linear Partial differential equation with constant coefficients by method of Separation of Variables, solve a one dimensional Wave and a one dimensional Heat equation.

COURSE OUTCOMES:

The student will be able to:

- CO 1 :** Apply the mathematical tool for the solution of Ordinary Differential equations, Orthogonal trajectories, Newton's Law of Cooling and Law of Growth (Decay).
- CO 2 :** Evaluate higher order homogenous and non-homogenous linear differential equations with constant coefficients.
- CO 3 :** Estimate the Fourier series expansion of one variable functions.
- CO 4 :** Estimate the Taylor's, Maclaurin's series expansion of two variable functions and extreme values of two or more variable functions.
- CO 5 :** Evaluate a first order quasi-linear (Lagrange) partial differential equations and first order non-linear partial differential equations.
- CO 6 :** Evaluate a one dimensional Wave and Heat equation.

UNIT-I :**Ordinary differential equations of first order: (8 hrs)**

Linear type - Bernoulli type-Exact type - Equations reducible to exact type- Orthogonal Trajectories-Newton's law of cooling - Law of Growth and Decay.

UNIT-II:**Ordinary differential equations of higher order : (8 hrs)**Higher order homogenous and non-homogenous linear differential equations with constant coefficients- Complimentary Functions-Particular integrals for the functions of type $\sin(ax+b)/\cos(ax+b)$, x^m , e^{ax} , $e^{ax}V(x)$ - Method of variation of parameters, Applications-LCR circuits.**UNIT-III:****Fourier series: (8 hrs)**Fourier Series -Even and odd functions- Fourier series of functions defined in the interval $(0, 2\pi)$, $(-\pi, \pi)$, $(0, 2c)$, $(-c,c)$ - Half range Fourier sine and cosine series.

UNIT-IV: Partial Differentiation(8 hrs)

Functions of two or more variables-Partial differentiation-Total Derivative- Taylor's and Maclaurin's Series (without proof) - Maxima, minima of functions without constraints and functions with constraints (Lagrange method of undetermined multipliers).

UNIT-V: Partial Differential Equations of first order (8 hrs)

Partial differential Equations - Formation of partial differential equations– solutions of first order quasi-linear (Lagrange) partial differential equations and first order non-linear (standard type) partial differential equations.

UNIT-VI: Applications of Partial Differential Equations (8 hrs)

Solution of linear Partial differential equations with constant coefficients – Method of Separation of Variables- One dimensional Wave and Heat equations.

SUGGESTED TEXT BOOKS

1. **B.V.Ramana**, Higher Engineering Mathematics, 44th Edition, Tata McGraw Hill New Delhi, 2014.
 2. **Dr.B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2015.
- Reference Books**
3. **Erwin Kreyszig**, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
 4. **Veerarajan T.**, Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

ENGINEERING PHYSICS

Subject Code : 20BST106

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To Recognize the nature of Oscillation in terms of energy exchange
- To Realize the principles of optics in designing optical devices
- To Comprehend the Principles of Lasers
- To Infer the Principles of Fiber Optics
- To Summarize general principles of crystal and molecular structures
- To Identify Magnetic properties and Superconducting properties

COURSE OUTCOME: Will be able to**CO1** : Resolve the knowledge of Oscillations in terms of energy exchange**CO2** : Apply the principles of optics in designing optical devices**CO3** : Illustrate the Principles of Lasers**CO4** : Outline the Principles of Fibre Optics.**CO5** : Interpret general principles of crystal and molecular structures.**CO6** : Infer Magnetic properties and Superconducting properties**UNIT- I: WAVES & OSCILLATIONS****Damped Oscillations:** Harmonic oscillator; Differential Equation of Wave Motion, Damped Harmonic oscillator; Over-Damped, Critically Damped and Under-Damped Oscillations**Forced Oscillations:** Resonance and Quality Factor**UNIT- II : Wave Optics****Interference** - Introduction, Principle of Superposition of Waves, Interference in Plane Parallel Film due to Reflected Light, Newton's Rings under Reflected Light - Determination of Wavelength of Monochromatic Source of Light.**Diffraction** - Introduction, Differences between Interference and Diffraction, Fraunhofer Diffraction due to Single Slit – Intensity Distribution.**UNIT-III : Lasers****Lasers** - Introduction, Characteristics of Lasers- Coherence, Directionality, Monochromaticity and High Intensity, Principle of Laser – Absorption, Spontaneous and Stimulated Emission, Einstein Coefficients (Qualitative), Population Inversion, Optical Resonator and Lasing Action, Ruby Laser [Three Level System], Helium-Neon Laser [Four Level System], Applications of Lasers in Industry, Scientific and Medical Fields.**UNIT-IV : Fiber Optics****Fiber Optics** - Introduction, Optical Fiber Construction, Principle of Optical Fiber – Total Internal Reflection, Conditions for Light to Propagate - Numerical Aperture and Acceptance Angle, Differences between Step Index Fibers and Graded Index Fibers, Differences between Single Mode Fibers and Multimode Fibers, Applications of Optical Fibers in Communication

UNIT-V : Introduction to Solid State Physics

Crystal Structure - Introduction, Basic Terms – Lattice, Basis, Crystal Structure, Coordination Number, Atomic Radius, Packing Fraction, Free Volume, Lattice Parameters, Unit Cell and Primitive Cell, Crystal Systems and Bravais Lattices, Structure and Packing Fractions of Simple Cubic, Body Centered Cubic and Face Centered Cubic Crystal Structures.

UNIT-VI : Materials Science

Magnetic Materials: Types of Magnetic Materials (Dia, Para, Ferro, Ferri&Antiferro), Hysteresis, Weiss Theory of Ferromagnetism, Soft and Hard Magnetic Materials.

Superconductivity: Introduction, Meissner Effect, Type-I & Type-II Superconductors, Applications

Texts

1. A Textbook of Engineering Physics, [M N Avadhanulu](#) & [P G Kshirsagar](#), S.Chand Publishers
2. Fundamentals of Physics by Resnick, Halliday and Walker

References

1. University Physics by Young and Freedman
2. Solid State Physics by S. O. Pillai, New Age International Publishers
3. Engineering Physics, Volume-I&II, P.K.PalaniSwamy, Scitech Publications Hyderabad
4. Engineering Physics Volume I&II Dr.K.Vijaykumar, S.Chand Publishing Company, New Delhi
5. Engineering Physics Dr. S. Mani Naidu, Pearson Publications Chennai

THERMODYNAMICS

Subject Code: 20MET101

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To identify and formulate elementary level engineering problems related to thermodynamics and energy transformation in a conceptual form as well as in terms of mathematical and physical models.
- To apply the basic principles of classical thermodynamics to the analysis of processes and cycles involving pure simple substances.
- To effectively generalize the basic axioms of classical, macroscopic thermodynamic analysis and to extrapolate these concepts to systems and substances not necessarily covered in the course.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1 : Apply basic concepts, zeroth law and first law to thermodynamic processes

CO 2 : Apply steady flow energy equation to flow systems, First law to Non-flow thermodynamic processes

CO 3 : Apply Second law of Thermodynamics to Estimate the efficiency of Heat engine and COP of Heat pump. Determine increase of entropy in system due to any thermodynamic process.

CO 4 : Calculate available and unavailable energies for steady flow process and Non-flow process

CO 5 : Determine energy transferred using equations and Mollier charts for pure substances.

Determine properties of mixtures from the properties of its constituents and composition.

CO 6 : Derive thermal efficiency and mean effective pressures for various thermodynamic cycles and compare their performances.

UNIT-I

Terminology & Laws: System - Types, Boundary, Surroundings, Control volume. Macroscopic and microscopic viewpoints, Concept of continuum. Zeroth Law of TD -Thermodynamic equilibrium, State, Property – Extensive and Intensive, Process, Cycle - Reversible and Irreversible, Work, Heat.

First Law: First Law of TD -Internal Energy, Joule's Experiments, PMM-I.

UNIT-II

First Law Applied to Non-Flow Processes: Corollaries, First law applied to various non-flow processes – Change in Internal Energy – Systems undergoing process and cycle – Free expansion.

First Law Applied to Flow Systems: Steady Flow Energy Equation – Turbine, Nozzle and Heat Exchanger, Limitations of First law.

UNIT-III

Second Law: Kelvin Plank statement -Heat Engines, Clausius statement - Heat Pump, Their equivalence, PMM-II, Carnot Cycle – Carnot Efficiency

Entropy: Clausius Theorem –Clausius Inequality, Concept of entropy- Principle of increase of entropy, Third Law – Zero Entropy, Disorderliness

UNIT-IV

Available Energy: AE Referred to cycle – Decrease in AE when heat transfer through Finite Temperature Difference, AE from Finite Energy Source. Maximum work in Reversible Process.

Availability: Steady flow process, Non-flow Process.

UNIT-V

Pure Substances: Introduction, P-V-T surfaces, T-S diagrams, Mollier charts, Property Tables, Phase Transformations – Quality or Dryness fraction.

Gas Laws and TD relations: Avogadro's Law, Ideal gas – Equation of state, Universal gas constant, Difference in Heat Capacities, Ratio of Heat Capacities. Maxwell's Equations, Various Thermodynamic Processes

UNIT-VI

Thermodynamic Cycles: Otto, Diesel, Dual Combustion – Description, P–V and T-S diagram, Thermal efficiency, Comparison, Mean effective pressure

TEXT BOOKS:

1. Engineering Thermodynamics, P.K. Nag, Tata McGraw-Hill Publications.
2. Thermodynamics: An Engineering Approach, Michael A. Boles and Yungus A. Cengel, Tata McGraw-Hill Publications.
3. Thermal Engineering, R.K. Rajput, S.Chand Publications.
4. Steam Tables & Mollier Charts. (**Permitted for Exam**)

REFERENCES BOOKS:

1. Thermal Engineering, P.L. Ballaney, Khanna Publications,
2. Thermal Engineering, M.L.Mathur, F.S.Mehta, Jain Brothers Publications,
3. Introduction to Thermodynamics, J.B.Jones, G.A.Hawkins, John Wiley Publications,
4. Fundamentals of Thermodynamics, Gordon John Van Wylen, Richard Edwin Sonntag, John Wiley Publications,

BASIC ELECTRICAL ENGINEERING**Subject Code: 20EST101**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the basic knowledge of electric circuits
- To illustrate knowledge with network reduction techniques.
- To analyze AC circuits.
- To provide knowledge on Magnetic circuits.
- To become familiar with DC Generator.
- To understand the concept of DC Motor.

COURSE OUTCOMES:**CO1 :** Able to summarize different electrical circuits.**CO2 :** Able to construct network reduction techniques.**CO3 :** Able to outline the basics of AC circuits.**CO4 :** Able to state magnetic circuits.**CO5 :** Able to examine DC Generator.**CO6 :** Able to explain DC Motor.**UNIT –I Introduction to Electric Circuits**

Basic definitions, Electrical circuit elements (R, L and C), Voltage and current sources Independent and dependent sources, Ohm's Law, Series & Parallel circuits, Source transformation, Kirchoff's Laws, , simple problems.

UNIT-II Network Reduction Techniques

Star-Delta transformation, Nodal Analysis, Super node, Mesh analysis, super mesh-Problems.

UNIT-III AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series only), real power, reactive power, apparent power, power factor, simple problems.

UNIT-IV Magnetic circuits

Basic definitions of magnetic flux, flux density, Reluctance, Magneto motive force (m.m.f), magnetic field intensity, magnetic permeability and susceptibility. Comparison between magnetic and electrical circuits, inductively coupled circuits, coefficient of coupling, dot convention, simple problems on magnetic circuits.

UNIT-V DC Generator

Generator-Principle of Operation, Construction, EMF equation, Classification, O.C.C, internal and external characteristics of shunt generator, Applications.

UNIT-VI DC Motor

Motor-principle of operation, Torque equation, Classification Speed Control Methods, Operation of 3 point starter, Applications.

TEXT BOOKS

1. Principles of Electrical and Electronics Engineering by V.K.Mehta, S.Chand& Co.
2. Introduction to Electrical Engineering – M.S Naidu and S. Kamakshaiah, TMH Publ.

REFERENCE BOOKS .

1. Basic Electrical Engineering Dr.K.B.MadhuSahuscitech publications (india) pvt.ltd.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
3. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill,2010.

WORKSHOP AND MANUFACTURING PRACTICE
(Common for all Branches – Semester I / II)

Subject Code: 20ESL102

L	T	P	C
1	0	4	3

COURSE OBJECTIVES:

- The Engineering Workshop Practice for engineers is a training lab course spread over entire semester. The modules include training on different trades like Fitting, Carpentry, Black smithy etc... which makes the students to learn how various joints are made using wood and other metal pieces.

COURSE OUTCOMES:

On completion of this course, students should be able to:

- CO 1 :** Make half-lap, mortise & tenon, corner dovetail or bridle wooden joints.
CO 2 : Develop sheet metal into objects like square tray, taper side tray.
CO 3 : Develop sheet metal into conical funnel or elbow pipe.
CO 4 : Forge MS rod from round to square cross-section, or into L- or S- bend.
CO 5 : Fabricate MS pieces into either a straight, square, dovetail or V-fit.
CO 6 : Connect a staircase or a tube light house-wiring electrical circuit.

I. Wood Working Technology - Familiarity with different types of wood and tools used in wood Working technology.

Tasks to be performed:

- 1) Half – Lap joint
- 2) Mortise and Tenon joint
- 3) Corner Dovetail joint
- 4) Bridle joint.

II. Sheet Metal Working – Familiarity with different types of tools used in sheet metal working, developments of sheet metal jobs from GI sheets, knowledge of basic concepts of soldering.

Tasks to be performed:

- 1) Square Tray
- 2) Taper side Tray
- 3) Conical Funnel
- 4) Elbow Pipe.

III. Forging Technology – Familiarity with different types of tools used in forging technology. Knowledge of different types of furnaces like coal fired, electrical furnaces etc...

Tasks to be performed:

- 1) round M.S rod to square bar
- 2) L bend in given M.S. Rod.
- 3) S bend in given M.S. Rod.
- 4) heat treatment tests like annealing, normalizing etc...

IV. Fitting Technology – Familiarity with different types of tools used in fitting technology.

Tasks to be performed:

- 1) “V” – fitting
- 2) square fitting
- 3) Dovetail fitting
- 4) Straight fitting

V. HOUSE WIRING

- 1) Tube light connection
- 2) Staircase connection

Note: Any two jobs from each trade must be performed by the student.

PHYSICS LAB**Subject Code : 20BSL101**

L	T	P	C
0	0	3	1.5

COURSE DESCRIPTION:

This Laboratory course is intended to apply the scientific method to expedite experiments that include

- Error analysis
- Waves Fundamentals
- Mechanics
- Physical Optics
- Lasers and Fibre Optics
- Semiconductor devices

So that student can verify theoretical ideas and concepts covered in lecture through host of analytical techniques, statistical analysis and graphical analysis.

COURSE OBJECTIVES:

- To Operate Sensitive Instruments for precision measurements
- To Identify Error for targeted accuracy
- To Interpret the results of mechanical parameters such as modulus of elasticity and acceleration due to gravity through simple oscillatory experiments using torsional pendulum or physical pendulum
- To determine relevant parameters associated with Interference and Diffraction phenomena using Travelling Microscope and Spectrometer.
- To Exhibit Techniques and Skills associated with Modern Engineering Tools such as Lasers and Fiber Optics
- To characterize semiconducting material devices.

COURSE OUTCOMES: Will be able to

CO 1 : Demonstrate the ability for precision measurements to design instrumentation

CO 2 : Estimate the Error for targeted accuracy

CO 3 : Infer the results of mechanical parameters such as modulus of elasticity and acceleration due to gravity through simple oscillatory experiments using torsional pendulum or physical pendulum

CO 4: Apply the knowledge of Optics to calculate geometrical parameters of thickness of thin object and radius of curvature of a lens

CO 5: Illustrate techniques and skills associated with Modern Engineering Tools such as Lasers and Fiber Optics

CO 6: Evaluate characteristics of semiconducting material devices

LIST OF EXPERIMENTS

1. Precision Measurements and Instruments
2. Error Analysis and Graph Drawing
3. Determination of Rigidity Modulus of the Material of Wire using Tensional Pendulum
4. Determination of Acceleration due to Gravity (g) using Compound Pendulum
5. Newton's Rings – Determination of the Radius of Curvature of a given Plano Convex Lens
6. Determination of Thickness of Thin Object using Wedge Method
7. Verify the characteristic curve of NTC Thermistor.
8. Determination of width of a single slit using LASER
9. Determination of Numerical Aperture and Bending Loss of an Optical Fiber
10. Determination of Energy Band Gap using the given Semiconductor

MANUAL / RECORD BOOK

1. Manual cum Record for Engineering Physics Lab, by Prof. M. Rama Rao, Acme Learning.
2. Lab Manual of Engineering Physics by Dr.Y. Aparnaand Dr. K. VenkateswaraRao
(VGS booklinks, Vijayawada)

BASIC ELECTRICAL ENGINEERING LAB**Subject Code : 20ESL101**

L	T	P	C
0	0	3	1.5

Course Objective:

To introduce the student to study different electrical components and to verify the basic laws related to electrical engineering, Speed control of D.C. motor, testing of transformer, electrical wiring system through study, practice, and experiments.

Course Outcomes:

Students will be able to

CO1 : Label various types of electrical components.

CO2 : Demonstrate various basic electrical laws.

CO3 : Demonstrate speed control DC motor

CO4 : Demonstrate speed control Characteristics of generator.

CO5 : Experiment with lamps.

CO6 : Examine electrical wiring system.

List of Experiments:

1. Study of electrical components.
2. To verify Ohm's law.
3. To verify (a) Kirchhoff's current law (b) Kirchhoff's voltage law.
4. To verify the total resistance of the series and parallel connected circuits.
5. Find armature resistance, field resistance and filament Lamp Resistance using V-I method.
6. Magnetization characteristics of DC shunt generator.
7. Speed control of D.C. Shunt motor by a) Armature Voltage control b) Field flux control method
8. Fluorescent tube connection.
9. (a) One way control of lamp
(b) Two way control of lamp
10. Fan wiring.

Additional Experiments:

11. Soldering and bread board precautions.
12. To find voltage current relationship for series RL circuit and determine power factor.

COMPUTER AIDED DRAFTING LAB**Subject Code: 20MEL101**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To understand the fundamentals of computer aided design and drafting
- To generate of basic lines and profiles in computer graphics.
- To modify the drawing in drafting software.
- To generate orthographic views from the given isometric view.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1 : Create 2D drawing using basic drawing commends.

CO 2 : Create 2D drawings with dimensions using advanced drawing and editing commends.

CO 3 : Apply constraints, hatching to created 2D drawings.

CO 4 : Use layers concepts for created Auto CAD drawings.

CO 5 : Use Plot Control Commands for created Auto CAD drawings.

CO 6 : Generate orthographic views from isometric views in drafting software.

List of experiments on the following topics :

1. 2D Drawing and editing commands in Auto CAD.
2. Constraints - Tangency, parallelism, Inclination and perpendicularity.
3. Dimensioning, limits, fits, applying tolerances and Basic Principles of GD&T (Geometric Dimensioning & Tolerancing).
4. Laer concepts, plot control commands, Hatching & drawing detailing.
5. Generate orthographic views from a given isometric view.

The above concepts are to be conducted in any drafting software like Auto CAD etc.

At least Ten exercises are to be completed.

ENVIRONMENTAL SCIENCE

Subject Code: 20MCT202

L	T	P	C
2	0	0	0

COURSE OBJECTIVES:

- Memorize the knowledge of environment and status of different resources on earth.
- Identify the significance, arrangement, causes of annihilation and conservation of ecosystems and biodiversity..
- Identify the significance, types and conservation of biodiversity.
- Discriminate causes, effects of a variety of pollutions and suitable control methods.
- Identify the hurdles of sustainable development; evaluate the different environmental management and legal issues.
- Describe the population growths, health problems and evaluate the environmental assets.

COURSE OUTCOMES:

By Studying this Course Student will

CO 1 : Recognize and speaks well again on the general issues of environment and know how to conserve resources for better usage.

CO 2 : Explain and demonstrate the ecosystems setup, assess.

CO 3 : Recognize and conserving of diversity to upkeep.

CO 4 : Examine a range of pollution problems along with control and their eco-friendly disposal methods.

CO 5 : Translate the sustainable development practice through clean development mechanisms.

CO 6 : Evaluate the changing trends of world population and compile the information in order to document the environmental assets.

UNIT – I (6 lectures)

Importance of Environmental Studies and Natural Resources: Definition of Environment – Importance - Need for Public Awareness

Forest Resources - Use and over exploitation - deforestation – consequences – case study

Water Resources - Use and over utilization - dams - benefits and problems on Tribes and Environment

Food Resources – Food security concept - changes caused by agriculture and overgrazing - effects of modern agriculture – fertilizer - pesticide problems - water logging - salinity – concept of sustainable agricultural methods - case study

Energy Resources - Non-renewable energy resources – coal – crude oil - natural gas - use of renewable and alternate energy sources

UNIT – II (3 lectures)

Ecosystems: Definition – Structure of ecosystem: producers - consumers – decomposers.

Functions of ecosystem: Food chains - food webs - ecological pyramids - Energy flow – Nutrient cycles (Carbon cycle and Nitrogen cycle). Ecological succession

UNIT-III (3 lectures)

Biodiversity and its conservation: Definition of Biodiversity - Values of biodiversity - Biogeographical

classification of India - Hot Spots of India - Endangered and endemic species of India –Threats to biodiversity - Conservation of biodiversity

UNIT – IV (6 lectures)

Environmental Pollution: Definition – causes - effects - control measures of Air pollution - Water pollution - Noise pollution – Marine Pollution - Nuclear hazards.

Solid waste Management: Causes - effects - disposal methods of urban waste – biomedical wastes - case studies

Disaster management: floods – earthquakes – cyclones

UNIT – V (6 lectures)

Social Issues and the Environment: Concept of Unsustainable and Sustainable development – Water conservation: Rain water harvesting- Watershed management – Global environmental challenges: climate change - global warming – acid rains - ozone layer depletion -World summits on environment: Stockholm conference – Rio-earth summit – Kyoto protocol – Environment (Protection) Act - Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act - Wildlife (Protection) Act -Forest (Conservation) Act

UNIT – VI (4 lectures)

Human Population and the Environment: Population growth patterns - variation among nations - Population problems - control -Environment and human health - Role of information Technology in Environment and human health

TEXT BOOKS:

1. Shashi Chawla. 2015, *A Text book of Environmental Studies*, Revised edition, TMH, New Delhi
2. Bharucha, E. 2005, *Text book of Environmental Studies*, First edition, Universities Press (India) Pvt. Ltd., Hyderabad
3. Suresh K. Dhameja. 2006-07, *Environmental Studies*, Third revised edition, S.K. Kataria & Sons (P) Ltd., New Delhi
4. Benny Joseph. 2015, *Environmental Studies*, Revised edition, TMH, New Delhi

REFERENCE BOOKS:

1. Odum, E.P, *Fundamentals of Ecology*, Third edition, W.B. Saunders & Co (P) Ltd., Philadelphia.
2. P. D. Sharma, *Ecology and Environment*, Revised edition, Rastogi Publications (P) Ltd.
3. Cunningham, W.P., Cunningham, M.A., *Principles of Environmental Science*, TMH, New Delhi.
4. Peavy, Rowe and Tchobanoglous, *Environmental Engineering*, Mc Graw – Hill Internationaledition.
5. Graedel, T.E., Allenby, B.R., *Industrial Ecology and Sustainable Engineering*, Pearson Publications.

COMPLEX VARIABLES AND STATISTICAL METHODS

Subject Code: 20BST203

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- Test if a function is analytic, harmonic and then construct a harmonic conjugate function.
- Evaluate integrals using the Cauchy Integral theorem.
- Identify singular points of a function then calculate residues using Residue Theorem.
- Understand the concepts of discrete and continuous distributions.
- Understand the concept of sampling theory.
- Analyze the testing of hypothesis by t-test, z-test, Chi-square test.

COURSE OUTCOMES:

On completion of this course, students will be able to

CO 1 : Construct a harmonic and conjugate harmonic function.

CO 2 : Evaluate integrals using the Cauchy Integral formulae.

CO 3 : Identify singular points of a function then calculate residues using Residue Theorem.

CO 4 : Obtain probability of random variable.

CO 5 : Execute Central limit theorem for Sampling Distributions.

CO 6 : Perform the large and small sample tests.

UNIT-I

Complex Functions : Functions of a complex variable- analyticity and its properties -Cauchy-Riemann equations in Cartesian and polar coordinates (without proof). Harmonic and conjugate harmonic functions-Milne-Thompson method.

UNIT-II

Complex Integral : Cauchy's integral theorem (without proof)-Cauchy's integral formula (without proof)-Generalized Cauchy's integral formula (without proof).

UNIT-III

Residues : Singular point –types of singularities- isolated, essential, removable –Pole of order m. Residue –Evaluation of residues – Residue theorem (without proof) and its applications.

UNIT-IV

Random Variables and Distributions : Discrete and Continuous Random Variables –Properties. Distributions- Binomial – Poisson's -Normal distribution.

UNIT-V

Sampling Theory : Introduction to Sampling Theory -Population and Samples –Sampling distribution of means (σ known and σ unknown)- Central limit theorem- point estimation – Maximum error estimation-Interval estimation.

UNIT-VI

Tests of Hypothesis : Hypothesis-null and alternative hypothesis – type-I and type-II error –level of significance –one tail and two tail test, z-test, Student's-t-test, F-test, Chi-square test.

TEXT BOOKS:

1. Complex Analysis And Statistical Methods, Dr.B.Krishna Gandhi, Dr.T.K.V.Iyengar and S.Ranganatham and Dr.M.V.S.S.N.Prasad, S.Chand & Company.
2. Probability and Statistics for Engineers, Miller and Freund's, Prentice Hall of India.
3. Higher Engineering Mathematics, B.S.Grewal, Khanna Publishers.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics, Irvin Kreyszig, Wiley India Pvt. Ltd.
2. Probability and Statistics, Athanasios Papoulis, Pearson education.

ENGINEERING MECHANICS

Subject Code: 20EST203

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To develop an understanding of the principles of statics and the ability to analyze problems using static equilibrium equations.
- To introduce the basic principles of mechanics applicable to rigid bodies in equilibrium.
- To develop the fundamentals of engineering mechanics and problem solving skills essential for mechanical engineering
- To teach the basic principles of mechanics applicable to the motion of particles and rigid bodies.

COURSE OUTCOMES:

- CO 1 :** Determine the resultant of a planar force system using resolution of force and principle of moments.
- CO 2 :** Draw free-body diagrams of given rigid bodies and compute unknown forces using equations of equilibrium of a planar force system by graphical and analytical methods.
- CO 3 :** Comprehend the effect of friction on equilibrium of rigid bodies. Analyze the plane trusses by calculating axial forces in the members using method of joints.
- CO 4 :** Calculate centroid and moment of inertia of plane figures of triangular, rectangular and circular cross sections.
- CO 5 :** Predict the motion parameters of bodies under rectilinear, curve linear and general plane motion.
- CO 6 :** Solve the problems involving dynamics of particles and rigid bodies

UNIT- I

System of forces: Fundamental concepts and principles of engineering mechanics – Laws of mechanics – Forces and components - Resultant of coplanar concurrent forces - Vector approach on addition, subtraction of forces.

Equilibrium of force systems: Equilibrium – Free body diagrams – Equations of equilibrium – Equilibrium of planar systems – Graphical methods and analytical methods for equilibrium of planar systems - Equilibrium of rigid bodies - Principle of transmissibility

UNIT-II

Moment of a force: Introduction – Principle of moments – Equivalent system of forces – Reduction of system of forces into single force and couple - Resultant of planar force systems.

Moment Applications: Varignon's theorem – Moment of a force and its applications.

UNIT- III

Analysis of Trusses: Types of loads – Types of supports and their reactions – Analysis of plane trusses using method of joints.

Friction: Introduction – Limiting friction – Types of friction and laws of friction – Application of friction - Inclined plane – Ladder, wedge and screw friction.

UNIT- IV

Centroid and Centre of gravity: Centroid of lines and areas – Determination of centroid of regular laminas by integration method – Centroid of composite figures – Theorems of Pappus and Guldinus – Concept of center of gravity.

Area moment of inertia: Determination of moment of inertia of area by integration – Moment of Inertia by analytical method – Radius of gyration – Parallel and perpendicular axis theorems – Polar moment of inertia – Concept of mass moment of inertia

UNIT- V

Kinematics: Rectilinear motion – Curvilinear motion – Rectangular components of curvilinear motion - Normal and Tangential components of acceleration.

Kinematics of rigid bodies: Angular motion – fixed axis rotation – Analysis of plane motion.

UNIT- VI

Kinetics: Kinetics of rigid bodies – Fixed axis rotation – rolling bodies - General plane motion – Equilibrium of rigid bodies in plane motion – D'Alembert's Principle- Work Energy Principle- for rigid bodies in plane motion

TEXT BOOKS:

1. Engineering Mechanics, S.S. Bhavikatti, J.G. Rajasekharappa, New Age Publications,
2. Engineering Mechanics, A.K. Tayal, Umesh Publications, 13th Edition, 2008.
3. Ferdinand L. Singer: Engineering Mechanics, Harper Collins Publishers India, 3rd Edition, 2008.

REFERENCES BOOKS:

1. Irving. H. Shames: Engineering Mechanics, PHI Publishers, 4th Edition, 2008.
2. Ferdinand P. Beer, E. Russell Johnston (2010), Vector Mechanics for Engineers: Statics and Dynamics (9th Edition), Tata McGraw-Hill International Edition.
3. Russell C Hibbeler, (2009), Engineering Mechanics: Statics and Dynamics (12th Edition), Prentice Hall
4. K.L. Kumar, Engineering Mechanics, TMH Publishers, 3rd Edition, 2009.
5. Engineering Mechanics by S. Timoshenko and D.H. Young, McGraw-Hill.

MATERIALS ENGINEERING

Subject Code: 20MET202

L	T	P	C
2	1	0	3

COURSE OBJECTIVES:

- To understand different engineering materials and their structures.
- To understand the phase diagrams.
- To understand the powder metallurgy processes.
- To understand various heat treatment processes.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1 : Gain thorough knowledge in engineering materials and their structures.

CO 2 : Understand necessity of alloying and effect of alloying element on properties of materials.
Understand thoroughly Iron carbon equilibrium diagram.

CO 3 : Describe different types of cast irons and steels.

CO 4 : Gain knowledge of heat treatment processes of steel material

CO 5 : Understand necessity of making components using powder metallurgy route also study classification of aluminium and Titanium

CO 6 : To acquire knowledge on material testing methods and its process

UNIT-I

Structure of Metals: Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys.

UNIT-II

Constitution of Alloys: Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

Phase Diagrams : Experimental methods of construction of equilibrium phase diagrams, Isomorphous alloy systems, Lever rule, Study of Iron and Iron carbide phase diagram.

UNIT-III

Cast Irons and Steels: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, tool and die steels.

UNIT-IV

Heat treatment of steels: Stages of heat treatment and cooling methods. Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability, surface - hardening methods, hot working, cold working of steels

UNIT-V

Powder Metallurgy: Definition, Methods of production of metal powders, Stages in powder metallurgical components preparation, Design considerations.

Aluminum and Titanium: Classifications, Structure and properties.

UNIT-VI

Mechanical Properties and Testing: Types of properties, Hardness Testing: -Rockwell, Brinell and Vickers, Toughness Testing: Charpy V-Notch, Izod tests, creep, fatigue tests.

TEXT BOOKS:

1. Introduction to Physical Metallurgy / Sidney H. Avener.
2. Elements of Material science / V. Rahghavan

REFERENCE BOOKS:

1. An introduction to Metallurgy , sir Alan Cottrell , second edition universities press (India) private limited
2. Engineering materials and metallurgy/R.K.Rajput/ S.Chand.
3. Science of Engineering Materials / Agarwal

FLUID MECHANICS

Subject Code: 20MET203

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide knowledge on different fluid properties and fluid flow.
- To study hydrostatic forces and center of pressure on submerged plane and curved surfaces.
- To study concepts of fluid flows and apply equation of continuity, flow net analysis.
- To study the concepts of closed conduit flow.
- To study various methods of dimensional analysis and outline the similarities between model and prototype.
- To Study the boundary layer theory.

COURSE OUTCOMES:

On completion of this course, students should be able to

- CO 1 :** Define various physical properties of fluids, and understand how manometers are used to measure fluid pressure. List various flow classifications.
- CO 2 :** Compute hydrostatic forces and center of pressure on submerged plane and curved surfaces.
- CO 3 :** Derive and solve problems based on continuity equation. Apply Euler, Bernoulli, Navier-Stokes, Impulse- momentum equations to solve practical fluid flow problems.
- CO 4 :** Compute losses in fluid flow using Darcy Weisbach equation. Explain and solve problems based on various flow measurement devices.
- CO 5 :** Gain knowledge about dimensional analysis.
- CO 6 :** Understand and solve the boundary layer problems.

UNIT-I

Introduction: Physical properties of fluids: Specific mass, Specific weight, Specific Volume – Specific gravity, Viscosity, Surface tension & Capillarity, Vapour pressure and Compressibility – Pressure: Pascal’s law, Hydrostatic law, Atmospheric, Gauge and Vacuum pressure

Measurement of pressure: Pressure gauges – Manometers: Simple & Differential manometers.

UNIT-II

Fluid Statics: Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Center of Pressure.

Derivations and Problems Buoyancy & Flotation, Meta Center, Meta centric height.

UNIT-III

Fluid Kinematics: Description of fluid flow: Path line, Stream line, Streak line, Stream tube, Velocity & Acceleration – Classification of fluid flows: Steady & Unsteady, Uniform & Nonuniform, Rotational & Irrational flows, Continuity equation for 1D, 2D and 3D flows, Stream function, Velocity potential function

Fluid dynamics: Surface and Body forces – Euler’s and Bernoulli’s equations for flow along a stream line for 3D flow – Navier-Stokes equations (Explanation only) – Momentum equation and its applications: Force on pipe bend.

UNIT-IV

Measurement of flow: Pitot tube, Venturimeter and Orifice meter,

Flow through pipes: Darcy Weisbach equation – Minor losses in pipes: Pipes in series and pipes in parallel – Total energy line and Hydraulic gradient line

UNIT-V

Integral analysis: Control volume analysis for mass, momentum and energy.

Dimensional Analysis: Introduction, Dimensions, Dimensional Homogeneity, Methods of dimensional analysis – Rayleigh's method, Buckingham's π –method.

UNIT-VI

Boundary layer – definition- boundary layer on a flat plate – laminar and turbulent boundary layer displacement, energy and momentum thickness – Momentum integral equation-Boundary layer separation and control – drag on flat plate.

TEXT BOOKS:

1. Hydraulics, Fluid Mechanics and Hydraulic Machinery, P.N. Modi, S.M. Seth, Standard Book House Publications,
2. Fluid Mechanics Frank M. White, McGraw Hill Publications.
3. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Publications.

REFERENCE BOOKS:

1. Fluid Mechanics and Hydraulic Machines, R.K. Rajput, S. Chand Publications
2. Fluid Mechanics and Fluid Power Engineering, D.S. Kumar, S.K. Kotaria & Sons Publications,
3. Fluid Mechanics and Machinery, D. Rama Durgaiah, New Age Publications,
4. Hydraulic Machines, T.R. Banga, S.C. Sharma, Khanna Publications,
5. Instrumentation for Engineering Measurements, James W. Dally, William E. Riley, John

APPLIED THERMO FLUIDS - I

Subject Code: 20MET204

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To learn the working, and estimate the performance of different IC engines.
- To provide basic knowledge on hydraulic turbines and pumps.
- To learn about working and operation of different air compressors.

COURSE OUTCOMES

On completion of this course, students should be able to

CO 1 : Understand construction, working and mechanism of 2-stroke and 4-stroke IC engines.

CO 2 : Calculate engine performance using various parameters and heat balance sheet.

CO 3 : Describe combustion processes occurring in SI and CI engines.

CO 4 : Illustrate mechanism and construction of various Hydraulic Turbines viz., Pelton wheel, Kaplan and Francis.

CO 5 : Estimate the discharge and head loss in centrifugal pumps.

CO 6 : Explain operating and working principles of rotary and reciprocating compressors.

UNIT-I

IC Engines: Introduction, Working of 2-stroke and 4-stroke Engine, SI engines and CI engines, Comparison between SI and CI engines, Comparison between 2-stroke and 4-stroke engines; Classification – based on Cycle of Operation, Type of Fuel Used, Method of Charging, Type of Ignition, Type of Cooling, Cylinder Arrangements.

UNIT-II

Fuels: Introduction to Solid, Liquid and Gaseous fuels, Fuel rating – Octane and Cetane numbers, Flash point, Fire point, Calorific value, Stoichiometric air-fuel ratio.

IC Engine Performance: Performance Parameters – Indicated power, Brake power, frictional power, Mechanical, Relative, Thermal - Indicated & Brake, and Volumetric Efficiency, Mean Effective Pressure, Mean Piston Speed, Specific Fuel Consumption, Air-Fuel Ratio (A/F) – Numerical solving.

UNIT-III

Spark Ignition Engines: Combustion, Flame front, Flame propagation, Flame speed, Effect of turbulence and other parameters on flame speed, Stages of combustion, Normal and abnormal combustion - Knocking; Effect of variables on knock.

Compression Ignition Engines: Combustion, Stages of combustion, variables affecting delay period, Ignition delay - Diesel knock.

UNIT-IV

Impact of jet on vanes: Inclined & Curved vanes (Stationary & Movable), Impact of jet on series of curved vanes

Hydraulic Turbines: Classification of turbines - Pelton Turbine, Francis turbine and Kaplan turbine – Working, work done, efficiencies, hydraulic design.

UNIT-V

Centrifugal Pumps: Classification, Working, and work done, Manometric head, Losses and Efficiencies, Specific speed, Pumps in series and parallel, Characteristic curves, Net Positive Suction Head (NPSH).

UNIT-VI

Reciprocating Compressors: Principle of operation, Work required, Isothermal efficiency, Volumetric efficiency, Optimal pressure ratio, Staging, Effect of Intercooling.

Reciprocating pumps: Working, Discharge, Slip and indicator diagrams.

TEXT BOOKS

1. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Publications
2. Internal Combustion Engines, V. Ganesan, Tata McGraw Hill Publications
3. Thermal Engineering, R.K. Rajput, Laxmi Publications

REFERENCES BOOKS

1. Hydraulic Machines, T.R. Banga, S.C. Sharma, Khanna Publications
2. Fluid Mechanics and Hydraulic Machines, R.K. Rajput, S. Chand Publications
3. A Course in Thermal Engineering, S.C. Arora, S. Domkundwar, Dhanpat Rai Publications

FLUID MECHANICS AND HYDRAULIC MACHINES LAB**Subject Code: 20MEL202**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To give the practical exposure about fundamentals of fluid mechanics and hydraulics.
- To provide practical knowledge about the turbo-machinery.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1 : Conduct impact of jet on vanes, and performance test on Pelton wheel.

CO 2 : Conduct performance tests on Francis turbine and Kaplan turbine.

CO 3 : Conduct performance tests on single-stage and multi-stage centrifugal pump and reciprocating pump.

CO 4 : Calibrate Venturimeter and orifice meter.

CO 5 : Determine head loss and friction factor for a given pipeline.

CO 6 : Calibrate Turbine Flow Meter.

List of Experiments

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Impact of Jet on Vanes
4. Calibration of Turbine flow meter
5. Determination of Friction factor for give closed conduit
6. Effect of minor losses in closed conduit flow
7. Performance test on Single-stage Centrifugal pump
8. Performance test on Multit-stage Centrifugal pump
9. Performance test on Reciprocating pump
10. Performance test on Pelton wheel
11. Performance test on Francis turbine

Note: conduct any 10 experiments from the given list.

THERMAL ENGINEERING LAB

Subject Code: 20MEL203

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To gain knowledge on the testing and performance of different IC engines.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1 : Measure and draw valve and port timing diagrams on IC engines.

CO 2 : Determine engine frictional power by motoring, retardation and Morse tests.

CO 3 : Conduct economical speed test and heat balance test on an engine.

CO 4 : Conduct performance tests on 4-stroke diesel, 2-stroke petrol engines.

CO 5 : Conduct performance test on multi-stage reciprocating air compressor.

CO 6 : Study various types of boilers with its mountings and accessories.

LIST OF EXPERIMENTS:

1. Valve Timing Diagram (single cylinder 4 stroke diesel engine)
2. Port Timing Diagram (single cylinder 2 stroke petrol engine)
3. Determination of Frictional Power by Retardation Test.
4. Determination of Frictional Power by Motoring Test.
5. Determination of Frictional Power by Morse Test.
6. Economical Speed Test.
7. Heat-Balance Sheet.
8. Performance Test on a 4-Stroke Diesel Engine.
9. Performance Test on a 2-Stroke Petrol Engine.
10. Demonstration of mechanical & volumetric efficiency of reciprocating compressor.
11. Demonstration of Disassembly / Assembly of Engines.

Note: Any 10 of the above experiments are to be conducted.

METALLURGY AND MATERIALS LAB**Subject Code: 20MEL204**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To provide knowledge on mechanical behaviour of materials.
- To acquaint with the experimental methods to determine the mechanical properties of materials.
- To understand metallographic structures.
- To understand different material testing techniques.
- To find treated and untreated steel hardness of given specimens.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1 : Determine metallographic structure for pure metals, cast irons, mild steels, alloys.

CO 2 : Interpret effect of heat treatment on hardness of steels measured using Jominy End Quench Test.

CO 3 : Summarize the crystal structure for SC, BCC, FCC and HCP.

CO 4 : Analyze and determine the grain size, grain shape and orientation of grain boundaries using image analyzer.

CO 5 : Determined the effect of ageing behaviour of the materials.

CO 6 : Prepare fibre reinforced composites via hand-layup method and learnt significance of composites.

LIST OF EXPERIMENTS:

1. Study of Crystal Structures through Ball Models
2. Metallurgical Microscope: Principles and Operations
3. Specimen Preparation For Metallographic Analysis
4. Preparation of any one specimen and metallographic observation of pure metals copper and aluminum.
5. Preparation of any one specimen and metallographic observation of white cast iron, grey cast iron, nodular iron.
6. Draw the microstructure in Fe-Fe₃C Phase Diagram and write down the phases
7. Preparation of any one specimen and metallographic observation of mild steel, low carbon steel, medium carbon steel, high carbon steel and high speed steel.
8. Preparation of any one specimen and metallographic observation of Al-Si alloys, Al-Bronze alloy, Pb-Tin soldering alloy, Pb-Tin antimony alloy.
9. Standard test Methods for Estimation of Grain Size
10. Find The Hardness of The Various Treated and Untreated Steels.
11. Hardenability measurement by Jominy End Quench test.

Note: Any 10 of the above experiments are to be conducted

PYTHON PROGRAMMING

Subject Code: 20ESI204

L	T	P	C
3	0	3	4.5

COURSE OBJECTIVES

This course will enable students to

- Learn Syntax and Semantics and create Functions in Python
- Handle Strings and Files in Python
- Understand Lists, Dictionaries and Regular expressions in Python
- Understand use of functions and file handling in python
- Implement Object Oriented Programming concepts in Python
- Introduction to Regular Expressions and matching in Python

COURSE OUTCOMES

By the end of this course the student will be able to

- CO 1 :** Examine Python syntax and semantics and be fluent in the use of Python flow control and functions
- CO 2 :** Demonstrate proficiency in handling Strings and File Systems
- CO 3 :** Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions
- CO 4 :** Implement file handling functions and user defined functions in python
- CO 5 :** Interpret the concepts of Object-Oriented Programming as used in Python
- CO 6 :** Implement Regular Expressions and matching in Python

UNIT – I

Introduction to Python: History, Features, Installing Python, Running Python, Operators, Statements and Expressions.

Control Structures: Conditional Statements, Loops

Exercise Questions: 1

Ex 1: Write the python programs to calculate the following

- a) Find the factorial of given number
- b) To print all the prime numbers below n. n value should be taken from the user at the time of execution

Ex 2: Write the python programs to perform the following

- a) To check given number Armstrong or not.
- b) To check Strong number.
- c) To print Fibonacci series.

UNIT – II

Data Types: Mutable vs immutable data type, Numbers - Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Functions, Related Modules Sequences - Strings, Lists, and Tuples, Dictionaries and Set Types

Exercise Questions: 2

Ex 3: Write the python programs to calculate the following

- Write a Python program to get a string from a given string where all occurrences of its first char have been changed to '\$', except the first char itself.
- Write a Python program to remove the characters which have odd index values of a given string.
- To remove punctuations from the string
- Write a Python program to count repeated characters in a string
- Write a Python program to count Uppercase, Lowercase, special character and numeric values in a given string

Ex 4: Write the python programs to perform the following

- Implement a STACK program by using PYTHON.
- Implement a QUEUE program by using PYTHON.
- Implement a Python Program for creating a dictionary and display its keys alphabetically.
- Write a Python program to convert a list into a nested dictionary of keys.
- Write a python program to remove duplicates from the list

UNIT – III

Functions: Definitions, Declaration, Parameter passing, calling functions

File Handling: creating a file, opening a file, I/O with file (read, write, append), closing a file

Exercise Questions: 3

Ex 5: Write the python programs to calculate the following

- To find HCF or GCD of two numbers
- To find sum of natural numbers using recursive function

Ex 6: Write the python programs to perform the following

- Read a file line by line into a list
- Get filename, line count, file extension, file creation and modification date .
- Reads and displays the content of the file
- Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.

UNIT – IV

Modules: Modules and Files, Namespaces, Importing Modules, Importing Module Attributes, Module Built-in Functions, Packages, Other Features of Modules.

Exercise Questions: 4

Ex 7: Write the python programs to calculate the following

- Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
- Write a python program to define a module and import a specific function in that module to another program.

UNIT – V

Classes in Python : Principles of Object Orientation , Creating Classes , Instance Methods , Special Methods ,class Variables and Inheritance, Data base connectivity .

Exercise Questions: 5

Ex 8: Write the python programs to calculate the following

- Define a class, which have a class parameter and have a same instance parameter.
- Define a class named 'Shape' and its subclass 'Square'. The Square class has an 'init' function which takes a given length as an argument. Both classes have an area function which can print the area of the shape, where Shape's area is 0 by default..

UNIT-VI

Regular Expressions: Introduction, Special Symbols and Characters, Res and Python

Exercise Questions: 6

Ex 9: Write the python programs to calculate the following

- implement Re.findall, re.split, re.sub, re.subn, re.search and Match.group.
- Write a Python program to check the validity of a password (input from users).

Validation :

- At least 1 letter between [a-z] and 1 letter between [A-Z].
- At least 1 number between [0-9].
- At least 1 character from [\$#@].
- Minimum length 6 characters.
- Maximum length 12 characters.

TEXT BOOKS

1. Wesley J .C hun "Core Python Applications Programming", 3rd Edition, 2012, Prentice Hall.
2. Brian jones, David Beazley “Python Cookbook ”, 3rd Edition.

REFERENCES BOOKS

1. Mark Lutz "Programming Python, 4th Edition" O'Reilly Media.
2. Think Python, Allen Downey, Green Tea Press

Web Links

- <https://docs.python.org/3/tutorial/index.html>
- <https://pythonprogramminglanguage.com>

APPLIED THERMO FLUIDS -II

Subject Code: 20MET205

L	T	P	C
2	1	0	3

COURSE OBJECTIVES

- To learn the working, and estimate the performance of Rankine Cycle.
- To provide basic knowledge on Gas turbine.
- To learn the estimation of cooling load on Air-Conditioning system

COURSE OUTCOMES

On completion of this course, students should be able to

- CO 1 :** Estimate the performance of a Rankine cycle and understand the methods to improve the cycle performance.
- CO 2 :** Describe the construction and working of different types of boilers.
- CO 3 :** Analyze and Design the steam nozzle and condenser for the purpose of steam power plant
- CO 4 :** Analyze and Design the turbine used in steam power plant.
- CO 5 :** Analyze and Design the turbine used in Gas power plant.
- CO 6 :** Estimate the cooling load on Air-Conditioning system pertaining to different climatic conditions.

UNIT - I

RANKINE CYCLE: Thermodynamic analysis of Rankine cycle, modified rankine cycle, Methods to improve cycle performance – Regeneration – Reheating – problems.

UNIT - II

BOILERS: Classification, Working and Construction: Fire-tube boilers – Cochran, Cornish, Lancashire, Locomotive, Scotch; Water-tube boilers – Bobcock & Wilcox, Stirling; High-pressure boilers – Lamont, Loeffler, Benson, Velox, Boiler mountings and accessories.

UNIT - III

STEAM NOZZLES: Function of a nozzle – applications - types, Thermodynamic analysis, Area-velocity relationship, Condition for maximum discharge, Critical pressure ratio.

STEAM CONDENSERS: Purpose of a condenser in a steam power plant – surface and mixing condensers, Different types of modern wet and dry cooling towers.

UNIT - IV

IMPULSE TURBINES: Compounding methods: Velocity, Pressure, Pressure-velocity – diagrams, Power developed, Axial thrust, Blade or diagram efficiency, Condition for maximum efficiency.

REACTION TURBINES: Degree of reaction, Parson Reaction turbine, Condition for maximum efficiency.

UNIT - V

GAS TURBINES: Simple gas turbine plant – Ideal cycle, Essential components, Parameters of performance – Actual cycle, regeneration, intercooling and reheating – Closed and semi-closed cycles – Merits and demerits.

UNIT - VI

PSYCHROMETRY: Psychometric Properties & Processes –Sensible and Latent heat loads and SHF, RSHF, GSHF, ESHF, BPF and ADP, Air conditioning load calculations for simple application of a small room.

TEXT BOOKS

1. Thermal Engineering by R.K. Rajput, S.Chand Pub.
2. Kothandaraman, C.P., Domkundwar .S and Domkundwar A.V.,”A course in Thermal Engineering”, Dhanpat Rai & Sons.
3. Mahesh. M. Rathore, “Thermal Engineering”, 1st Edition, Tata Mc Graw Hill Publications.
4. A Course in Thermal Engineering, S.C. Arora, V. Domukundwar, Dhanpat Rai Pub.
5. Steam Tables. (**Permitted in Exams**)

REFERENCES BOOKS

1. A Course in Thermal Engineering, S.C. Arora, S. Domukundwar, Dhanpat Rai Publications
2. Arora .C.P., “Refrigeration and Air Conditioning”, Tata Mc Graw Hill.
3. Ballaney. P.L." Thermal Engineering”, Khanna publishers.
4. Thermal Engineering, R.S. Khurmi, J.K. Gupta, S. Chand Pub.
5. Gas Turbines and Propulsive Systems, P.R. Kajuria, S.P. Dubey, Dhanpat Rai Pub.

MANUFACTURING TECHNOLOGY –I

Subject Code: 20MET206

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand different manufacturing processes.
- To understand various tools, equipment and processes used in pattern making, mold and core making and foundry shop.
- To learn necessary details of various welding and allied joining processes such as gas welding, arc welding, resistance welding, brazing and soldering.
- To understand fundamental concepts related to forging and other mechanical working processes.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1: Identify elements of casting process including patterns, molding materials especially of sand, gating, riser, runner and melting furnaces.

CO 2: Design Riser in metal casting and understand special casting processes.

CO 3: Comprehend the working of different welding processes including arc, resistance and other weldings, along with their subtypes of welding.

CO 4: Calculate rolling process parameters, and understand Extrusion and Drawing processes.

CO 5: Explain principles of various kinds of forging and sheet metal working processes

CO 6: Explain various high velocity forming processes and plastic injection and blow molding processes.

UNIT - I

Foundry: Introduction to casting process, Process steps, Advantages, Applications, Pattern types and pattern allowances – Molding materials, Importance of constituents, Molding tools and equipment.

Molding Sands: Types of Moldingsands, Sand molding types:– CO₂ molding – Shell molding.

Melting and Casting: Melting furnaces, Cupola, Electrical, Induction furnaces, casting defects, Remedies.

UNIT - II

Gating system: Elements of gating system, Gating system design, Calculation of gating system dimensions for simple objects, Riser design, chills and chaplets, solidification of casting.

Special Casting processes: Precision Investment casting, Centrifugal casting, Permanent mould casting (Gravity Die casting), Die casting

Welding: Fundamentals, classification of welding processes, types of welds and types of joints.

Gas Welding: Equipment, oxy-acetylene flame, types, gas welding procedure, gas cutting.

UNIT - III

Arc Welding: Principle of arc, Equipment, Electrodes, Shielded metal arc welding, Tungsten Inert Gas welding (TIG), Metal Inert Gas (MIG) welding, Mode of metal transfer in GMAW process, submerged arc welding.

Resistance Welding: Principle, Spot welding, Seam welding, Projection welding, Flash welding.

Other Welding Process: Laser beam welding, Thermit welding. Brazing, Braze welding, Soldering, Weld Defects.

UNIT - IV

Forming: Fundamentals, Introduction to metal working process, Hot working, Cold working.

Rolling: Rolling fundamentals, Rolling stand arrangements Analysis of rolling process- Derivation of Length of deformation zone, Angle of bite, Maximum reduction possible for one pass.

Extrusion & Drawing: Extrusion fundamentals, Classification of Extrusion- Forward Extrusion, Backward Extrusion, Impact extrusion, Hydrostatic extrusion. Types of drawing: Wire drawing, Tube drawing.

UNIT - V

Forging: Fundamentals, Types of forging operations, Smith, Press, Drop forging.types of forging dies

Sheet Metal Working: Principles of sheet metal working, Punching and blanking. Cup Drawing, Bending, Embossing, Coining

UNIT - VI

High Velocity Forming (HVF), High Energy Rate Forming (HERF) : High velocity forming types - Explosive forming, Magnetic pulse forming, Electro hydraulic forming.

Plastics Processing: Types of plastics, Properties, Additives, Applications of plastics, Injection molding, Blow molding

TEXT BOOKS:

1. Manufacturing Technology Vol-I, P.N. Rao, Tata McGraw Hill Publications
2. Production Technology, P. C. Sharma, S. Chand Publications

REFERENCES BOOKS:

1. Production Technology, R.K. Jain, Khanna Publications,
2. Elements of Workshop Technology Vol-II, S.K. HajraChoudhury, A.K. HajraChoudhury,
3. Nirjhar Roy, Media Promoters Publications,
4. Production Technology, Hindustan Machine Tools Publications,
5. Workshop Technology Vol - II, W.A.J. Chapman, Oxford Publications,

STRENGTH OF MATERIALS

Subject Code: 20MET207

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To compute normal and shear stresses and strains in bars of varying sections and composite bars subjected to external forces and temperature changes.
- To plot shear force and bending moment distribution diagrams.
- To determine shear stresses and bending stresses in beams of circular, rectangular I and T cross sections.
- To determine torsional shear stresses in shafts and stresses in thin cylinders
- To calculate crippling load for columns
- To compute deflection of beams

COURSE OUTCOMES:

On completion of this course, students should be able to

- CO 1 :** Compute normal and shear stresses and strains in bars of varying sections and composite bars subjected to external forces and temperature changes.
- CO 2 :** Compute shear force and bending moments for statically determinate cantilever or simply-supported beams subjected to various loads
- CO 3 :** Determine flexural stresses and shear stresses in beams of circular, rectangular I, T and channel cross sections.
- CO 4 :** Determine torsional shear stresses in circular and hollow circular shafts and stresses and strains in thin cylinders.
- CO 5 :** Calculate the crippling load for a column.
- CO 6 :** Compute beam deflections using double integration and moment-area methods.

UNIT-I**SIMPLE STRESSES & STRAINS:**

Types of stresses and strains, Hooke's law, Stress-strain diagram for mild steel, Working stress, Factor of safety, Lateral strain, Poisson's ratio, Bars of varying section – Composite bars – Temperature stresses, Elastic Constants and relationship between them.

UNIT-II**SHEAR FORCE AND BENDING MOMENT:**

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

UNIT-III**FLEXURAL STRESSES:**

Theory of simple bending, Assumptions – Derivation of bending equation $M/I = \sigma/y = E/R$, Neutral axis – Determination bending stresses – Section modulus of rectangular and circular sections (solid and hollow), I, T and Channel sections.

SHEAR STRESSES:

Governing equation for shear stress – Shear stress distribution across cross sections like rectangular, circular, I, T and Channel.

UNIT-IV

TORSION

Shafts Subjected to pure torsion, Torsion equation, Torsional rigidity, Comparison of solid and hollow shafts.

Thin cylinders: Thin seamless cylindrical shells - Derivation of formula for longitudinal and circumferential stresses - hoop, longitudinal and Volumetric strains - changes in dia, and volume of thin cylinders.

UNIT-V

THEORY OF COLUMNS:

Definition, classification and strength of columns. Euler's formula for long columns, Assumptions, limitations. Derivations of Euler's formula for different end conditions. Rankine's Hypothesis for columns. Columns subjected to eccentric loading.

UNIT-VI

DEFLECTION OF BEAMS:

Bending into a circular arc – Slope, deflection and radius of curvature, Differential equation for the elastic line of a beam – Double integration method – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads and uniformly distributed loads – Moment area method, application to cantilever and simply supported beams.

TEXT BOOKS:

1. Strength of Materials, S.S. Bhavikatti, Lakshmi Publications,
2. Strength of Materials, R.K. Rajput, S. Chand Publications,

REFERENCES BOOKS:

1. Strength of Materials, S.S. Rattan, Tata McGraw Hill Publications,
2. Analysis of Structures Vol-I, Vazirani, Ratwani, Khanna Publications,
3. Mechanics of Materials, Ferdinand Beer, E. Russell Johnston, John DeWolf, David Mazurek, Tata McGraw Hill Publications,
4. Mechanics of Materials, BC Punmia, Laxmi publications
4. Engineering Mechanics of Solids, Egor P. Popov, Prentice Hall India Publications,

PRODUCTION TECHNOLOGY LAB**Subject Code: 20MEL205**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- Practically understand different manufacturing processes in production technology.
- Practically understand the difference between cold working and hot working processes.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1 : Prepare green sand mold for single-piece and multi-piece patterns.

CO 2 : Create joints using electric arc, spot, gas welding techniques.

CO 3 : Outline practical procedure for TIG and MIG welding.

CO 4 : Form plastic parts using injection and blow molding.

CO 5 : Fabricate a pipe bend and a washer using hydraulic and mechanical press.

CO 6 : Fabricate a wooden pattern using wooden lathe.

LIST OF EXPERIMENTS:**I. MOLDING PRACTICE:**

1. Preparation of a green sand mould using single piece pattern.
2. Preparation of a green sand mould using multi piece pattern.
3. Preparation of wooden pattern using wood lathe turning machine.

II. WELDING PRACTICE:

4. Preparation of a butt joint using electric arc welding.
5. Preparation of a lap joint using arc welding.
6. Preparation of a lap joint using spot welding.
7. Preparation of corner joint using electric arc welding.
8. Preparation of T joint using electric arc welding.

III. PLASTIC MOLDING: Injection Molding:

9. Preparation of a key chain by using two plate mold.
10. Preparation of a bottle cap by using three plate mold. Blow Molding:
11. Preparation of a bottle by using blow molding technique.

IV. MECHANICAL PRESSES:

12. Preparation of a pipe bends using hydraulic press.
13. Preparation of a washer using mechanical press

STRENGTH OF MATERIALS LAB

Subject Code: 20MEL206

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To understand metallographic structures.
- To understand different material testing techniques.
- To find hardness, tensile strength and compressive strength of given specimens.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1 : Determine metallographic structure of pure metals, cast irons, mild steels and alloys.

CO 2 : Interpret effect of heat treatment on hardness of steels by using Jominy End Quench Test.

CO 3 : Determine mechanical properties of given specimen using tension test, compression test, bending test, shear test on universal testing machine.

CO 4 : Grade the specimen by conducting Brinell and Rockwell hardness tests.

CO 5 : Compute spring stiffness by measuring spring deformations for applied loads.

CO 6 : Grade the specimen by conducting Izod and Charpy impact strength.

LIST OF EXPERIMENTS:

1. Direct tension test.
2. Bending test on simply supported beam.
3. Torsion test.
4. Hardness tests:
 - a) Brinell hardness test.
 - b) Rockwell hardness test.
5. Test on springs.
6. Compression test on wooden cube.
7. Impact test.
 - a) Izod, b) Charpy.
8. Shear test.

TRANSFORM THEORY
(INTERDISCIPLINARY ELECTIVE – I)
(for MECH/CIVIL)

Subject Code: 20IET211

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the Laplace transform of different basic functions and its properties.
- To study Inverse Laplace Transforms and apply Laplace transforms to solve differential equations.
- To Study the mathematical tool of Fourier transforms their properties and applications.
- To study Inverse Fourier transforms their properties.
- To study the mathematical tool of Z- transform, their properties and implementation.
- To study Inverse Z Transforms and apply Z- transform to solve Difference Equations.

COURSE OUTCOMES:

The student will be able to:

CO 1 : Evaluate Laplace Transform of different functions utilizing its properties.**CO 2 :** Evaluate Inverse Laplace Transform of different functions and solve Differential Equations.**CO 3 :** Estimate Fourier transform/ Fourier sine(cosine) Transform of functions.**CO 4 :** Estimate inverse Fourier transform/ inverse Fourier sine(cosine) transform of different functions.**CO 5 :** Evaluate Z-transform of different functions utilizing different properties.**CO 6 :** Evaluate inverse Z- transform of different functions and solve Difference Equations utilizing different properties.**UNIT-I****Laplace Transforms:**

Laplace Transform for elementary functions – Properties- 1st shift and 2nd shifting theorems - Laplace transform of derivative, integrals, multiplication by t^n and division by t - unit step and unit impulse function.

UNIT-II**Inverse Laplace Transforms:**

Inverse Laplace Transform –Evaluation by partial fractions, convolution theorem(without proof), application of Laplace transforms to solve ordinary differential equations.

UNIT-III**Fourier Transforms :**

Fourier Integral Theorem (without proof)- Fourier sine and cosine integrals –complex form of Fourier Integral - Fourier transform – Fourier sine and cosine transforms – properties.

UNIT-IV

Inverse Fourier Transforms:

Inverse Fourier Transforms, Inverse sine and cosine transforms - properties – Convolution Theorem.

UNIT-V

Z- Transforms:

Z-transform – Linear property – Damping rule – Shifting rule – Initial and final value theorems- Z transforms of functions multiplied and divided by n.

UNIT-VI

Inverse Z- Transforms:

Inverse Z-Transforms of basic functions, Partial fractions, Convolution theorem. Application of Z transforms to solve Difference Equations.

SUGGESTED TEXT BOOKS

1. B.V.Ramana, Higher Engineering Mathematics, 44th Edition, Tata McGraw Hill New Delhi, 2014.
2. Dr.B.S.Grewal, Higher Engineering Mathematics, 43nd Edition, Khanna Publishers, 2015.

REFERENCE BOOKS

1. Advanced Engineering Mathematics , Erwin Kreyszig, 9th Edition, John Wiley & Sons.
2. Engineering Mathematics for first year, Veerarajan T., Tata McGraw-Hill, New Delhi.
3. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications.

**ELEMENTS OF BUILDING PLANNING
(INTERDISCIPLINARY ELECTIVE – I)
(for MECH)**

Subject Code: 20IET214

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

Students will have

- To interpret the conventional building materials.
- To summarize the objectives of building byelaws, principles and regulations
- To apply the minimum standards for various parts of buildings.
- To draw the line plan of a school and hospital for given site plan
- To describe the orientation of buildings based on earth's motion around the sun and significance of bond for brick walls
- To draw plan, elevation and sectional elevation of single room buildings from the given line diagram.

COURSE OUTCOMES

After completion of this course, students should be able to

CO 1 : Interpret the conventional building materials.

CO 2 : Summarize the objectives of building byelaws, principles and regulations

CO 3 : Apply the minimum standards for various parts of buildings.

CO 4 : Draw the line plan of a school and hospital for given site plan

CO 5 : Describe the orientation of buildings based on earth's motion around the sun and significance of bond for brick walls

CO 6 : Draw plan, elevation and sectional elevation of single room buildings from the given line diagram.

UNIT-I

Building Materials: Conventional Building Materials such as Brick, Cement, Steel, Wood - Modern Building Materials – Plumbing Fixtures – Sanitary fittings – Materials for Building Electrification – Ready to use building materials currently available in the market.

UNIT-II

Building Byelaws and Regulations: Introduction- terminology- objectives of building byelaws floor area ratio floor space index- principles under laying building bye laws- classification of buildings- open space requirements – built up area limitations- height of buildings- wall thickness – lightening and ventilation requirements.

UNIT-III

Residential buildings: Minimum standards for various parts of buildings, requirements of different rooms and their grouping, characteristics of various types of residential buildings - Study of structural elements of Building – Minimum standards for Septic tank, balcony, corridor and staircase.

UNIT- IV

Public Buildings: Planning of educational institutions, hospitals and dispensaries. Requirements and minimum standards for various public buildings. Draw the line plan of a school and hospital for given site plan

UNIT-V

Principles of Planning and Orientation of the Residential Building: Orientation of Buildings based on Earths motion round the Sun – Significance of Bond for Brick walls – Study of specifications of doors, Windows, ventilators and roofs – Prefabricated Buildings and Toilets.

UNIT-VI

Drawing practice: Single room building, given line diagram with specifications to draw, plan, elevation and sectional elevation.

TEXT BOOKS:

1. Planning and Design of buildings by Y.S. Sane, 2015
2. Planning, designing and Scheduling by Gurucharan Singh and Jagadish Singh, 2012
3. Building planning and drawing by M. Chakravarthi, 2016

REFERENCE BOOKS:

1. Building drawing by Shah and Kale
2. 'A' Series & 'B' Series of JNTU College of Engineering, Anantapur,

MATHEMATICAL MODELING AND SIMULATION
(INTERDISCIPLINARY ELECTIVE – I)
(for ECE/MECH/CIVIL/CSE/IT)

Subject Code: 20IET216

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

By the end of this course, students in this class will understand the basic principles of programming and implementing mathematical concepts in MATLAB. Specifically, they will be able to write numerical algorithms and evaluate the computational results using graphical representations. The ultimate goal is to motivate the students for their profession and for future courses in curriculum.

COURSE OUTCOMES:

CO1 : Translate mathematical methods to MATLAB code.

CO2 : Generalize results and represent data visually.

CO3 : Apply computer methods for solving a wide range of engineering problems.

CO4 : Utilize computer skills to enhance learning and performance in other engineering and science courses.

CO5 : Demonstrate professionalism in interactions with industry.

CO6 : Understands about Scilab.

UNIT - I

Introduction to MATLAB: Historical Background, Applications, Scope of MATLAB, Importance of MATLAB for Engineers, Features, MATLAB Windows (Editor, Work Space, Command History, Command Window). Operations with Variables, Clearing Operations, Commands, Data types, Operators.

UNIT - II

Data and Data Flow in MATLAB: Vectors, Matrix Operations & Operators, Reshaping Matrices, Arrays, Colon Notations, Functions.

UNIT - III

MATLAB Programming: Conditional Statements, Loops, Writing Script Files, Error Correction, Saving Files, Worked out Examples.

UNIT - IV

Matlab Advanced: Plotting graphs, Creating Plot & Editing Plot, MATLAB-Algebra, Calculus, Differential, Integration, Polynomials, solving a system of linear equations.

UNIT - V

Simulink-I: Introduction, Importance, Model Based Design, Tools, Mathematical Modeling,

UNIT - VI

Simulink-II: Converting Mathematical Model into Simulink Model, Running Simulink Models, Introduction to scilab.

TEXT BOOKS:

1. Getting Started With MATLAB: A Quick Introduction for Scientists and Engineers (English) by RudraPratap, OXFORD University Press.
2. MATLAB Programming by Y. Kirani Singh, B.B. Chaudhuri, PHI Publication

REFERENCE BOOKS:

1. MATLAB[®] Programming For Engineers Fourth edition by Stephen J. Chapman
2. Applied Numerical Methods Using MATLAB 1st Edition by Won Y. Yang, WenwuCao, Tae SangChung, JohnMorris.

<https://in.mathworks.com/products/simulink.html>

**INTRODUCTION TO ELECTRONIC MEASUREMENTS
(INTERDISCIPLINARY ELECTIVE – I)
(for EEE/MECH/CIVIL/CSE/IT)**

Subject Code: 20IET218

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide knowledge of performance characteristics and classify static errors of different measuring instruments.
- To construct DC Ammeter, DC Voltmeter, Ohmmeters for measurement of unknown current, voltage and resistance.
- To introduce various Signal generators and Harmonic Distortion analyzers.
- To become familiar with the working of CRO and special Oscilloscopes for measurement of electronic parameters.
- To construct AC and DC bridges for measurement of unknown Resistance, Inductance and Capacitance.
- To understand working principles of transducers for the measurement of non-electrical quantities.

COURSE OUTCOMES:

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

CO 1 : Define various performance characteristics and classify static errors of Instruments.

CO 2 : Calculate the resistance values for construction of DC voltmeter, Ammeter and Ohmmeters.

CO 3 : Explain the working of various signal generators and analyzers for distortion measurements.

CO 4 : Describe the working and use of CRO and special oscilloscopes.

CO 5 : Determine the value of unknown resistance, inductance, capacitance and frequency of excitation.

CO 6 : Classify transducers and identify suitable transducer for measuring various non-electrical quantities.

UNIT - I

Performance characteristics of instruments: Static characteristics - accuracy, resolution, precision, expected value, error and sensitivity, Error in measurement, Types of Static error, Dynamic characteristics - speed of response, fidelity, lag and dynamic error.

UNIT - II

DC Meters: DC Ammeter Construction, Multirange ammeter, Universal Shunt and Extending Range. RF ammeter. DC Voltmeter – Construction, Multirange voltmeter, Extending Range. Ohmmeters - Series type and shunt type.

UNIT - III

Signal Generators and Harmonic Distortion Analyzers:

Signal Generators - Standard signal generator, AF sine and square wave generator, Function Generator.

Harmonic Distortion Analyzers: Fundamental Suppression Type – Resonance Bridge, Wien's Bridge, Bridged T-Network.

UNIT - IV

CRO and Special Oscilloscopes: CRT features, Block Diagram of oscilloscope, Dual Beam CRO, Dual trace oscilloscope, Storage oscilloscope.

UNIT - V

DC and AC Bridges: DC Bridge – Measurement of Resistance – Wheatstone's Bridge. AC Bridges - Measurement of inductance - Maxwell's Bridge, Anderson's bridge. Measurement of capacitance – Schering's Bridge and Wien's Bridge

UNIT - VI

Transducers: Classification, Resistive Transducer – Potentiometer type – Pressure Transducer and Position Transducer, unbonded and bonded strain gauges, Thermistor, Inductive Transducer-LVDT, Capacitive Transducer – Pressure Transducer, Temperature Transducer-Thermocouple.

TEXT BOOKS:

1. Electronic instrumentation – H.S.Kalsi, Tata McGraw Hill, 2004, 2/e.
2. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrick and W.D. Cooper, PHI, 2002, 5/e.

REFERENCE BOOKS:

1. Electronic Instrumentation & Measurements - David A. Bell, PHI, 2003, 2/e.
2. Electronic Test Instruments, Analog and Digital Measurements - Robert A.Witte, Pearson Education, 2004, 2/e.

<https://nptel.ac.in/courses/108/105/108105153/>

<http://nitttrc.edu.in/nptel/courses/video/108105153/108105153.html>

UNIX UTILITIES
(INTERDISCIPLINARY ELECTIVE – I)
(for ECE/EEE/MECH/CIVIL)

Subject Code: 20IET219

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- Know about UNIX operating system
- Understand important commands which are used in UNIX
- Learn shell programming
- Study UNIX file system
- Understand the process mechanism

COURSE OUTCOMES

- CO 1 :** Describe UNIX Architecture and Functions of OS
- CO 2 :** Demonstrate the basic set of commands and utilities in UNIX system
- CO 3 :** Design and Implement of UNIX file system
- CO 4 :** Familiar with various shell commands
- CO 5 :** Develop shell scripts to automate various tasks
- CO 6 :** Analyze the different types of processes in UNIX environment

UNIT – I

Introduction to Unix-Brief History,What is Unix-Unix Components, Operating system services, Assumptions about hardware. Introduction to the Kernel: Architecture of the UNIX operating system, Introduction to system concepts – Kernel data structures – System administration.

UNIT – II

Using Unix-Commands, Unix-Some Basic Commands-. Unix Command - man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip. Unix Utilities:- Introduction to unix file system, vi editor, file handling utilities, security by file permissions, process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, Text processing utilities and backup utilities , detailed commands to be covered are tail, head , sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, comm, cmp, diff, tr.

UNIT – III

The File system –The Basics of Files-What’s in a File-Directories and File Names- Permissions-I Nodes-The Directory Hierarchy, File Attributes and Permissions-The File Command knowing the File Type-The Chmod Command Changing File Permissions-The Chown Command Changing the Owner of a File-The Chgrp Command Changing the Group of a File.

UNIT – IV

Using the Shell-Command Line Structure-Met characters-Creating New Commands- Command Arguments and Parameters-Program Output as Arguments-Shell Variables- -More on I/O Redirection-Looping in Shell Programs.

UNIT – V

Shell Programming-Shell Variables-The Export Command-The Profile File a Script Run During Starting-The First Shell Script-The read Command-Positional parameters-The \$? Variable knowing the exit Status-More about the Set Command-The Exit Command- Branching Control Structures-Loop Control Structures-The Continue and Break Statement- The Expr Command: Performing Integer Arithmetic-Real Arithmetic in Shell Programs-The here Document(<<)-The Sleep Command-Debugging Scripts-The Script Command-The Eval Command-The Exec Command.

UNIT – VI

The Process-The Meaning-Parent and Child Processes-Types of Processes-More about Foreground and Background processes-Internal and External Commands-Process Creation-The Trap Command-The Stty Command-The Kill Command-Job Control.

TEXT BOOKS

1. Introduction to Unix Shell Programming by M.G.Venkateshmurthy, Parson.
2. Your Unix the ultimate guide, Sumitabha Das, TMH. 2nd Edition.

REFERENCE BOOKS

1. Unix and shell programmingby B.M. Harwani, OXFORD university press.
2. Unix programming environment, Kernighan and Pike, PHI. / Pearson Education
3. Beginning shell scripting, E. Foster – Johnson & other, Wile Y- India

FUNDAMENTALS OF DATA STRUCTURES
(INTERDISCIPLINARY ELECTIVE – I)
(for ECE/EEE/MECH/CIVIL)

Subject Code: 20IET21A

L	T	P	C
3	0	0	3

COURSE OUTCOMES:

On completion of this course, the student will be able to:

- CO 1 :** Compute the time and space complexities and calibrate the performance of a given algorithm.
- CO 2 :** Compare the performances of various Searching and Sorting techniques.
- CO 3 :** Illustrate the applications of Stacks and Queues.
- CO 4 :** Demonstrate the advantages of dynamic memory allocation via linked lists.
- CO 5 :** Implement the basic operations and Traversals on binary Trees.
- CO 6 :** Understand traversals and shortest path algorithms on a Graph.

UNIT – I

Introduction: Basic Concepts of Data Structures and types of Data Structures; Performance Analysis of algorithms; Asymptotic Notations (O, Ω, θ)

UNIT – II

Searching: Linear Search, Binary Search: Algorithm & Analysis; Sorting: Methodology & Performance Analysis of Sorting Algorithms: Selection, Bubble, Insertion, Quick, Merge sort.

UNIT – III

Stacks: Definition, operations, Applications of Stacks: Conversion of infix to postfix expression
Queues: Definition, operations, Applications of Queues;

Unit – IV

Linked Lists: Comparison with Arrays; Operations on Singly linked list: Creation, Insertion, Deletion, Traversing; Operations on Doubly linked list; Operations on Implementation of Stack and Queue using Linked Lists.

UNIT-V

Trees: Basic Terminology of Trees; Binary Tree: Traversals; Binary Search Tree Operations: Insert, Delete;

UNIT-VI

Graph: Basic Terminologies and Representations of Graphs; Graph traversal algorithms: Breadth-FS & Depth-FS; Minimum spanning tree algorithms: Prim's and kruskal's algorithms

TEXT BOOKS:

1. Mark Allen Weiss , “Data Structures and Algorithm Analysis”, Fourth Edition , Pearson.
2. Ellis Horowitz, SartajSahni, “Fundamentals of Data Structures”, Illustrated Edition, Computer- Science Press.

REFERENCE BOOKS:

1. Michel T. Goodrich, Roberto Tamassia, David Mount, “Data Structures and Algorithm Analysis”, 2nd Edition, John Wiley & Sons, Inc.
2. Adam. Drozdek , “Data Structure And Algorithms In C++”, 4th edition, Cengage.

REFERENCE LINKS:

1. <https://nptel.ac.in/courses/106/102/106102064/>
2. <https://nptel.ac.in/courses/106/106/106106127/>

**COMPETITIVE PROGRAMMING - I
(INTERDISCIPLINARY ELECTIVE – I)
(for ECE/EEE/MECH/CIVIL)**

Subject Code: 20IET21C

L	T	P	C
3	0	0	3

COURSE OBJECTIVES :

- To help Students regulate their behavior in a social environment as Engineering Professionals.
- To make students aware of the impact of taking social, legal and Administrative decisions about their profession.
- To understand the political and constitutional parameters in work environment.
- To understand the need and strengths of our nation and adopt their knowledge for future career.

COURSE OUTCOMES :

By the end of this course the student will be able to:

CO 1 : Realize the rigidity of our Indian Politics and Administrative aspects.

CO 2 : A Student can understand our nation federalism.

CO 3 : Can assess different types of risk involved in misadministration.

CO 4 : Can create competitive advantage.

CO 5 : Summarizes the legal and Administrative establishments.

CO 6 : A student can infer financial aspects for betterment of the National Building.

UNIT – I**Introduction:**

Historical perspective of the constitution of India - Salient features of The Indian Constitution - Amendment Procedure of The Indian Constitution. 42nd amendment (Mini Constitution) - 44th amendment (1978 – Janatha Govt.)

UNIT – II**Important Features of Constitution:**

Fundamental Rights (Article 12 to 35), Duties (51 A – 1976 emergency) and Directive principles (Article 36 to 51) of State Policy - Articles 14 to 18 - Articles 19 - Article 21

UNIT – III**Parliamentary Form of Govt. in India:**

President of India - Emergency provisions - National Emergency – Article 352 President Rules – Article 356- Financial Emergency – Article 360 Prime Minister and Cabinet - Supreme Court of India (Indian Judiciary)

UNIT – IV**Indian Federalism:**

Union – State relations; - Legislative , Administrative and Financial relations. Local self Govt. – Constitutional Schemes in India (73 & 74 Constitutional amendments)

UNIT – V

Parliamentary Committees:

Public Accounts Committee - Estimates Committee - Committee on Public Undertakings. - Election commission of India (Article -324) - Comptroller and Auditor General (CAG) of India (Article – 148 to 150)

UNIT – VI

Finance Commission:

Finance Commission(Article – 280) - Neethi Aayog (Planning Commission) and - Political Parties.

TEXT BOOKS:

1. Introduction to Indian Constitution by D.D Basu, Lexis Nexis Butterworth wadhwa Nagapur, 2008.
2. Politics in India by Rajini Kothari, Orient LongMan, 2005.
3. The Indian Constitution by Madhav Khosla by Oxford University Press India, 2012.

INTRODUCTION TO ROBOTICS AND MECHATRONICS
(Honors/Minor Course : ROBOTICS)

Subject Code: 20ROT201

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- The course is aimed at providing concepts and skills in the industrial automation domain related to mechatronics, robotics, electrical machines and drives.
- In this subject, the fundamental concepts and methodologies are introduced for understanding mechatronic systems and industrial robots; then, they will acquire fundamental knowledge and competences of the subject.
- This course will help in understanding the evolving Mechatronics systems from their underlying physical principles and properties.
- This course recognizes the synergistic combination of all related branches of engineering and have adequate multi-disciplinary knowledge and conceptual skills

COURSE OUTCOMES:

By the end of this course the student will be able to:

CO1: Understand the history, evolution and anatomy of robot.

CO2: Comprehend the concept of machine and mechanism, architecture and selection of actuation system for various applications.

CO3: Apply the knowledge of sensors for a typical application of robots.

CO4: Design the process of mechatronics system

CO5: Gain the knowledge on data acquisition and signal conditioning

CO6: Describe and discuss the basic fundamentals of microprocessors and microcontrollers

UNIT – I:

Introduction to Robotics: Brief History, Automation and Types, Robots, Robotics and, Principles, Development of Robotics, Laws of Robotics, Specifications and Classifications, Degree of Freedom, Anatomy and Work Volume, Applications.

UNIT – II:

Robot Actuation Systems: Machine and Mechanism, Architecture of Robotics Systems
Mechanical - Cams, Gear trains, Ratchet and Pawl, Belt and chain drives, Bearings. Electrical - Electrical systems, Solid State Switches, Solenoids, D.C. motors, A.C. motors, Stepper motors, Pneumatic and, Hydraulic Actuation System - Introduction to Hydraulic and Pneumatic Systems, Directional Control valves, Flow control valves.

UNIT – III:

Sensors: Robotic Sensors, Position Sensors - Optical, Non-Optical, Velocity Sensors, Accelerometers, Proximity Sensors - Contact, Non-Contact, Range Sensing, Touch and Slip Sensors, Force and Torque Sensors.

UNIT – IV:

Introduction to Mechatronics: Definition and Components, Applications, Mechatronics System Design, Procedure and Possible Design Solutions, Building Blocks of Mechanical, Electrical, Electro-Mechanical, Thermal and Fluid Systems, Open and Closed Loop Systems, Digital and Analogue Control Systems.

UNIT – V:

Signal Conditioning and Data Acquisition: Filtering, Pulse Modulation, A/D and D/A Converters, Multiplexers, Data Acquisition Systems.

UNIT – VI:

Basic Introduction to Microprocessor: Microcontrollers and PIC Microcontroller, 8051 Programming, Peripheral Interfacing, Microprocessor, Microcontroller in Robotics, Control Modes, PID and Digital Controllers, Velocity Control, Adaptive Control, , Programmable Logic Controllers: Fundamentals of PLCs, Mnemonics and Timers, Relays and Counters, Master and Jump Control, Data Control, Analog I/O Control

TEXT BOOKS:

1. R.K. Mittal & I.J. Nagrath, “Robotics & Control” TMH-2007.
2. Groover. M.P. Industrial Robotics, technology, programming and application Mc-Graw Hill 2012.
3. Brian morriss, “Automated manufacturing Systems – Actuators Controls, sensors and Robotics”, McGraw Hill International Edition, 2000.
4. DevadasShetty, Richard A.Kolkm, “Mechatronics system design, PWS publishing company, 2009.

REFERENCES:

1. K.S Fu, R.C. Gonzalez, C.S.G. Lee, Robotics, McGraw Hill, 1987.
2. S. K. Saha, “Introduction to Robotics”, Tata McGraw-Hill Publishing Company Ltd. (2008).
3. Craig. J. J. “Introduction to Robotics- mechanics and control”, Addison- Wesley, 1999.
4. Asada, H., and J. J. Slotine. *Robot Analysis and Control*. New York, NY: Wiley, 1986. ISBN: 9780471830290.
5. Introduction to Embedded Systems: Shibu K V, McGRAW Hill Publications.
6. PIC Microcontrollers and Embedded Systems: M. A. Mazidi, R.D. Mckinlay and D. Casey, Pearson Publications
7. W.Bolton, “Mechatronics”, Pearson education, second edition, fifth Indian Reprint, 2003.

HUMAN VALUES

Subject Code: 20MCT305

L	T	P	C
2	0	0	0

COURSE OBJECTIVES

- To explain the student how to govern the professional behavior in their career as employee.
- To interpret the culture when they are working in different organizations.
- To understand value of education and self- development.
- To anticipate good value sin students.
- To let the student know about the importance of character.
- To let the student understand the personality and behavior development.

COURSE OUTCOMES

By the end of this course the student will be able to

- CO1:** Analyze ethical behavior in the workplace
CO2: Adapt appropriate behavior in the family and society
CO3: Understand the challenging environment in workplace
CO4: Understand the Global culture in engineering problems
CO5: Identify the importance of Human values in real life
CO6: Assess over all personality of an individual

UNIT-I

Introduction to Values and Morals: Theory of Evolution – Ethics as a necessity for spiritual evolution-- Description of Human Values & Morals ---- Values --- Integrity, Honesty, Courage, Empathy, Personality, Character, Self Confidence, Respect for Others, 7 Way sof Misusing Truth – Work Culture, Social Responsibility, Responsibilities as a Citizen, Co operation and Commitment, Caring and Sharing Religion vs. Spirituality, Philosophy, Customs and Practices --- Impediments to Responsibility – Self-Interest, Fear, Self-Deception, Ignorance, Ego, Narrow Vision, Uncritical Acceptance of Authority, Group Thinking

UNIT-II

Mind and Its Mysteries: What is Mind? Mind and Body, Mind and Food, Mental faculties, Theory of perception, Memory, Tendencies, Thought Creates the World-- Power of Thought, Thought Culture, Desires, Pleasure and Pain -- Cultivation of Virtues, Control of Senses and Mind--Discrimination, Dispassion, Sacrifice--Concentration, Meditation and Enlightenment

UNIT-III

Risk, Safety and Environment : Difficulties in Estimating Risk—Approach to Acceptable Risk, Regulator’s Approach to Risk – Engineer’s Liability, Changing Legal Rights of the Employees--Organizational Disobedience by Contrary Action, by Non-Participation, by Protest – Environmental Laws and Judicial Intervention in Related Matters-Environmental Movements.

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UNIT-IV

Non-Ethical Practices in Vogue: Engineer's Responsibility for Rights - Respect for Authority – Conflict of Interests - Occupational crime -- Global Issues – How Multinational Corporations Influence Government Decisions, Risk and Public Policy- Engineers as Managers, Advisors and Experts, Engineers as Moral Leaders Problem of Bribery, Extortion, Grease Payments, Nepotism exists between Politicians and Industrialists. Case Study–Chinese Minister Sentenced to Death for Corruption

UNIT-V

Values and Self-Development: Social values and individual attitudes. Work ethics, Indian vision of humanism Moral and non-moral valuation Standards and principles Value judgments

UNIT-VI

Personality and Behavior Development: Soul and Scientific attitude Positive Thinking. Integrity and discipline Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brother hood and religious tolerance true friendship, happiness Vs suffering, love for truth. Aware of self destructive habits, Association and Cooperation, Doing best for saving nature

TEXT BOOKS:

1. Charles E Harris, Micheal J Rabins, "Engineering Ethics, Cengage Learning (2009)
2. Mike Martin and Rol and Schinzinger, "Ethics in Engineering" McGraw Hill, (2005)
3. Mind, Its Mysteries and Control, Swami Sivananda, Divine Life Society Pub (1994)
4. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi (1998)
5. Dr SB. Nageswararao " Humour in Management " Walnut Publications, Bhubaneswar (2022)

MACHINE DESIGN**Subject Code: 20MET308**

L	T	P	C
3	0	0	3

Note: Design data book is allowed in examinations**COURSE OBJECTIVES:**

- To determine the dimensions of a mechanical components subjected to static loads using theories of elastic failure.
- To design the dimensions of keys and rigid couplings and compute the dimensions of a component subjected to fatigue loads for infinite life.
- To design the size of a bolt and a weld bead in bolted and welded joints subjected to axial and eccentric loads
- To determine the width of a flat belt drive and design cylinder for IC engine.
- To design the dimensions of connecting rod and crankshaft.
- To design major dimensions of spur and helical gears for dynamic loads, bending strength and wear.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO1: Determine the dimensions of shafts and other mechanical components subjected to static loads using theories of elastic failure.

CO2: Design the dimensions of keys and rigid couplings and compute the dimensions of a component subjected to fatigue loads for infinite life.

CO3: Design the size of a bolt and a weld bead in bolted and welded joints subjected to axial and eccentric loads.

CO4: Determine the width of a flat belt drive and design cylinder for IC engine.

CO5: Design the dimensions of connecting rod and crankshaft.

CO6: Design major dimensions of spur and helical gears for dynamic loads, bending strength and wear.

UNIT – I

Introduction: General considerations in machine design, Design process, types of machine design.

Design Against Static Load:

Combined Torsional and bending stresses, eccentric loading, various theories of elastic failure.

Shafts: Design of solid and hollow shafts for strength and rigidity, Design of shafts for combined torsion and bending loads.

UNIT – II

Keys and Shaft Couplings: Design of Sunk key, Stresses in keys, Rigid couplings: Muff, and flange couplings.

Design Against Fatigue Load:

Stress concentration, Theoretical stress concentration factor, Fatigue stress concentration factor, Notch sensitivity – Design for fluctuating stresses, endurance limit, estimation of endurance strength, Goodman line, Soderberg line.

UNIT – III

Welded Joints: Design of welded joints with initial stresses, Strength of transverse fillet welded joints, Strength of parallel fillet welded joints, welded joints subjected to eccentric loading

Bolted Joints: Design of bolted joints under eccentric loading – Bolts of uniform strength.

UNIT – IV

Belt Drives: Types of flat belt drives, ratio of belt tensions, power transmitted, centrifugal tension, initial tension, design of belt width or thickness of flat belt drive.

Design of Engine Cylinder: Cylinder wall, Cylinder head, Studs for cylinder head.

UNIT – V

Design of Connecting Rod: Buckling of connecting rod, cross-section of connecting rod, Big and small end bearings, Big end cap and bolts, check for whipping stress.

Design of Crankshaft: Centre crankshaft at TDC position, Centre crankshaft at angle of maximum torque.

UNIT-VI

Design of Spur Gear Drives: Force analysis on spur gear tooth, Gear blank design, module and face width, Beam strength of gear tooth, Effective load on gear tooth, Estimation of module based on beam strength, Wear strength of gear tooth, Estimation of module based on wear strength,

Design of Helical Gear Drives: Force analysis on helical gear tooth, Beam strength of helical gears, Effective load on gear tooth and Wear strength of helical gears.

TEXT BOOKS:

1. Machine Design, V.B. Bhandari, Tata McGraw Hill Publications,
2. Machine Design, R.S. Khurmi, J.K. Gupta, S. Chand Publications,
3. Machine Design Data Book, V.B. Bhandari, Tata McGraw Hill Publications.

REFERENCES BOOKS:

1. Machine Design, Allen Strickland Hall, A. Holowenko, Herman G. Laughlin, Schaum Series, Tata McGraw Hill Publications,
2. Shigley's Mechanical Engineering Design, Joseph E Shigley, Tata McGraw Hill Publications,
3. Machine Design, N.C. Pandya, C.S. Shah, Charotar Publications,
4. Machine Design, P.C.Sharma, D.K.Aggarwal,S.K.kataria & sons Publications,
5. Design of Machinery by Robert.L.Norton, McGraw-Hill Publications

KINEMATICS & DYNAMICS OF MACHINERY

Subject Code: 20MET309

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand different mechanisms, machines and their constraints.
- To get clear idea about planar mechanisms and to determine velocity and acceleration of different parts in a given mechanism by using graphical as well as analytical techniques.
- To provide the tools necessary for kinematic and dynamic analysis of mechanisms and machines.
- To provide skills necessary to consider the role of dynamics in the design of machines.

COURSE OUTCOMES:

On completion of this course, students should be able to

- CO1:** Differentiate Kinematic link, pair, mechanism, and machine; also explain the inversions of mechanisms.
- CO2:** Determine the velocity and acceleration of links in simple planar mechanisms
- CO3:** Determine the interference, contact ratio, angle of action, and sliding velocity of involute gears and calculate the train value of simple, compound and epicyclic gear trains.
- CO4:** Perform dynamic force analyses of slider crank mechanism and determine the coefficient of fluctuation of speed in flywheels.
- CO5:** Explain working principles of centrifugal governors and classify braking system
- CO6:** Explain and determined the effect of gyroscopic couple on ships, automobiles and airplanes.

UNIT-I

Mechanisms: Kinematic Link, Classification: Rigid Link, Flexible and Fluid link, Constrained motion: Completely, Partially or successfully constrained, incompletely constrained, classification of kinematic pairs, Kinematic chain, Mechanism and machine, Inversions of Four bar and Single slider crank chain and Isomorphism.

UNIT-II

Velocity and Acceleration Analysis of Mechanisms: Velocity and Acceleration analysis of four bar, single slider crank, crank and slotted lever quick return motion mechanisms. Kennedy's theorem–Determination of instantaneous centre, determination of angular velocity of various links in a four bar and slider crank mechanisms.

UNIT-III

Gears: Toothed gears, Types, Law of gearing, Expressions for arc of contact and path of contact, Phenomenon of interference, condition for minimum number of teeth to avoid interference.

Gear Train: Introduction, Train value, Types – Methods of finding train value or velocity ratio for simple, compound, reverted and epicyclic gear train.

UNIT-IV

Static & Dynamic Force Analysis: Static and dynamic force analysis of slider crank mechanism.

Fly Wheels: Turning moment, turning moment diagrams – Determination of coefficient of fluctuation of energy and fluctuation of speed.

UNIT-V

Governors: Watt, Porter, Proell and Hartnell governors Sensitiveness, isochronism and hunting.

Brakes: Classification of Brakes, Block /shoe brake, Band Brake, Differential band brake.

UNIT-VI

Gyroscopes: Gyroscopic forces, planes and couple – Gyroscopic effects in airplane, naval ship and four wheeled automobile.

TEXTBOOKS:

1. Theory of Machines and Mechanisms, S.S.Rattan, Tata McGrawHill Publications,
2. Theory of Machines, R.S Khurmi, J.KGupta, S.Chand Publications,

REFERENCESBOOKS:

1. Theory of Machines, P.L.Ballaney, Khanna Publications,
2. Theory of Machines, R.KBansal, Laxmi Publications,
3. Theory of Machines, Sadhu Singh, Pearson Publications,
4. Theory of Machines, John Joseph Uicker, G.R.Pennock, Joseph Edward Shigley, Oxford Press Publications.

MANUFACTURING TECHNOLOGY - II**Subject Code: 20MET310**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide basic knowledge on different machines like lathe, shaper, and planner.
- To provide clear information on cutting tool geometry.
- To provide basic concepts of limits, fits, tolerances and gauge design.

COURSE OUTCOMES:

On completion of this course, students should be able to

- CO1:** Assess machinability of different materials using specific cutting forces and surface finish. Explain theory of metal cutting including cutting tool geometry, materials, life and wear.
- CO2:** Describe basic parts and various operations performed on lathe. Explain the mechanisms used in various special purpose lathes.
- CO3:** Discuss parts, working principles, operations and applications of shaping, slotting, planning machines.
- CO4:** Discuss about working principles, operations and applications of milling, drilling, broaching and grinding machines.
- CO5:** Explain gear cutting, gear forming, gear generation, gear shaping and gear hobbing.
- CO6:** To gain knowledge in measuring techniques and instruments, limits and limit gauges, go and no-go gauges, and some of the gauges used in inspection of mechanical parts in Industry.

UNIT-I

Theory of Metal Cutting: Introduction, Material removal processes, Types of machine tools – Theory of metal cutting, Cutting tool geometry, Chip formation – Orthogonal cutting, Merchant's Force diagram – Cutting tool materials, Tool wear, Tool life, Surface finish – Cutting fluids.

UNIT-II

Centre Lathe: Constructional features, Various operations, Taper turning methods, Thread cutting methods – Special attachments, Machining time and power estimation.

Special Purpose Lathes: Capstan and turret lathes, Automats, Single spindle, Swiss type, Automatic screw type, Multi spindle, Turret Indexing mechanism, Bar feed mechanism.

UNIT-III

Reciprocating Machine Tools: Working principles of planer, shaper and slotter. Differences and similarities among them, Quick Return Mechanism applied to the machines, Operations performed, Work holding devices, machining time calculations.

UNIT-IV

Milling, Drilling and Allied Operations, Broaching: Types, Milling cutters, Operations, Indexing – Hole making, Drilling Quill mechanism, Reaming, Boring, Broaching machines, Broach construction, Push, Pull, Surface and Continuous Broaching machines.

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UNIT-V

Abrasive Processes and Gear Cutting: Abrasive processes, Grinding wheel, Specifications and selection, Types of grinding processes, Cylindrical grinding, Surface grinding, Centreless grinding – Honing, Lapping, Super finishing, Polishing and Buffing, Abrasive jet machining, Gear cutting, Forming, Generation, Shaping, Hobbing.

UNIT-VI

Systems of Limits and Fits: Introduction, Nominal size, Tolerance limits, Deviations, Allowance, Fits and their types, Unilateral and bilateral tolerance system, Hole and shaft basis systems, Interchangeability and selective assembly.

Limit Gauges: Taylor's principle – Design of go and no-go gauges, plug ring, snap, gap, taper, profile and position gauges.

TEXT BOOKS:

1. A Textbook of Production Technology: Manufacturing Processes by P C Sharma, Published by S Chand & Co Ltd., India.
2. Manufacturing Technology - Metal Cutting and Machine Tools, By P.N. Rao; Tata – McGraw – Hill.

REFERENCES BOOKS:

1. Production Technology, R.K. Jain, S.C. Gupta, Khanna Pub.
2. Workshop Technology Vol-II, B.S. Raghuvanshi, Khanna Pub.
3. Metal Cutting Principles, Milton C Shaw, CBS Pub.
4. Metal Cutting and Machine Tools, Geoffrey Boothroyd, CRC Press.

CAD/CAM
(Professional Elective –I)

Subject Code: 20MEE311

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To develop basic knowledge on computer aided drafting and modeling.
- To provide knowledge on computerized numerical control, process planning & manufacturing systems.

COURSE OUTCOMES:

On completion of this course, students should be able to

- CO1:** Describe CAD devices and software, graphic standards.
- CO2:** Understand the wireframe and surface models and develop mathematically synthetic curves and surfaces including Bezier curves, Bezier surfaces and NURBS.
- CO3:** Understand Boundary Representation (B-rep) and Constructive Solid Geometry (CSG) solid modeling methodologies. Apply 2D & 3D transformations and inverse transformations.
- CO4:** Describe computer aided manufacturing processes and write simple CNC programs to perform different operations like turning and milling.
- CO5:** Explain group technology concepts in production to facilitate cellular manufacturing and develop automated process plans using variant and generative approaches.
- CO6:** Differentiate steps involved in migrating from conventional manufacturing to FMS.

UNIT-I

Product Life Cycle: CAD tools, CAD systems, Benefits of CAD – Working and Screen coordinate systems, Image drawing techniques, Random Scan and Raster Scan.

UNIT-II

Wireframe and Surface Modeling: Wireframe models, Types and mathematical parametric representation of analytic and synthetic curves, Surface models, Types and mathematical parametric representation of analytic and synthetic surfaces.

UNIT-III

Solid Modeling: Solid models, Solid entities, Solid representation, Fundamentals of solid modeling, Introduction to Boundary Representation and Constructive Solid Geometry.

2D And 3D Transformations: Geometric Transformations, Transformations of geometric models, Problems on 2D & 3D Transformations, Homogeneous Transformations.

UNIT-IV

NC/CNC: Definition of NC,CNC & DNC, Basic components of NC systems, Types of NC control systems, Applications of NC, NC part programming, Simple CNC part programming.

CAM: Definition of CAM, Tool Path Simulation and CNC program generation procedure in CAM.

UNIT-V

Group Technology: History of Group Technology (GT), Role of GT in CAD/CAM integration, Part families, Classification and coding: MICLASS and OPITZ coding systems – Benefits of GT – Cellular manufacturing, Rank Order Clustering (ROC) method.

Process Planning: Role of process planning in CAD/CAM integration, Approaches to computer aided process planning, Variant approach and generative approaches.

UNIT-VI

Flexible Manufacturing Systems: Definition of FMS, Components, Classification, Work station types, Functions of material handling and storage systems, FMS layout configuration, CIM control system and its functions, applications and benefits.

Introduction To Rapid Prototyping: Fundamentals of Rapid Prototyping Techniques, Definitions, Advantages, Working Principles and Applications.

TEXT BOOKS:

1. CAD/CAM Theory and Practice, Ibrahim Zeid, Tata McGraw Hill Publications, 2nd Edition.
2. Automation, Production Systems & Computer Integrated Manufacturing, M.P. Groover, PHI Publications, 4th Edition.
3. Mathematical Elements for Computer Graphics, Rogers and Adams, Tata McGraw Hill Publications, 2nd Edition.
4. Rapid Prototyping, M.Adithan, Atlantic Publishers & Distributors Pvt Ltd, 1st Edition.

REFERENCES BOOKS:

1. CAD/CAM, M.P. Groover, Emory Zimmers, Pearson Education Publications, 1st Edition.
2. CAD/CAM Principles & Applications, P. N. Rao, Tata McGraw Hill Publications, 3rd Edition.
3. Computer Control of Manufacturing System, Yorem Koren, Tata McGraw Hill Publications, 1st Edition.
4. CAD/CAM/CIM, P. Radhakrishnan, S. Subramanyan, V. Raju, New Age International Publications, 3rd Edition.

AUTOMOBILE ENGINEERING
(Professional Elective –I)

Subject Code: 20MEE312

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide broad knowledge about the engine, fuel-supply systems, cooling systems, transmission.
- To provide braking system, steering, suspension and electrical subsystems of an automobile.

COURSE OUTCOMES:

On completion of this course, students should be able to

- CO1:** Explain construction and layout of automobile engine operation, components, types, emissions and pollution standards.
- CO2:** Explain the operation of the components involved in both carburetor based and direct fuel injection-based fuel systems.
- CO3:** Explain engine cooling systems and Ignition Systems mechanism and types.
- CO4:** Discuss starting, charging electrical systems, electrical accessories and operation of transmission system components including clutch, gearbox, propeller shaft, differential, axles, wheels and tires.
- CO5:** Explain construction and operation of steering and suspension systems.
- CO6:** Explain braking system working, components, types and applications.

UNIT-I

Introduction: Components of four-wheeler automobile – Power transmission – Rear wheel drive, front wheel drive, 4-wheel drive, Layout, Types of automobiles, Emission from Automobiles, Pollution standards

UNIT-II

I.C.Engines: Fuel Supply System

S.I. Engines: Fuel supply systems, Mechanical and electrical fuel pump, fuel filters – Carburetor, Air filters – Petrol injection.

C.I. Engines: Requirements of diesel injection systems, Types of injection systems, Fuel pump, Nozzle, Spray formation, Injection timing.

Electrical Vehicles: Introduction, Components of EV, Power train system, Need for BMS, EV and its applications.

UNIT-III

Cooling System: Cooling requirements, Air cooling, Liquid cooling, Radiators, Types, Engine Lubrication System

Ignition System: Function of ignition system – Battery ignition system: Constructional features of storage, Magneto coil ignition system.

UNIT-IV

Electrical System: Charging circuit, Starting system: Bendix drive mechanism, Solenoid switch – Lighting systems, Horn, Wiper, Engine temperature indicator.

Transmission System: Clutches, Principle, Types, Fluid flywheel – Gear box, Types, epicyclic Gear Box– Propeller Differential rear axles types – Wheels and tires.

UNIT-V

Steering System: Steering geometry: Camber, Castor, King pin rake, Combined angle toe in – Center point steering – Types of steering mechanism

Suspension System: Objective of suspension systems – Rigid axle suspension system, Shock absorber – Independent suspension system.

UNIT-VI

Braking System: Introduction, Working principle, Types – Mechanical braking system – Hydraulic brake system, Requirement of brake fluid, Pneumatic and vacuum brakes. Simple problems on braking systems and applications.

Automobiles Emissions - Pollution standards national and international- pollutants- pollution control – techniques – noise pollution and control.

TEXT BOOKS:

1. Automotive Mechanics Vol-I&II, Kripal Singh, Standard Publications,
2. Automobile Engineering, William H Crouse, Donald L Anglin, McGraw Hill Publications,

REFERENCES BOOKS:

1. Automotive Technology: Principles, Diagnosis, and Service, James D. Halderman, Pearson Publications,
2. Automotive Mechanics, G.B.S. Narang, Khanna Publications,
3. Automotive Mechanics, Joseph Heitner, Van Nostrand Reinhold Publications.
4. Automobile Engineering, S.K. Gupta - S.Chand Publications.
5. I.C.Engines –V Ganesan
6. I.C.Engines – Mathur and Sharma

COMPOSITE MATERIALS
(Professional Elective –II)

Subject Code: 20MEE313

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- Introduce the fundamental concepts of Composites
- Review the basic composite concepts
- Discuss types of composites with interface
- Methods for preparation of composites
- Classification of reinforcement
- Interfacial bonding between matrix and reinforcement

COURSE OUTCOMES

CO1: To understand of classification of matrix materials and reinforcements

CO2: To understand preparation of composites methods and structures

CO3: To synthesize and evaluate interfacial bonding among reinforce and matrix material

CO4: To understand the fabrication techniques of ceramic composites

CO5: To understand and known fabrication methods of fibre reinforced ceramic composites

CO6: To determined the toughening mechanism in the polymer composites

UNIT-I

Introduction: definitions and classifications; natural composites; role of matrix and reinforcement; factors which determine properties; the benefits of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT-II

Reinforcements and the reinforcement matrix interface: natural fibers; synthetic organic fibers – aramid, polyethylene; and synthetic inorganic fibers – glass, alumina, boron, carbon, silicon based fibers; particulate and whisker reinforcements, reinforcement matrix interface – wettability, interfacial bonding, methods for measuring bond strength.

UNIT-III

Metal matrix composites: Introduction, important metallic matrices; metal matrix composite processing: solid state processing – diffusion bonding, powder metallurgy; liquid state processing – melt stirring, compocasting (rheocasting), squeeze casting, liquid infiltration under gas pressure; deposition – spray co-deposition and other deposition techniques like CVD and PVD; in situ processes.

UNIT-IV

Interface reactions. Properties of MMCs – physical properties; mechanical properties like elastic properties, room temperature strength and ductility, properties at elevated temperatures, fatigue resistance. Processing, structure of multifilamentary superconductors, properties of aluminium reinforced with silicon carbide particles.

UNIT-V

Ceramic matrix composites: Introduction; processing and structure of monolithic materials – technical ceramics, glass-ceramics. Processing of ceramics: conventional mixing and pressing – cold pressing and sintering, hot pressing, reaction bonding processes, techniques involving slurries, liquid state processing – matrix transfer moulding, liquid infiltration, sol-gel processing, vapour deposition techniques like CVD, CVI, liquid phase sintering, lanxide process and in situ processes.

UNIT-VI

Polymer Matrix Composites: Introduction; polymer matrices – thermosetting, thermo plastic, rubbers. Processing of PMCs , Processing, properties and applications of fibre-reinforced epoxies, PEEK matrix composites, rubber matrix composites. Damping characteristics. Environmental effects in polymer matrix composites. Recycling of PMCs..

TEXT BOOKS

1. Composite Materials: Engineering and Science, by Matthews and Rawlings, CRC Press, Ed. 1, 2000.
2. Composite Materials Science and Engineering, K.K.Chawla, Springer, New York, NY, Ed.3, 2012.

REFERENCES BOOKS

1. An Introduction to composite material, by D.Hull and T.W. Clyne, Cambridge University press, 2012.
2. Metal Matrix Composites, Thermomechanical Behaviour by M.Taya, and R.J.Arsenault, Pergamon Press, Oxford, England ; New York : Pergamon Press, 1989
3. .Fundamentals of Metal Matrix Composites by S.Suresh, A.Martensen, and A.Needleman, Butterworth, Heinemann, 1993.

TRIBOLOGY
(Professional Elective –I)

Subject Code: 20MEE314

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce Tribology as a significant design consideration that affects the performance of engine and automotive elements.
- To teach different bearing types, modeling and performance considerations
- To familiarize students with different types of lubricants and lubrication processes.
- To introduce concepts of hydrodynamic lubrication.
- To introduce concepts in friction and wear phenomena.

COURSE OUTCOMES:

On completion of this course, students would be able to

CO1: Analyse the contact surface topography.

CO2: Analyse surface parameters and calculate contact pressure, temperature and film thickness simulate wear.

CO3: Understand the types of friction and wear mechanisms and measure them.

CO4: Familiarize with lubrication types, properties and use the suitable lubricant.

CO5: Solve problems on hydrodynamic and hydrostatic lubrication.

CO6: Familiarize with bearing elements, materials, types and applications of tribology.

UNIT-I

Engineering Surfaces Topography of Engineering Surfaces – Surface parameters- Geometric – Statistical parameters – Measurements - Surface contact - Types of contact – Hert’z theory of elastic contact. Surface modification - Transformation hardening - Thermo-chemical process - Laser - Electron beams and Plasma treatment.

UNIT-II

Friction and wear Friction – Laws of friction - Stick-slip phenomenon- Friction characteristics of metals and non-metals - Adhesion and Ploughing theory of friction- Measurement of friction. Wear - Wear mechanisms – Inter-facial wear and Chemical wear-Wear measurements Ferrography and oil analysis.

UNIT-III

Lubricants and Lubrication regimes Types of Lubricants - Physical Properties – Viscosity, Viscosity Index - Testing principles - Lubricant additives. Lubrication regimes- Lambda ratio – Hydrodynamic – Elasto-hydrodynamic - Hydrostatic - Boundary and Solid lubrication.

UNIT-IV

Hydrodynamic Lubrication Fluid film in simple shear – Mechanism of pressure development in a convergent film– Pressure induced and velocity induced flows- Reynolds equation for fluid film lubrication – Long bearing and short bearing approximations- Load carrying capacity - Sommerfield Number – Friction -Thermal equilibrium.

UNIT-V

FILM LUBRICATION THEORY: Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings - Reaction torque on the bearings - Virtual Co-efficient of friction - The Somerfield diagram.

UNIT-VI

Materials and Applications Materials for rolling element bearings - Fluid film bearings - Dry bearings. Technological Applications of tribology - Automotive Tribology.

TEXT BOOKS:

1. Engineering Tribology, Prasanta Sahoo, PHI Learning Private Limited Publications, 1st Edition.
2. Engineering Tribology, W.Batchelor and G.W.Stachowiak, Elsevier Publications, 4th Edition.
3. Fundamentals of Engineering Tribology with Applications, Harish Hirani, Cambridge University Press, 1st Edition.

REFERENCE BOOKS:

1. Friction and Lubrication of solids, Bowden, F.P. & Tabor, D.,(2001), Oxford University press.
2. Tribology, Neale, M.J., ,(1999), Hand Book, Butterworth.
3. Theory and practice of Lubrication for engineers, Fuller D.D., (1999), John Wiley sons.
4. Introduction to Tribology, Bharat Bhushan, (2002), John Wiley and Sons.

FUNDAMENTALS OF FUZZY LOGIC
(Interdisciplinary Elective –II)

Subject Code: 20IET321

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Understand the concepts of fuzzy sets, membership functions and their operations.
- Frame linguistic variables and analyze the fuzzy quantifiers.
- Frame simple fuzzy sets.
- Fuzzify and defuzzify any desired area of classical Mathematics using Fuzzy controllers.
- Understand the concepts of Mamdani Approach & Takagi Sugeno's Approach.

COURSE OUTCOMES:

Student is able to

- CO 1.** Perform different fuzzy operations on fuzzy sets or membership functions.
- CO 2.** Construct linguistic variables and estimate the fuzzy quantifiers as per the requirement.
- CO 3.** Construct a simple Fuzzy set.
- CO 4.** Develop simple Fuzzy expert system to Fuzzify and defuzzify any desired area with suitable controllers using different inference rules.
- CO 5.** Apply Mamdani Approach & Takagi Sugeno's Approach to simple problems.
- CO 6.** Apply Mamdani Fuzzy Model & Takagi Sugeno Model for simple Engineering problems.

UNIT-I

Fuzzy set Theory: Crisp Sets- an overview, Fuzzy sets – membership functions -types of membership functions: Triangular, Trapezoidal, Gaussian-examples. Basic Fuzzy set operations- union, intersection, complement. Properties of Fuzzy Sets. ,

UNIT-II

Fuzzy Relations: Cardinality, operations, properties, fuzzy cartesian product and composition, fuzzy tolerance and equivalence relations, forms of composition operation.

UNIT-III

Fuzzy Logic: Classic and fuzzy logic, approximate reasoning, Natural language, linguistic hedges, Fuzzy propositions, Fuzzy connectives, Fuzzy quantifiers, Fuzzy Inference -fuzzy rule based systems, graphical technique of inference.

UNIT-IV

Construction of Fuzzy sets: Methods of construction –an overview, Direct methods with one expert, Direct methods with multiple experts, constructions from Sample data –examples.

UNIT-V

Fuzzy Expert System –Fuzzification & De-fuzzification: Fuzzy Controllers, Fuzzy Logic Control- Fuzzification- Fuzzy membership values, linguistic Hedges, Fuzzy Logical operators, Fuzzy Inference rules. Defuzzification-Centre of gravity method, centre of sums method, Mean of Maximum method.

UNIT-VI

Fuzzy Expert System- Mamdani Approach & Takagi Sugeno's Approach **with simple examples.**

TEXT BOOKS:

1. Fuzzy Sets and Fuzzy Logic-Theory and Applications, George. J. klir / Bo Yuan, Prentice-Hall of India Pvt Limited.
2. Neural Networks, Fuzzy Logic, and Genetic Algorithms, S.Rajasekharan, G.A.Vijayalakshmi Pai, Prentice-Hall of India Pvt Limited.

REFERENCES:

1. Fuzzy Logic with Engineering Applications, Timothy J.Ross, 3rd edition, John wiley & sons Ltd.

GEOGRAPHICAL INFORMATION SYSTEM
(Interdisciplinary Elective –II)

Subject Code: 20IET322

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To interpret map projections
- To describe GIS components in GIS.
- To discuss data analysis operations in GIS
- To apply the concepts of DBMS in GIS
- To analyze spatial data and modeling in GIS
- To apply GIS in real time applications

COURSE OUTCOMES:

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

- CO 1.** Interpret map projections
CO 2. Describe GIS components.
CO 3. Discuss data analysis operations in GIS
CO 4. Apply the concepts of DBMS in GIS
CO 5. Analyze spatial data and modeling in GIS
CO 6. Apply GIS in real time applications

UNIT – I

Fundamental Concepts of Map: Introduction; Classification of Maps; Scale of maps; Spatial referencing System; Map Projections- Classification; commonly used map projections and their comparisons- Grid systems.

UNIT – II

Basic Concepts of Geographical Information System: Introduction to GIS; components of a GIS; Geo spatial Data: Spatial Data- Attribute data-Joining Spatial and attribute data.

UNIT – III

GIS Operations: Spatial Data Input – Attribute data Management -Data display Data Exploration –Data Analysis.

UNIT – IV

Data Base Management Systems: Introduction - Functions of DBMS; Components of DBMSGIS Data file Management- Simple List, Ordered Sequential Files; Data Base Models Hierarchical Database Models, Network Systems.

UNIT – V

Spatial Data Modeling: Introduction; stages of GIS data modeling; Graphical representation of Raster data, Graphical representation of Vector data; Raster GIS Model, Vector GIS Model.

UNIT – VI

Applications of GIS: Land use and Land cover, agriculture, forestry, geology, urban applications, flood zone delineation and mapping.

TEXT BOOKS:

1. Peter A Burrough, Rachael A. Mc Donnell and Christopher D. Lloyd (2016), Principles of Geographical Information Systems, 3rd edition, Oxford University Press.
2. M.Anji Reddy(2012), Text Book of Remote Sensing and Geographical Information systems, 4th edition, BS Publications/BSP Books

REFERENCE BOOKS:

1. Chor Pang Lo and Albert K.W. Yeung (2016), Concepts & Techniques of GIS, Pearson Education
2. Kang – tsung Chang (2017), GIS, 4th edition, McGraw-Hill Education

RENEWABLE ENGEGY SOURCES
(Interdisciplinary Elective –II)

Subject Code: 20IET323

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To Outline the concept regarding solar radiation.
- To Outline the concept regarding the collection of solar energy and storage of solar energy
- To Outline the concept regarding different types of wind mills.
- To Outline the concept regarding different types of biomass digesters and geothermal energy conversion.
- To Outline the concept regarding ocean energy conversion
- To Outline the concept regarding direct energy conversion

COURSE OUTCOMES:

After completion of this course the student can able to

CO 1. Define different kind of solar radiation.

CO 2. Understand different methods of collection of solar energy and storage of solar energy.

CO 3. Classify different types of wind mills.

CO 4. Classify different types of biomass digesters and geothermal energy.

CO 5. Classify different types of ocean energy extracting techniques.

CO 6. Distinguish different kinds of direct energy conversion techniques.

UNIT – I

Principles of solar radiation: Role and potential of new and renewable source, the solar energy option, the solar constant, extraterrestrial and terrestrial solar radiation, instruments for measuring solar radiation.

UNIT-II

Solar energy collection, storage and applications: Flat plate and concentrating collectors, Different methods of storage -Sensible, latent heat. Solar Applications- solar heating/cooling technique, solar distillation and, photovoltaic energy conversion.

UNIT-III

Wind energy: Sources and potentials, block diagram, **Types:** horizontal and vertical axis windmills. Types of generators and its parts.

UNIT-IV

Biomass and Geothermal energy: Principles of Bio-Conversion, Anaerobic/aerobic digestion, gas yield. Resources, types of wells, Open loop and closed loop energy conversion.

UNIT-V

Ocean energy: OTEC, Principles utilization, setting of OTEC plants, Tidal and wave energy: Potential and conversion techniques.

UNIT-VI

Direct energy conversion (DEC): Need for DEC, principles of DEC. Thermoelectric generators, seebeck, peltier and joul Thomson effects, MHD generators, principles, hall effect, magnetic flux, principle of MHD, power generation with closed loop MHD systems.

TEXT BOOKS:

1. Non-Conventional Energy Sources /G.D. Rai
2. Renewable Energy Technologies /Ramesh & Kumar /Narosa

REFERENCE BOOKS:

1. Renewable energy resources/ Tiwari and Ghosal/ Narosa.
2. Non-Conventional Energy / Ashok V Desai /Wiley Eastern.
3. Non-Conventional Energy Systems / K Mittal /Wheeler
4. Solar Energy /Sukhame

PRINCIPLES OF COMMUNICATIONS
(Interdisciplinary Elective –II)

Subject Code: 20IET325

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Explain the fundamental concepts of modulation and demodulation of Amplitude modulation and Angle modulation schemes.
- Understand various pulse modulation schemes.
- Compare the different types of Digital communication systems
- Understand various Digital modulation schemes.
- Understand the concept of channel capacity, information theory and Shannon's theorem.

COURSE OUTCOMES:

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

- CO 1.** Determine Modulation Index, Bandwidth and power of AM,DSB- and SSB for the given specifications and also compare various Demodulation techniques of AM.
- CO 2.** Compute Modulation parameters of FM and PM waves as per the given specifications and also compare FM and PM in terms of characteristics and applications.
- CO 3.** Describe Sampling theorem and Compute Nyquist sampling rate for the given signal and also compute Modulation parameters of PAM,PWM and PPM for the given specifications.
- CO 4.** Analyze the PCM,DM and ADM techniques with respect to baud rate bit error rate and also construct the above said signals as per given conditions.
- CO 5.** Determine Modulation parameters of ASK,FSK,PSK, DPSK and QPSK for the given data and also construct the wave forms for the given specifications.
- CO 6.** Differentiate noises in communications systems and compute noise figure as per given specifications.

UNIT - I

Amplitude Modulation: Need for modulation, Types of Amplitude modulation, AM, DSB , SSB , Power and BW requirements, generation and Demodulation of AM.

UNIT-II

Angle Modulation: Frequency & Phase modulations, advantages of FM over AM, Bandwidth consideration, Narrow band and Wide band FM, Comparison of FM & PM.

UNIT-III

Pulse Modulations: Sampling, Nyquist rate of sampling, Sampling theorem for Band limited signals, PAM, regeneration of base band signal, PWM and PPM

UNIT- IV

Digital Communication: Advantages, Block diagram of PCM, Quantization, effect of quantization, quantization error, Base band digital signal, DM, ADM.

UNIT-V

Digital Modulation: ASK, FSK, PSK, DPSK, QPSK.

UNIT-VI

Noise: External noise, Internal noise, noise calculations, noise figure and noise temperature.

TEXT BOOKS:

1. Electronic Communication Systems – Kennedy & Davis, TMH, 4th edition.
2. Digital Communications – Dr. Sanjay Sharma, S.K.Kataria and sons, New delhi, 2015

REFERENCE BOOKS:

1. Communication Systems Engineering – John. G. Proakis, Masoud and Salehi, 2nd Ed. PHI/Pearson, 2004.
2. Digital and Analog Communication Systems – Sam Shanmugam, John Wiley, 2005.

WEBSITE REFERENCES:

1. <https://youtube.com/playlist?list=PLq-Gm0yRYwTgX2FkPVcY6io003-tZd8Ru>
2. <https://youtube.com/playlist?list=PLmA4L9UCzuEMcZv9QxlBoUJHcNFM2LIpf>

JAVA PROGRAMMING
(Interdisciplinary Elective –II)

Subject Code: 20IET326

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- The objective of the course is to teach the basic concepts and techniques which form the Object Oriented Programming Paradigm.
- Well equipped with Java SDK environment to create, debug and run simple Java programs

COURSE OUTCOMES:

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

- CO 1.** Become familiar with the fundamentals and acquire programming skills in the Java language.
- CO 2.** Understand fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods, using class libraries, etc.
- CO 3.** Understand and apply various object oriented features like inheritance, polymorphism to solve various computing problems and take the statement of a business problem and from this determine suitable logic for solving the problem.
- CO 4.** Identify Java's standard packages and the different levels of member access and how they relate to packages and implement error handling techniques using exception handling.
- CO 5.** Explore common issues encountered when creating a cross-platform multi-threaded applications
- CO 6.** Develop efficient Java applets to provide interactive features to web applications.

UNIT – I

Introduction To Java: Evolution of Java, Java Buzzwords, The Java Virtual Machine, An overview of Java- Simple Java Program, Naming Conventions in Java, Data types, Variables, Expressions, Automatic type Conversion, Operators, Control Statements , Input and Output, Arrays, Strings.

UNIT – II

Classes & Objects: Class fundamentals, Declaring Objects, Initializing the instance variables, Access Control, Constructors, Methods in Java- Overloading Methods, Static Methods, Recursion, final keyword, this keyword, garbage collection, finalize() method.

UNIT – III

Inheritance: Inheritance Basics, Types of Inheritance, The Keyword 'super', Final with inheritance.

Polymorphism: Method Overriding, Dynamic Method Dispatch, Abstract Classes.

Interfaces: Interface, Multiple Inheritance using Interface, Abstract Classes vs. Interfaces.

UNIT – IV

Packages: Packages, Different Types of Packages, Access Protection, Importing Packages.

Exception Handling: Exception-handling fundamentals, throw Clause, throws Clause, Types of Exceptions: Built-in Exception, User Defined Exception.

UNIT – V

Threads: Java Thread Model, Main Thread, Creating a Thread and Running it, Terminating the Thread, Creating Multiple Threads, Thread Synchronization, Thread Priorities.

UNIT – VI

Applets: Applet Basics, Applet Life Cycle, A Simple Applet, HTML applet tag, Applet Parameters.

TEXT BOOKS:

1. Herbert schildt (2010), The complete reference, 7th edition, Tata Mc graw Hill, New Delhi.

REFERENCE BOOKS:

1. T. Budd (2009), An Introduction to Object Oriented Programming, 3rd edition, Pearson Education, India.
2. J. Nino, F. A. Hosch (2002), An Introduction to programming and OO design using Java, John Wiley & sons, New Jersey.
3. Y. Daniel Liang (2010), Introduction to Java programming, 7th edition, Pearson education, India.

INTRODUCTION TO DBMS
(Interdisciplinary Elective –II)

Subject Code: 20IET327

L	T	P	C
3	0	0	3

COURSE OBJECTIVES :

- To introduce basic RDBMS concepts, SQL, Database Design and Query processing and also to introduce transaction processing, issues and techniques relating to concurrency and recovery in multi-user database environments, and various Data structures for External Data storage and efficient retrieval.

COURSE OUTCOMES :

Students will be able to:

- CO 1.** Differentiate Database Systems from File Systems and Define the Terminology, Features, Classifications, Characteristics embodied in Database Systems.
- CO 2.** Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.
- CO 3.** Create /Modify the Structure and write optimized SQL Queries to extract and modify information from Tables or Views.
- CO 4.** Apply and tell the concept of Triggers and PL/SQL.
- CO 5.** Apply Normalization techniques and improve the database design by normalization.
- CO 6.** Apply and tell the concept of transaction, concurrency control and file and page organization.

UNIT-I

Database System Applications, History of Database Systems, Database Systems versus file Systems, View of Data: Data Abstraction, Instances, and Schemas, Data Models: The ER Model, Relational Model, Other Data Models, and Database System Structure.

UNIT-II

Database Design and ER diagrams: Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Conceptual Design with the ER Model, Introduction to the Relational model.

UNIT-III

Introduction to SQL, Data types in SQL, DDL commands, DML commands, DCL commands, TCL commands, Aggregative Operators, Views, Integrity constraints, Logical connectives AND, OR, and NOT.

UNIT- IV

Introduction to Nested Queries, Correlated Nested Queries, Set-Comparison Operators, Joins, Triggers, PL/SQL introduction, and example programs on PL/SQL.

UNIT- V

Schema refinement and Normal forms: Problems Caused by Redundancy, Decomposition, Properties of Decomposition, Functional Dependencies, Reasoning about FDS: Introduction to Normalization, First Normal form, Second Normal form, Third Normal form, and Fourth Normal form.

UNIT- VI

Introduction to Transaction, Transaction States-Atomicity, Consistency, Isolation, and Durability properties, Schedule, Serializability, Concurrent Executions, File Organization, and Indexing.

TEXT BOOK:

1. Database System Concepts – Abraham Silberschatz, Korth, McGraw hill, 7th Edition, 2021
2. Fundamentals of Database Systems - Elmasri, Navrate, Pearson Education, 7th Edition, 2017

REFERENCE BOOKS:

1. Database Management Systems - Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill, 3rd Edition, 2014.

Web links:

1. <https://www.javatpoint.com/dbms-tutorial>
2. <https://www.javatpoint.com/dbms-sql-introduction>

COMPETITIVE PROGRAMMING-II
(Interdisciplinary Elective –II)

Subject Code: 20IET329

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Understanding importance of Mathematics and Problem solving approaches for Programming
- Understanding importance of optimized solution for problem solving

COURSE OUTCOMES:

After completion of the course, the students will be able to

- CO 1.** Analyze the problem using Mathematics
CO 2. Develop solution using Dynamic linear Data structures
CO 3. Select appropriate Sorting /Searching technique to solve the Problem
CO 4. Develop solutions using stack and queue
CO 5. Develop solutions using Non-Linear Data Structures
CO 6. Develop Solution to problems using Dynamic Programming.

UNIT – I

Number Theory: Modular arithmetic, exponentiation ,Modular exponentiation, Greatest Common Divisor, Extended Euclidean algorithm, Modular multiplicative inverse, Prime Number, Sieve of Eratosthenes.

Problems to Practice: Factorial Trailing Zeroes, Happy Number, Ugly Number, Smallest Integer Divisible by K, Prime Arrangements, Poor Pigs, Check If It Is a Good Array, Rabbits in Forest

UNIT – II

Linked List: Singly Linked List, Doubly Linked List and Circular Linked List and Josephus Circle problem

Problems to practice: Add Two Numbers, Swap Nodes in Pairs, Rotate List, Palindrome Linked List, Linked List Cycle, Remove Duplicates from Sorted List

UNIT – III

Sorting: Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quicksort and Count Sort.

Searching: Linear Search and Binary Search

Practice Problems: Find Peak Element, Guess Number Higher or Lower, Koko Eating Bananas, Find Minimum in Rotated Sorted Array, Sort Colors, Largest Number, Pancake Sorting, Valid Anagram.

UNIT – IV

Stacks and Queues: Implementation in Array and Linked list and classic problems on Stacks and Queues.

Problems to practice : Min Stack, Valid Parentheses, Trapping Rain Water, Largest Rectangle in Histogram, Asteroid Collision, Simplify Path, Next Greater Element I, Online Stock Span, Implement Stack using Queues

UNIT – V

Trees : Terminology of Tree concept, Types of Trees ,Tree traversal and Binary Search Tree.

Graphs: Terminology, Representation of Graph, Graph Traversal DFS and BFS

Problems to Practice: Word Ladder, Shortest Path in Binary Matrix, Rate In Maze.

UNIT – VI

Dynamic Programming :Introduction, Bottom up DP, Top Down DP, Coin Change Problem, Road Cutting problem, Egg dropping problem, 0/1 Knapsack problem, Longest common Sub Sequence problem.

TEXT BOOK:

1. T.H. Cormen et.al. – Introduction to Algorithms – PHI, New Delhi, 2005.
2. E. Horowitz. et.al., Fundamentals of computer Algorithms, Universities Press, 2008, 2nd Edition.

REFERENCE BOOKS:

1. G.Brassard & P. Bratley – Fundamentals of Algorithms, PHI, New Delhi, 2005.
2. S.Dasgupta et.al. – Algorithms, TMH, New Delhi – 2007.
3. Silberschatz, Korth :Database System Concepts. McGraw hill,5th Edition.
4. Elmasri, Navrate:Fundamentals of Database Systems. Pearson Education,6th Edition

REFERENCE LINKS :

1. <https://leetcode.com/problems/>
2. <https://nptel.ac.in/courses/106106131/>
3. <https://www.spoj.com/problems>

3D MODELING LAB

Subject Code: 20MEL307

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To provide knowledge on different CAD software.
- To provide knowledge of modelling tools for creating solid and surface models.

COURSE OUTCOMES :**CO1:** Design 3D models using operations like extrude, revolve, shell, sweep etc.**CO2:** Design 3D models using features like move, pattern, mirror, fillet, chamfer etc**CO3:** Assemble individual 3D components using various assembly constraints**CO4:** Develop Exploded views from the modeled assembly drawing.**CO5:** Create 2D surfaces using simple surfacing operations.**CO6:** Draft 3D models to create 2D drawings including various views

Introduction to computer aided sketching (2-D drawings): Introduction to sketcher workbench (Any Two) Profile tool bar, circle tool bar, predefined profile tool bar, constrained definition, Operation Tool bar, Re-limitations Tool bar

Part Design: Introduction to part design workbench (Any Five)

Sketched based features: Pad, Pocket, Shaft, Groove, Hole, Rib, slot, Stiffener, Multi-sections Solid, And Constraints Dress-Up Features: Edge Fillet, Chamfer, Draft Angle, shell, Thickness, Remove Face.

Transformation features: Translation, mirror, rectangular pattern, circular pattern, scaling etc.

Assembly Design: Introduction to Assembly design workbench (Any Two)

Importing of Parts & Products, Types of Assembly: Top down Assembly, Bottom-Up Assembly

Assembly Constraints: Manipulation, Fix Component Constraint, Coincidence Constraint, Contact Constraint, Offset Constraint, Angle Constraint.

Wireframe and Surface Design: Introduction to Wireframe and Surface design workbench (Any one)

Drafting: Introduction to drafting workbench (Any Two)

Drafting Approach, View Creation, Dimensioning, Geometry modification, Editing Option

Note: Use any of following modeling software: CATIA, Unigraphics, Solid works.

To create the following models Using CATIA V5 Software

1. Develop 3D model of a Support, Clamp [CO-1]
2. Develop 3D model of a Bearing, Bracket. [CO-1]
3. Develop 3D model of a Body, Foot [CO-1]
4. Develop 3D model of a Stop, Angle [CO-1]
5. Develop 3D model of a Elbow pipe. [CO-1]
6. Develop 3D model of a Stud Component. [CO-2]
7. Develop 3D model of a Cover. [CO-2]
8. Develop 3D model of a Helical Gear. [CO-2]

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|-----|----------------------------------------------------------------------------------------------|--------|
| 9. | Develop 3D model of a Nozzle Vacuum cleaner | [CO-2] |
| 10. | Assemble the 3D components of Cam Shaft | [CO-3] |
| 11. | Assemble the 3D components of Flange coupling | [CO-4] |
| 12. | Assemble the 3D components of Universal Joint. | [CO-4] |
| 13. | Develop 3D model of a Water Mug | [CO-5] |
| 14. | Develop the Part drawing for Stud Component in the form of orthographic and isometric views. | [CO-6] |

MACHINE TOOLS & METROLOGY LAB**Subject Code:20MEL308**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To provide knowledge and hands on experience with various metal cutting machines and Metrology.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO1: Generate plain and tapered steps using turning operations on lathe machine.

CO2: Develop threads and knurled surfaces by using lathe machine.

CO3: Perform drilling, Tapping slotting, shaping, Planning operations using respective machines.

CO4: Operate milling machine and produce various milled surfaces.

CO5: Create smooth surface by using surface grinding machine.

CO6: Measure length, diameter, bore, angle, taper, flatness using various instruments and Measure gears and thread by mechanical methods. Use toolmakers microscope for optical measurements.

MACHINE TOOLS LAB**LIST OF EXPERIMENTS:**

1. Introduction of general purpose machines – Lathe, Drilling machine, Shaper, Planing machine and grinding machine. Slotting machine, Cylindrical Grinder, Surface grinder, Tool and Cutter grinder.
2. Step turning, 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.

METROLOGY LAB**LIST OF EXPERIMENTS:**

1. Measurement of lengths, heights, diameters by vernier calipers micrometers.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, vernier calipers and checking chordal addendum and chordal height of spur gear.
4. Tool makers microscope and its application.
5. Angle and taper measurements by Bevel protractor, Sine bars.
6. Use of spirit level in finding the flatness of surface plate.

KINEMATICS AND DYNAMICS OF ROBOT MANIPULATOR
(Honors /Minor Degree Course)

Subject Code: 20ROI302

L	T	P	C
3	0	2	4

COURSE OBJECTIVES:

- The course is aimed at providing concepts and programming skills of robotics motion and control.
- In this subject, the fundamental concepts and numerical methodologies with programming are introduced for understanding the transformations of industrial robots; then, they will acquire fundamental knowledge and competences of the subject.
- This course will help in understanding the evolving concepts of kinematics, dynamics and trajectory generation from their underlying physical and numerical principles and properties with programming skills.
- This course recognizes the synergistic combination of all related branches of engineering and have adequate multi-disciplinary knowledge and conceptual skills

COURSE OUTCOMES:

The student will be able to:

CO1: Understand the fundamental transformations and rotation matrices of robot.**CO2:** Comprehend and apply the concepts of direct kinematics with matrix methods and D-H Notations for various applications.**CO3:** Understand and apply the concepts of Inverse Kinematics with matrix methods for various robots.**CO4:** Understand and apply the knowledge for the generation of trajectory planning and tasks.**CO5:** Understand and gain the knowledge on differential motion and statics.**CO6:** Describe and discuss the basic fundamentals of robot dynamics with application of different formulations.

UNIT – I: Coordinate Frames and Transformations, Coordinate frames, Description of objects in space, Transformation of vectors, inverting a Homogeneous transform, Fundamental rotation Matrices.

Exercise I: Build a robot by adding body parts and joints and Assign values and then perform the transformation operation.

UNIT – II: Degrees of freedom and mobility, Rotation representation, Coordinate transformations, DH parameters, Structure & Notations, D-H Notation, Direct Kinematics, Problems.

Exercise II: Perform the operation by calculating and visualizing the forward kinematics problem

UNIT – III: Introduction to Inverse Kinematics, Structure & Notations, Matrix methods for Inverse transformations, Problems.

Exercise III: Perform the operation by calculating and visualizing the inverse kinematics problem. Apply DH technique

UNIT – IV: Trajectory Planning and Generation, Definitions and Planning Tasks, Joint & Cartesian Space Techniques, Joint-Space versus Cartesian Space trajectory planning.

Exercise IV: Generate a trajectory to connect waypoints for a robot

UNIT – V: Differential Motion & Statics: Linear and Angular Velocities of Rigid Body and its Relationships, Mapping and Propagations along Links, Jacobian and Inverse Jacobian, Singularities and Static Analysis.

Exercise V: Compute Jacobian system for any given robot

UNIT – VI: Mechanics and Lagrangian Dynamic Models – 2DOF, Lagrangian - Euler and Newton – Euler Formulations, Comparisons, Inverse Dynamics.

Exercise VI: Generate matlab code for given robot dynamics problem

TEXT BOOKS:

- Craig, J. J., Introduction to Robotics: Mechanics and Control, Pearson, 3rd Edition, 2004.
- R.K. Mittal & I.J. Nagrath, “Robotics & Control” TMH-2007.
- Groover. M.P. Industrial Robotics, technology, programming and application Mc-Graw Hill 2012.

REFERENCES:

- K.S Fu, R.C. Gonzalez, C.S.G. Lee, Robotics, McGraw Hill, 1987.
- Asada, H., and J. J. Slotine. Robot Analysis and Control. New York, NY: Wiley, 1986. ISBN: 9780471830290.

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Subject Code: 20HST302

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide the basic knowledge of economics.
- To develop the ability of forecasting.
- To the Right understanding of Production Analysis.
- To create an awareness about the market conditions.
- To develop the knowledge of Capital Investment.
- To provide the basic knowledge of accounting.

COURSEOUTCOMES:

On completion of this course, students should be able to

CO1: Learn demand analysis, demand determinants and law of demand.

CO2: Understand demand forecasting and its governing factors.

CO3: Understand theory of cost analysis and production.

CO4: Understand market structures and types of market competition.

CO5: Understand the how to Invest the Capital.

CO6: Understand financial accounting including double-entry book keeping, journal, ledger and final accounts.

UNIT-I

Introduction to Managerial Economics: Definition, nature and scope of managerial economics.

Demand Analysis: Demand determinants, Law of demand and its exceptions. **Elasticity of**

Demand: Definition, Types of Elasticity, and Types of Price Elasticity.

UNIT-II

Demand Forecasting: Factors governing demand forecasting – Methods of demand forecasting: Survey methods, Statistical methods, Expert opinion method, Test marketing, Controlled experiments, Judgmental approach to demand forecasting.

UNIT-III

Theory of Production and Cost Analysis: Production function –One variable input Isoquants and Isocosts, MRTS, Least cost combination of inputs – Cobb-Douglas production function, Laws of returns.

Cost Analysis: Cost concepts – Break-Even Analysis (BEA), Determination of break-even point (simple problems), Managerial significance and limitations of BEA.

UNIT-IV

Introduction to Markets: Market structures, Types of competition, Features of perfect competition, Monopoly and monopolistic competition and Price determination.

UNIT-V

Capital Budgeting: Project evaluation techniques-Traditional, modern Methods. Payback, ARR, and CVP methods.(Simple problems).

UNIT-VI

Introduction to Financial Accounting: Double-Entry book keeping, Journal, Ledger, Trial Balance Final accounts (Trading account, Profit and loss account, and Balance sheet (with simple adjustments). **Introduction to Ratio Analysis: Different types of Ratio Analysis with simple problems.**

TEXT BOOKS:

1. Managerial Economics and Financial Analysis, S.A. Siddiqui, A.S. Siddiqui, New Age Publications,
2. Managerial Economics, Varshney, Maheswari, Sultan Chand Publications.

REFERENCEBOOKS:

1. Managerial Economics and Financial Analysis, A.R. Aryasri, Tata McGraw Hill Publications,
2. Managerial Economics, D. N. Dwivedi, Vikas Publications,
3. DR. SB. Nageswara Rao, "Marketing Management" Walnutpublications.com, Bhubaneswar-2021.

HEAT AND MASS TRANSFER

Subject Code: 20MET311

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To present a problem oriented in depth knowledge of heat and mass transfer
- To transfer the knowledge on heat transfer mechanisms - conduction, convection and radiation
- To transfer the knowledge on design of heat transfer equipment's - fins and heat exchangers
- To transfer the knowledge on method of reducing radiation heat transfer
- To address the underlying concepts, methods and applications of heat and mass transfer

COURSE OUTCOMES:**On completion of this course, students would be able to**

- CO1:** Classify the heat transfer problems and to apply the principles of steady state one dimensional conduction heat transfer of Cartesian, cylindrical coordinate systems
- CO2:** Evaluate the proper length of the fin, effectiveness and efficiency of heat transfer
- CO3:** Analyse the Unsteady state heat conduction through lumped heat parameter analysis and semi-infinite body using Heisler charts.
- CO4:** Evaluate the natural and forced heat transfer coefficient for laminar & turbulent flow over the flat plate and laminar & turbulent flow through pipe
- CO5:** Design the heat exchanger by applying LMTD and effective NTU methods
- CO6:** Compute shape factors for radiative bodies of different configurations and evaluate the radiation heat exchange between two or more bodies through electrical analogy

UNIT-I**Basic concepts:** Modes of Heat Transfer; Fourier's law, Newton's law and Stefan Boltzman law.**Conduction-I:** Fourier heat conduction equation – General heat conduction equation in Cartesian, cylindrical – Steady heat Conduction through plane walls, cylinders – Composite systems, Critical radius of insulation for cylinder.**UNIT-II****Conduction-II:** Heat Transfer from Extended Surfaces – Heat dissipation from an infinite long fin, insulated at tip and convection heat transfer from tip of the fin - Efficiency and Effectiveness of fin.**Unsteady state Heat Conduction** – Lumped System and semi-infinite body analysis – Use of Heisler's Charts**UNIT-III****Dimensional Analysis:** Basic concept, Methods of Dimensional analysis-Buckingham π Theorem and method, Rayleigh's method -Discussion of conservative equation and dimensional analysis applied for free & forced convection.**Natural Convection:** Mechanism of Free convection – Velocity and Thermal boundary layer formation – Grashof Number, Prandtl Number and Reynolds Number, Flow over Horizontal and vertical plates

UNIT-IV

FORCED CONVECTION: Basic Concepts, Heat transfer coefficients - External Forced convection–Laminar and Turbulent flow over plates, Internal Forced convection - Laminar and Turbulent flow through pipes

BOILING & CONDENSATION: Boiling, Pool boiling, Regimes of pool boiling – Flow boiling, film and drop wise condensation.

UNIT-V

Heat Exchangers: Types of heat exchangers – Nature of heat exchange, direction of flow, mechanical design, physical state of fluid, Overall heat transfer coefficient –Fouling factor, Heat exchanger analysis: LMTD method & Effectiveness NTU method.

UNIT-VI

Thermal Radiation: Classification of radiative bodies, Laws of radiation: Wein’s law, Stefan-Boltzman law, Kirchoffs law –Shape Factor – Black Body Radiation – Grey body radiation – Electrical Analogy and Radiation shields.

Mass Transfer: Introduction to mass transfer – Modes of mass transfer-concentrations, velocities and fluxes – Fick’s Law of Diffusion, Analogy of mass transfer with Heat transfer

TEXT BOOKS:

1. Heat and Mass Transfer_ *Fundamentals and applications*, Yunus A. Cengel and A.J. Ghajar, McGraw Hill Education
2. Fundamentals of Engineering Heat and Mass Transfer, R.C. Sachdeva, New Age Pub.
3. Heat Transfer Databook, C.P. Kothandaraman, New Age Pub. (**Permitted for Exams**)

REFERENCE BOOKS:

1. Heat and Mass Transfer, D.K. Dixit, McGraw Hill Education
2. Heat and Mass Transfer, P.K. Nag, McGraw Hill Education
3. Heat Transfer, Jack P. Holman, McGraw Hill Education
4. Heat and Mass Transfer, Frank. P. Incropera and David. P. DeWitt, Wiley Pulications
5. Heat and Mass Transfer, Dr. C.P.Arora and Dr. Sadhu Singh, Khanna Publishers

DYNAMIC SYSTEMS & MECHANICAL VIBRATIONS

Subject Code: 20MET312

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To draw the CAM profile for the given follower motion which include uniform velocity, uniform acceleration/retardation and simple harmonic motions.
- To evaluate various cases of balancing of rotating masses and reciprocating masses using graphical or analytical method.
- To determine natural frequencies of free and forced, undamped and damped, single degree of freedom systems which include longitudinal vibrating spring mass systems.
- To determine the whirling speed of single degree of freedom vibrating systems and also determine natural frequencies of free and forced two degree of freedom spring mass systems.
- To compute natural frequencies of torsional vibrating spring mass systems and explain various vibration control strategies.

COURSE OUTCOMES:

On completion of this course, students should be able to

- CO1:** Draw the CAM profile for the given follower motion which include uniform velocity, uniform acceleration/retardation and simple harmonic motions.
- CO2 :** Evaluate various cases of balancing of rotating masses and reciprocating masses using graphical or analytical method.
- CO3:** Determine natural frequencies of free and forced, undamped and damped, single degree of freedom system.
- CO4:** Determine natural frequencies and whirling speed of longitudinal vibrating spring mass systems of single degree of freedom system
- CO5:** Determine natural frequencies of free two degree of freedom spring mass systems.
- CO6:** Compute natural frequencies of torsional vibrating spring mass systems and explain various vibration control strategies.

UNIT-I

Cams: Definitions of cam and followers, Uses, Types of followers and cams, Terminology, Types of follower motion: Uniform velocity, Uniform acceleration, Simple harmonic – Maximum velocity and maximum acceleration during outward and return strokes and Construction of CAM profiles for knife edge and roller followers in the above 3 cases.

Analysis of Motion of Followers: Roller follower, circular cam with straight and curved flanks.

UNIT-II

Balancing of Rotating Masses: Single and multiple masses rotating in single and different planes.

Balancing of Reciprocating Masses: Primary, Secondary and higher balancing of reciprocating masses – Analytical and graphical methods – Locomotive balancing – Hammer blow, Swaying couple, Variation of tractive efforts - Unbalanced forces and couples.

R20 - B. Tech. - ME

UNIT-III

Vibrations of Single Degree of Freedom Systems:

Introduction to Vibrations - Free vibration of single-degree-of-freedom systems - Free Vibration of mass attached to vertical spring & Damper, Harmonically excited vibration.

UNIT-IV

Transverse Vibrations:

Vibration under general forcing conditions -Transverse loads, Vibrations of beams with concentrated and distributed loads – Dunkerley’s methods, Raleigh’s method – Whirling of shafts, Critical speeds

UNIT-V

Vibrations of Two Degree of Freedom Systems:

Free vibration of two degree-of-freedom systems - Free Vibration of mass attached to vertical spring & Damper, Natural frequencies and mode shapes of two degree of freedom..

UNIT-VI

Torsional Vibrations: Two and Three rotor systems.

Vibration Control of Industrial Equipment: Vibration Isolation & Transmissibility of single degree of freedom systems. Vibration control strategies: Force Reduction, Mass Addition, Tuning, Isolation, and Damping.

TEXT BOOKS:

1. Theory of Machines and Mechanisms, S.S. Rattan, Tata McGraw Hill Publications.
2. Theory of Machines, R.S Khurmi, J.K Gupta, S. Chand Publications.

REFERENCES BOOKS:

1. Mechanical Vibrations, Rao, S.S., Addison Wesley Longman, PHI Publications.
2. Textbook of Mechanical Vibrations, V. Rao, Srinivas, J. Dukkupati, 2nd Edition, PHI Publications.
3. Mechanical Vibrations, V.P.Singh, Dhanpatrai & Co. Publications.

ROBOTICS
(Professional Elective –II)

Subject Code: 20MEE321

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- This subject gives the knowledge about the fundamentals of the robotics technology and its wide area of applications in various fields.
- This gives the knowledge about the kinematic and dynamic aspects of the robot construction and designing aspects of the robots.

COURSE OUTCOMES:

On completion of this course, students should be able to

- CO1:** Describe commonly used robot configurations, end effectors, drives along with robotics history and applications.
- CO2:** Describe working principles of various sensors and actuators commonly used in a robot.
- CO3:** Solve forward and inverse kinematic problems of common robot configurations.
- CO4:** Develop robot trajectory planning avoiding obstacles. Solve dynamic problems using Lagrange-Euler and Newton-Euler formulations.
- CO5:** Discuss motion planning and programming robot motions for simple robot applications.
- CO6:** Discuss robot cell design and manufacturing & non-manufacturing applications of robots.

UNIT-I: Introduction to Robotics

Fundamentals of Robotics: Introduction to Robotics & Overview – Historical development of Robotics – Robotics & Automation - Terminology-DOF- Classification of Robots based on Configuration & Control.

Components of Industrial Robots: End-effectors - Types of end-effectors, mechanical grippers - basic definitions and operations, types of gripper mechanisms, gripper force analysis; other types of grippers - vacuum cups, magnetic, adhesive grippers, hooks, scoops, selection and design considerations in gripper.

UNIT-II: Robot Actuators & Sensors

Drive Systems: Classification of actuators, Electric, Pneumatic and Hydraulic actuators, servomotor, DC and AC servomotor, stepper motors.

Sensors: Overview of sensing – Functions of sensing – Types – position sensors: potentiometer, encoders, LVDT - Force and Torque sensors – Optical, Range sensors & Proximity sensors.

UNIT-III: Transformations and Robot Kinematics

Transformations: Introduction – Fundamental transformations – Properties – Homogeneous transformations – Applicable to both 2D & 3D in robotics & Problems

Forward & Inverse kinematic models: Denavit - Hartenberg (D-H) representation for rotational joints – Applicable to forward kinematics & simple Problems – Applicable to Inverse kinematics.

UNIT-IV: Trajectory Planning and Robot Dynamics

Trajectory planning: Introduction – Terminology – Steps in trajectory planning – Trajectory generation & types of trajectory-cubic polynomial and linear trajectory.

Robot Dynamics: – Differential transformations – Jacobian – Singularities – Lagrange- Euler (LE)formulation – Newton-Euler (NE) formulation

UNIT-V: Robot Programming& Motion Planning

Programming: Introduction to robot programming – methods of programming, simple programming using WAIT, SIGNAL and DELAY commands– programming languages.

Motion planning: Types of motions planning schemes– Obstacle avoidance of various graph based approaches like visibility graph, varonol diagram, cell decomposition, tangent graph and accessibility graph.

UNIT VI: Robot Applications, Work Cell Design

Applications: Material transfer - material handling, loading and unloading, processing - spot and continuous arc welding, spray painting, assembly and inspection.

Work Cell Design :Cell layout, types of cell layout, Cell design and modifications.

TEXT BOOKS:

1. Industrial Robotics, M. P. Groover, Pearson Education Publications,
2. Robotics & Control, R. K. Mittal, I. J. Nagarath, Tata McGraw Hill Publications,

REFERENCE BOOKS:

1. Robotics, K. S. Fu, Lee, McGraw Hill Publications,
2. An Introduction to Robot Technology, P. Coiffet, M. Chaironze, Kogam Page Publications, London.
3. Robotic Engineering, Richard D. Klafter, Prentice Hall Publications,
4. Robot Analysis and Intelligence, Asada, Slow time, Wiley Inter-Science Publications,
5. Introduction to Robotics, John J Craig, Pearson Education Publications,
6. Robot Dynamics & Control, Mark W. Spong, M. Vidyasagar, John Wiley & Sons (ASIA) Publications.

REFRIGERATION AND AIR CONDITIONING
(Professional Elective –II)

Subject Code: 20MEE322

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the student to applications of Refrigeration and Air conditioning
- To expose the student to different cycles of Refrigeration such as ideal cycle of Refrigeration, Air Refrigeration cycle, vapour compression Refrigeration cycle, vapour absorption refrigeration
- To provide the students with a proper understanding of Thermoelectric Refrigeration and Vortex tube Refrigeration
- To have an overview of psychrometric processes used in air conditioning
- To provide knowledge on load concepts of RSHF, GSHF, ESHF and ADP

COURSE OUTCOMES:

On completion of this course, students should be able to

- CO1:** Perform thermodynamic analysis on Ideal Refrigeration cycle .
- CO2:** Describe components and analyze COP of vapor compression cycles including sub-cooling and super-heating.
- CO3:** Describe components and analyze COP of vapor absorption cycles. Explain the working of essential components of vapor absorption refrigeration.
- CO4:** Perform thermodynamic analysis on Air Refrigeration cycles like Bell-Coleman cycle.
- CO5:** Explain the working principles of non-conventional refrigeration systems like thermo-electric, vortex-tube and pulse tube refrigeration systems.
- CO6:** Solve problems based on RSHF, GSHF, ESHF and ADP. Calculate air-conditioning cooling load.

UNIT-I:

Introduction to Refrigeration: Necessity and applications – Unit of refrigeration and C.O.P – Types of Refrigeration cycles. Ideal cycle of Refrigeration, Mechanical Refrigeration.

UNIT-II:

Vapour Compression Refrigeration: – working principle and essential components of the plant – simple vapour compression refrigeration cycle – COP – Representation of cycle on T-S, P-h and h.s. charts – effect of sub cooling and super heating – cycle analysis – Actual cycle influence of various parameters on system performance – Use of p-h charts. Refrigerants – Desirable properties – common refrigerants used – Nomenclature. Alternative of Refrigerants, Multi-stage

UNIT-III:

Vapour Absorption Refrigeration System – Working Principle, Essential components, Maximum COP of the Ideal VARS, Description and working of Li Br – Water Absorption Refrigeration System, Aqua- Ammonia Refrigeration System. Three Fluid absorption system - Principle of operation, salient features.

UNIT-IV:

Air Refrigeration : Bell Coleman cycle Actual air refrigeration systems – problems , Need of Refrigeration in Air- crafts. Aircraft Refrigeration systems.

Cryogenics: Liquification of gases – Linde , Claude systems, JT Coolers and Mixed Refrigerants

UNIT-V:

Non-conventional Refrigeration System: Thermo electric refrigeration, Vortex tube refrigeration, Pulse tube refrigeration, Steam jet refrigeration

UNIT-VI:

Need for Ventilation, infiltration – concepts of RSHF, GSHF, ESHF and ADP. – comfort Air conditioning - industrial air conditioning – Air conditioning load calculations for simple application of a small room.

Air Conditioning Systems - classification of Air Conditioning Systems: Summer Air Conditioning System, winter air Conditioning System, Year Round Air Conditioning System, Psychrometric processes used in Summer Air Conditioning System & winter air Conditioning System

TEXT BOOKS:

1. Refrigeration and Air Conditioning, CP Arora, Tata McGraw Hill Publications,
2. Refrigeration and Air Conditioning by R C Arora

REFERENCE BOOKS:

1. Principles of Refrigerations, Dossat, Willey Eastern Pub.
2. Refrigeration and Air Conditioning, Manohar Prasad, New Age Pub.
3. Refrigeration and Air Conditioning, R.S. Khurmi, J.K. Gupta, S.Chand Pub.
4. Refrigeration and Air Conditioning, P.L. Ballaney, Khanna Pub.

TOOL DESIGN
(Professional Elective –II)

Subject Code: 20MEE323

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To gain knowledge on designing of various cutting tools.
- To gain knowledge on designing of jigs and fixtures.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO1: Explain unconventional machining processes and super-finishing processes.

CO2: Design single and multi-point cutting tools.

CO3: Design twist drills as per the nomenclature.

CO4: Design reamers and broches.

CO5: Design press tools including die-sets and plastic tools.

CO6: Design jigs and fixtures for various machine tool operations.

UNIT-I

Classification and coding of carbide tools, Coated tools

Unconventional Machining Processes: Principles of working and applications of USM, EDM, ECM, AJM, LBM, and EBM

Super-finishing Processes: Honing, Lapping Burnishing, Ballizing, Polishing.

UNIT-II

Design of Single-Point Cutting Tools: Form Tools, Design of flat and circular form tools, Tool holding methods.

Design of Multi-Point Cutting Tools: Milling Cutters: Major types, design and manufacturing of peripheral, end and face milling cutters, forces and power estimation, grinding of milling cutters.

UNIT-III

Drills: Twist drill geometry, Design and manufacturing of twist drill – Effect of variation of different angles on torque and thrust forces – Types and design of shanks – Sharpening of twist drill, Design and manufacture of twist drills.

UNIT-IV

Broaches: Pull and Push types. Internal and External broaches, geometry and design and manufacturing of pull type and push type broaches.

Reamers: Types, Geometry, Reaming allowance, Tolerance disposition.

UNIT-V

Design of Press Tools: Die set elements – Design of die set for simple components in Blanking, Piercing, Bending, Drawing, Forging and Spinning.

Plastic Tools: Plastic dies for simple components.

UNIT-VI

Jigs & Fixtures: Design principles and constructional features – Locating methods associated with flat, cylindrical, internal and external surfaces, Types of locating pins, Requirements and choice of locating systems, Redundant location, Fool proofing – Setting blocks, Types of clamping devices and their basic elements, Quick action clamps and nuts.

TEXT BOOKS:

1. Tool Design, Cyril Donaldson, V. C. Goold, Tata McGraw Hill Pub.
2. Production Engineering Design (Tool Design, Surender Keshav, Umesh Chandra, Satya Prakashan Pub.

REFERENCES BOOKS:

1. Design of Cutting Tools, Rodin, Mir Publications, Moscow.
2. Design of Cutting Tool, Use of Metal Cutting Theory, Amitabha Bhattacharya, Inyong Ham, ASTM Pub.

FRACTURE MECHANICS
(Professional Elective –II)

Subject Code: 20MEE324

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide a comprehensive coverage on fundamental concepts of fracture mechanics. He should clearly understand the mechanisms of Griffith theory, LEFM, EPF and failure of forging, castings and weldments. The student should be able to identify the reasons for failure of various components during applications).

COURSE OUTCOMES:

On completion of this course, students should be able to

- CO1:** Explain the failure of the products manufactured through various processes and suggest remedial methods
- CO2:** Describe Griffiths analysis and R curves
- CO3:** Describe linear elastic fracture mechanics and elastic plastic fracture mechanics theories and apply them for fatigue studies
- CO4:** Discuss Elastic-Plastic fracture mechanics theories and apply them for fatigue studies
- CO5:** Understand the failure in forging and Weldments
- CO6:** Estimate reliability of the system and sensitivity of process parameters on quality of the product.

UNIT-I :

Introduction: Prediction of mechanical failure. Macroscopic failure modes; brittle and ductile behaviour. Fracture in brittle and ductile materials – characteristics of fracture surfaces; inter-granular and intra-granular failure, cleavage and micro-ductility, growth of fatigue cracks, The ductile/brittle fracture transition temperature for notched and unnotched components. Fracture at elevated temperature.

UNIT-II :

Griffiths analysis: Concept of energy release rate, G , and fracture energy, R . Modification for ductile materials, loading conditions. Concept of R curves.

UNIT-III:

Linear Elastic Fracture Mechanics (LEFM): Three loading modes and the state of stress ahead of the crack tip, stress concentration factor, stress intensity factor and the material parameter the critical stress intensity factor, crack tip plasticity, effect of thickness on fracture toughness.

UNIT-IV:

Elastic-Plastic Fracture Mechanics;(EPFM): The definition of alternative failure prediction parameters, Crack Tip Opening Displacement, and the J integral. Measurement of parameters and examples of use.

UNIT-V:

Failure of Forging, Casting And Weldments Causes of Failure in Forging like material characteristics, Deficiencies in design, Improper Processing / Fabrication or Deterioration resulting from service conditions.

Failure of Weldments – Reasons for Failure procedure for Weld Failure Analysis.

UNIT-VI:

Reliability: Reliability Concept and Hazard Function, Life Prediction, Condition Monitoring, Application of Poisson. Exponential and Weibull Distribution for Reliability, Bath Rub Curve, Parallel and Series System, Mean Time Between Failures and Life Testing.

TEXT BOOKS:

1. Elements of Fracture Mechanics by Prasant Kumar, Mc Graw Hill Education.
2. Deformation and Fracture Mechanics of Engineering Materials by Richard w.Hertzberg
3. Fracture Mechanics by Robert P Wei, Cambridge University Press
4. David Broek, Elementary Engineering Fracture Mechanics, Springer Netherlands.

REFERENCES BOOKS:

- B. Lawn, Fracture of Brittle Solids, Cambridge Solid State Science Series 2nd ed1993.
1. J.F. Knott, Fundamentals of Fracture Mechanics, Butterworths (1973)
 2. J.F. Knott, P Withey, Worked examples in Fracture Mechanics, Institute of Materials.
 3. H.L.Ewald and R.J.H. Wanhill Fracture Mechanics, Edward Arnold, (1984).
 4. S. Suresh, Fatigue of Materials, Cambridge University Press, (1998)
 5. L.B. Freund and S. Suresh, Thin Film Materials Cambridge University Press,(2003).
 6. G. E. Dieter, Mechanical Metallurgy, McGraw Hill, (1988)
 7. D.C. Stouffer and L.T. Dame, Inelastic Deformation of Metals, Wiley (1996)
 8. F.R.N. Nabarro, H.L. deVilliers, The Physics of Creep, Taylor and Francis, (1995)

INSTRUMENTATION AND CONTROL
(Professional Elective –III)

Subject Code: 20MEE331

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce measurement system and characteristics with errors
- To introduce displacement, acceleration, vibration measuring techniques.
- To introduce force, torque, power and speed measuring techniques.
- To deal with measurement of non-electrical quantities using sensors.
- To introduce concept of control system and PID controllers

COURSE OUTCOMES:

On completion of this course, students should be able to

- CO 1.** Define basic principles of measurement systems, and describe dynamic performance characteristics and sources of error and explain various displacement measuring instruments
- CO 2.** Explain various acceleration, force, torque, power and speed measuring methods and instruments
- CO 3.** Explain various strain, and pressure measuring methods and instruments
- CO 4.** Explain temperature and flow measuring methods and instruments
- CO 5.** Explain humidity and moisture measuring methods and instruments
- CO 6.** Explain various control system methods and PID controllers application

UNIT-I

Introduction: Basic principles and functional descriptions of measuring instruments with example – Dynamic performance characteristics, classification of errors, Error measurement analysis.

Displacement measurement: Resistive, inductive and capacitive transducers to measure linear and angular displacement.

UNIT-II

Measurement of acceleration: principles of seismic instruments, seismic instrument based capacitive and inductive accelerometer and vibrometer.

Force, load, torque and speed measurements: elastic force meters, strain gauge load cell, electrical and strain gauge torsion meters and stroboscope speed measurement.

UNIT-III

Strain measurement: Electrical resistance strain gauges, Gauge factor and measurement of tensile and compressive strains

Pressure measurement: Thermal conductivity gauge, Ionization type pressure gauges, McLeod pressure gauge, Bourdon tubes, Bellows, Diaphragm gauges.

UNIT-IV

Temperature measurement: Expansion, Resistive, Thermocouples, Pyrometers.

Flow measurement: Rota meter, Turbine flow meter, Hot-wire anemometer, Magnetic flow meter, Ultrasonic flow meters

UNIT – V

Humidity: Sling Psychrometer, Recording Type Psychrometer and Absorption Hygrometer.

Moisture: Dew point meter.

UNIT – VI

Control system and controllers: Introduction, Importance, Classification, Open and closed systems with examples. Control system terminology, P, PI, PID Control Algorithms.

RH Stability Criterion, Introduction to Bode Plots.

TEXT BOOKS:

1. Mechanical Measurement & control, Dr.D.S. Kumar, S.K. Kataria & Sons Publications, 4th Edition.
2. Control Systems Engineering, I.J. Nagrath, M. Gopal, New Age Publications, 6th Edition.

REFERENCES BOOKS:

1. Measurement systems: Application and design, Earnest. O. Doebelin, Adaptation by Manik and Dhanesh, Tata McGraw Hill Publications, 6th Edition.
2. Mechanical and Industrial Measurements, R.K. Jain, Khanna Publications, 2nd Edition.
3. A Course in Electrical & Electronic Measurements and Instrumentation, A.K. Sawhney, Dhanpat Rai Publications,
4. Experimental Methods for Engineers, J P Holmann, McGrawHill Publications, 8th Edition.

UNCONVENTIONAL MACHINING PROCESS
(Professional Elective –III)

Subject Code: 20MEE332

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To deliver knowledge on different unconventional machining techniques and their applications.
- To study the mechanism of various unconventional machining processes such as EDM, ECM, USM, abrasive jet machining, water jet machining and abrasive water jet machining.
- Understand the applications of plasma process for machine processes.
- State various parameters influencing the machining process.

COURSE OUTCOMES:

On completion of this course, students should be able to

- CO1:** Describe the need for, and applications of UCMP. Explain the considerations in process selection. Describe USM.
- CO2:** Describe AJM, WJM and AWJM processes along with material removal rate.
- CO3:** Explain ECM processes like honing, deburring, ECG along with material removal rate and mechanics of cutting.
- CO4:** Describe EDM, EDG and Wire EDM processes along with material removal rate and mechanics of cutting.
- CO5:** Describe EBM, LBM and PAM processes along with material removal rate and mechanics of cutting.
- CO6:** Describe ESD and STEM processes along with material removal rate and mechanics of cutting.

UNIT-I

Introduction: Need for non-traditional machining methods – Classification of modern machining processes – considerations in process selection and applications.

Ultrasonic Machining: Elements of the process, mechanics of material removal, MRR process parameters, economic considerations, applications and limitations.

UNIT-II

Abrasive Jet Machining (AJM): Water jet machining, abrasive water jet machining, abrasive flow machining, magnetic abrasive finishing - process parameters, material removal rate, mechanism analysis, process capabilities, abrasive particle size, limitations and applications.

UNIT-III

Electro-Chemical Machining (ECM): Fundamentals of electro chemical machining, electro chemical grinding, Electrochemical honing and deburring process, metal removal rate in ECM, tool design, surface finish and accuracy, economic aspects of ECM.

Chemical Machining (CHM): Fundamentals of Chemical machining, masks, etchants, advantages and applications.

UNIT-IV

Electric Discharge Machining (EDM): General principle and application, Electric Discharge Grinding (EDG) and Wire EDM – Power circuits for EDM, Mechanics of metal removal in EDM, process parameters, selection of tool electrodes and dielectric fluids, surface finish and machining accuracy.

UNIT-V

Electron Beam Machining (EBM) and Laser Beam Machining (LBM): basic principle and theory, process parameters, efficiency and accuracy, applications.

Plasma Arc Machining (PAM): Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industry.

UNIT-VI

Electro Stream Drilling (ESD) Introduction, ESD setup, electrolyte, drilling of curved hole, penetration drilling, dwell drilling, right angle drilling, process performance.

Shaped Tube Electrolytic Machining (STEM) Introduction, construction details, processes parameters, MRR, surface finish.

TEXT BOOK:

1. Advanced Machining Processes, V. K. Jain, Allied Publications.
2. A.Ghosh, A.K.Mallik, Manufacturing Science, EWP.

REFERENCE BOOKS:

1. Modern Machining Process, P.C. Pandey, Tata McGraw Hill Publications
2. Production Technology, HMT, Tata McGraw Hill Publications
3. New Technology, A. Bhattacharyya, Institution of Engineers(India) Publications

COMPUTATIONAL FLUID DYNAMICS
(Professional Elective –III)

Subject Code: 20MEE333

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

On completion of this course, students should be able to

- To introduce Governing Equations of viscous fluid flows
- To introduce numerical modeling and its role in the field of fluid flow and heat transfer
- To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
- To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.
- To create turbulence models and mesh generation

COURSE OUTCOMES:

CO1: Explain the differential equations for flow phenomena and numerical methods for flow solutions.

CO2: Analyze different mathematical models and computational methods used in fluid flow and discuss Taylor series using finite difference.

CO3: Analyze the accuracy of a numerical solution by comparison to known solutions of simple test problems and by elucidating grid generation techniques and mesh refinement.

CO4: Conduct stability analysis of problems related to fluid flows and heat transfer

CO5: Use iterative methods to solve parabolic and hyperbolic equations.

CO6: Evaluate forces in both internal and external flows by solving equations of fluid motion applying the implicit and explicit methods.

UNIT-I

Introduction: History and Philosophy of computational fluid dynamics, CFD as a design and research tool, Applications of CFD in engineering, Programming fundamentals, Numerical Methods

Governing equations: Models of the flow, The substantial derivative, Physical meaning of the divergence of velocity, Physical boundary conditions, Forms of the governing equations suited for CFD, Conservation form of the equations.

UNIT-II

Mathematical behavior of partial differential equations: Classification of quasi-linear partial differential equations, Methods of determining the classification, General behavior of Hyperbolic, Parabolic and Elliptic equations.

Basic aspects of discretization: Introduction to finite differences, Finite difference equations using Taylor series expansion and polynomials, Uniform and unequally spaced grid points. Discussion on adaptive grids

UNIT-III

Finite Difference Method

Finite Differences Introduction, elementary finite difference quotients, implementation aspects of finite-difference discretisation, Discussion on consistency, stability, conservativeness boundedness and transportiveness.

Stability Analysis – Grid independence study, Error analysis, Artificial dissipation and dispersion.

UNIT-IV

Schemes for Elliptic Equations: Finite difference formulation of steady state heat conduction equation. Direct Solution Algorithms- Gauss elimination and Tri-Diagonal Matrix Algorithm

Schemes for Parabolic Equations: Finite difference formulation of unsteady state heat conduction equation. Implicit and Explicit schemes, Iterative Solution Algorithms - Jacobi-iteration method, Gauss-Seidel iteration method

UNIT-V

Schemes for laminar fluid flow equations: Stream function Vorticity formulation

Pressure Velocity Coupling: Staggered grid, Discussion on SIMPLE SIMPLEC algorithm

UNIT-VI

Schemes for turbulent flow: Discussion on RANS, LES and DNS models for turbulent flow

TEXT BOOKS:

1. Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The finite volume Method",
2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill

REFERENCES:

1. Patankar, S.V. "Numerical Heat Transfer and Fluid Flow",
2. Chung, T.J. "Computational Fluid Dynamics",
3. Ghoshdastidar P.S., "Heat Transfer",
4. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer",
5. ProdipNiyogi, Chakrabarty, S.K., Laha, M.K. "Introduction to Computational Fluid Dynamics",
6. Anil W. Date "Introduction to Computational Fluid Dynamics".

NANO MATERIALS
(Professional Elective –III)

Subject Code: 20MEE334

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

- Nano Technology is one of the core subjects of multidisciplinary nature. This has extensive applications in the field of energy, electronics, Biomedical Engg. Etc. Built to specifications by manufacturing matter on the atomic scale, the Nano products would exhibit an order of magnitude improvement in strength, toughness and efficiency.
- The objective here is imparting the basic knowledge in Nano Science and Technology.

COURSE OUTCOMES

- CO1:** To understanding of Nano materials and its application
CO2: To analyze the importance of unique Properties of Nanomaterials
CO3: To determined and estimate the properties of Nanomaterials
CO4: To synthesize and evaluate nanostructure reinforce matrix material
CO5: To provide modelling techniques of Nano composites
CO6: To discuss various fabrication techniques and application

UNIT-I

Introduction: History and Scope, Can Small Things Make a Big Difference / Classification of Nanostructured Materials, Fascinating Nano structures, Applications of Nanomaterials, Nature: The Best of Nanotechnologist, Challenges and Future Prospects.

UNIT-II

Unique Properties of Nanomaterials: Microstructure and Defects in Nanocrystalline Materials: Dislocations, Twins, stacking faults and voids, Grain Boundaries, triple and disclinations, Effect of Nano-dimensions.

UNIT-III

Materials Behavior: Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, enhanced solid solubility, Magnetic Properties: Soft magnetic nanocrystalline alloy, Permanent magnetic nanocrystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties and Mechanical Properties.

UNIT-IV

Synthesis Routes: Bottom up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Sol-gel method, Self assembly.

Characterisation: Spectroscopic Analysis (UV-Visible Spectroscopy), Transmission Electron Microscopy (TEM), Dynamic Light Scattering (DLS), Zeta Potential, Inductively Coupled Plasma Mass Spectrometry (ICP-MS), Dark Field Microscopy, Aerodynamic Particle Sizer (APS).

UNIT-V

Modelling of nano composites: Top down approaches: Mechanical alloying, Nano-lithography, Consolidation of Nanopowders: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressing Spark plasma sintering.

UNIT-VI

Processing of nano composites: Powder metallurgy method, Pressure Infiltration technique, Stir Casting, Nano composites for hard coatings, DLC coatings.

TEXT BOOKS

1. Text Book of Nano Science and Nano Technology — B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, Universities Press (India) Private Limited 2013, Springer, Berlin, Heidelberg, XII, 244.
2. Introduction to Nanotechnology — Charles P. Poole, Jr., and Frank J. Owens, Wley India Edition, 2012.

REFERENCES BOOKS

1. Nano: The Essentials by T.Pradeep, Mc Graw- Hill Education, P.432, 2008.
2. Nanomaterials, Nanotechnologies and Design: An Introduction for Engineers and Architects by Michael F. Ashby, Paulo J. Ferreira and Daniel L.Schodek, ELSEVIER, 2009
3. Transport in Nano structures- David Ferry, Cambridge University press 2000
4. Nanofabrication towards biomedical application: Techniques, tools, Application and impact — Ed. Challa S.,S. R. Kumar, J. H. Carola, Wiley-VCH; 1st edition, 2005
5. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell, CRC Press, 2006.
6. Electron Transport in Mesoscopic systems – S. Dutta, Cambridge University press,2013.

DYNAMICS LAB

Subject Code: 20MEL309

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES

- To understand and verify the laws governing the kinematics and dynamics of machines.
- To understand the effect of gyroscopic couple.
- To understand the function of governors and dynamometers.
- To understand the behaviour of vibration in simple mechanical systems.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO1: Determine gyroscopic couple.

CO2: Test the performance of governors.

CO3: Test for balancing of rotating masses.

CO4: Determine the natural frequencies of vibrating systems and critical speed of rotating shaft.

CO5: Analyze cam profile

CO6: Carry out studies of various gear trains and mechanisms.

LIST OF EXPERIMENTS

1. Determination of gyroscopic couple using gyroscopic test rig.
2. Performance characteristics of a Watt/ Porter governor.
3. Performance characteristics of a spring loaded governor.
4. Performance characteristics of proell governor.
5. Experiment on Rope brake / Band brake dynamometer.
6. Experiment on static and dynamic balancing apparatus.
7. Determination of natural frequencies of un-damped as well as damped vibrating systems.
8. Determination of critical speed of rotating shaft.
9. Experiments using universal vibrating apparatus.
10. Experiment on Cam Analysis Apparatus.
11. Study of various gear trains.
12. Study of various mechanisms

Note: Any 10 experiments can be performed.

HEAT TRANSFER LAB

Subject Code:20MEL310

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

The course content enables students to:

- Impart experimental experience in Heat Transfer Lab those support Mechanical Engineering.
- Provide students with an opportunity of direct experience of doing Heat Transfer Lab calculation so that they can understand the basic principles and will be able to make a critical assessment of industrial environment.
- Teach the students fundamentals of Heat Transfer & its application, so as to identify, formulate and solve the problems of Heat Transfer device designs.
- Develop an idea about how to measure heat transfer coefficients/constants like h, emissivity, Stefan Boltzmann constants for devices like metal rod, lagged pipe, etc.,
- Encourage the students to understand importance energy conversion and make them to experience practical applications in Heat Transfer Lab.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO1: Evaluate heat transfer through lagged pipe, Insulating materials.

CO2: Determine the Thermal conductivity of a given metal Rod and overall heat transfer coefficient for a composite slab.

CO3: To Measure the Heat transfer coefficient for Pin Fin, Forced convection and Natural Convection.

CO4: Determine heat transfer in parallel-flow and counter-flow heat exchanger.

CO5: Determine radiation heat transfer using Stefan-Boltzman and emissivity apparatus.

CO6: Determine heat transfer in drop and film wise condensation.

List of Experiments:

1. Determination of Thermal Conductivity of Metal Rod.
2. Determination of Thermal Conductivity of Insulating Material(lagged pipe)
3. Determination of Overall Heat Transfer Coefficient of a Composite wall.
4. Determination of Effectiveness on a Metallic fin.
5. Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.
6. Determination of Heat Transfer Coefficient in a Forced Convection Flow through a Pipe.
7. Heat Transfer through a Concentric Sphere
8. Determination of LMTD and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers.
9. Determination of transient thermal history of a metal
10. Determination of Emissivity of a Surface.
11. Determination of Stefan Boltzman Constant.
12. Heat transfer in drop and film wise condensation.
13. Demonstration of finding critical thickness of insulation of a material
14. Demonstration of near isothermal characteristic exhibited by a heat pipe in comparison to stainless steel and copper pipes.

PROFESSIONAL COMMUNICATION SKILLS LAB**Subject Code:20HSL302**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES

- To provide students with a wide range of vocabulary to enable them to take language tests for higher education and employment
- To assist students acquire effective and adequate presentation skills
- To get students learn to collect comprehensive data for a project report
- To help students master techniques of being successful in group discussions
- To improve communication skills of students by making them participate in different language activities
- To prepare students for facing interviews self-assuredly

COURSE OUTCOMES

- CO1:** Students will be able to state meanings, synonyms, antonyms, analogies, idioms, phrases, one-word substitutes, word roots, prefixes and suffixes for words in general.
- CO2:** Students will be able to present and interpret data on select topics using pre-existing slides.
- CO3:** Students will be able to collect data extensively on a social issue and make it public for the sake of enlightening populace.
- CO4:** Students will be able to contribute proactively and extrapolate in group discussions.
- CO5:** Students will be able to make impromptu speeches.
- CO6:** Students will be able to prepare Job Application and Résumé / CV of their own, and face interviews confidently.

- UNIT I** : Classified Vocabulary
- UNIT II** : Power Point Presentation
- UNIT III** : Project Reports on Social Issues
- UNIT IV** : Group Discussion
- UNIT V** : Debate
- UNIT VI** : Job Application and Résumé / CV Writing— Mock Interviews

SUGGESTED READINGS:

- Advanced Communication Skills Lab. Version 1.0 (Software). K-VAN Solutions Pvt. Ltd.
- Communication Skills. Sanjay Kumar and Pushpa Lata. Oxford University Press. 2011.
- Speak Well. K. Nirupa Rani. Orient Blackswan, Hyderabad. 2012.
- Strengthen Your Communication Skills. M. Hari Prasad. Maruthi Publications, Hyd. 2014.
- Strengthen Your Steps. M. Hari Prasad. Maruthi Publications, Hyderabad. 2012.
- Technical Communication. Meenakshi and Sangeetha. OUP. New Delhi. 2013.

SOFTSKILLS**Subject Code: 20SSS301**

L	T	P	C
1	0	2	2

COURSE OBJECTIVES:

- Develop communicative competence in students of engineering
- Enrich students' emotional intelligence and inter-personal skills
- Enable students to understand the importance of employing appropriate body language when communicating.
- Develop students' competence in written communication
- Train students in interview skills, group discussions and presentation skills to enhance their employability skills
- Bridge the gap between the current skill sets of students and the skills required by a potential employer through practice.
- Make students industry ready by grooming them for corporate life.

COURSE OUTCOMES:**By the end of the course students should be able to:****CO1:** Apply communication theory to solve workplace communication issues.**CO2:** Demonstrate the communication required in the workplace: interpersonal and intrapersonal communication skills, listening skills along with barriers of communication**CO3:** Interpret the role Non verbal communication, Cultural differences ,business etiquettes in communication,**CO4:** Express and understand complex ideas accurately in written and spoken formats: resume writing, E-mail writing and report writing**CO5:** Express technical knowledge and expertise orally through presentations, group discussions and interviews to enhance employability competence**CO6:** Preparing students for Campus to Corporate transition and improve employability**UNIT - I:****FUNDAMENTALS OF COMMUNICATION**

Purpose and process of communication: Objectives of Communication-Process of Communication- Types of communication; noise, listening skills, Types of listening, essentials of good listening and tips.

UNIT - II:**INTERPERSONAL COMMUNICATION & EMOTIONAL INTELLIGENCE**

Managing Interpersonal and Intrapersonal communication - Role of Emotion in Interpersonal Communication- Barriers to Interpersonal Communication- Exchange Theory- Gateways for Effective Interpersonal Communication.

UNIT - III :

NON VERBAL COMMUNICATION, ATTIRE & ETIQUETTES

Non-verbal communication and Body Language: Kinesics, Proxemics, Paralanguage, Haptics, handshakes, appropriate body language and mannerisms for interviews: business etiquettes- across different cultures.

UNIT - IV :

TECHNICAL COMMUNICATION & RÉSUMÉ WRITING

Written communication: mechanics of writing, report writing- business correspondence-business letter and E-Mail format - Meetings and managing meetings- Resume and **cover letter** writing - Formats.

UNIT - V :

PRESENTATION AND GROUP DISCUSSION

Presentation skills: prerequisites of effective presentation, format of presentation; Assertiveness – strategies of assertive behavior; Communication skills for group discussion and interviews, Interview Techniques.

UNIT - VI :

CAMPUS TO CORPORATE TRAINING

Goal setting- Establishing SMART Goals, Importance of Mission Statement, Formulation of Goals ; **Time management** - Prioritization, Dealing with Difficult Tasks, Getting Organized; **conflict management-** Creating a Win-Win situation, Negotiation and Persuasion; Dealing with Aggressive Behavior SWOT analysis; **Team building skills-** Teambuilding Process and Techniques, Coordination in Teams

TEXT BOOKS:

- 1) E. Suresh Kumar,P. Sreehari,J. Savithri “Communication Skills and Soft Skills : An Integrated Approach” Published by Dorling Kindersley (India) Pvt. Ltd, Pearson Education in South Asia.2011
- 2) Meenakshi Rama: “*Business Communication*”, Oxford University Press, NewDelhi
- 3) C.S.G. Krishnamacharyulu and Dr. Lalitha Ramakrishnan, Business Communication, Himalaya Publishing House,Mumbai
- 4) Butterfield, Jeff. *Soft Skills for Everyone*. New Delhi: Cengage Learning. 2010
- 5) Nitin Bhatnager and Mamta Bhatnagar: Effective communication and soft skills: Strategies for Success, Pearson 2012

REFERENCE BOOKS:

- 1) Kelly M Quintanilla, Shawn T.Wahl:“Business and Professional Communication”, SAGE, New Delhi,2012.
- 2) Chauhan, G.S. and Sangeeta Sharma. *Soft Skills*. New Delhi: Wiley. 2016
- 3) Thorpe, Edgar and Showick Thorpe. *Winning at Interviews*. Pearson Education. 2004.
- 4) Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi
- 5) Edoardo Rovida· Giulio Zafferri: The Importance of Soft Skills in Engineering and Engineering Education, Springer 2022

ROBOT PROGRAMMING AND APPLICATIONS
(Honors /Minor Degree Course)

Subject Code: 20ROI303

L	T	P	C
3	0	2	4

COURSE OBJECTIVES:

- The course is aimed at providing concepts and basic programming skills of robotics and methods.
- In this subject, the fundamental concepts of programming are introduced for basic applications with use of sensors and actuators.
- This course will help in understanding the evolving concepts underlying physical and numerical principles and properties with programming skills for robot applications.
- This course recognizes the synergistic combination of all related branches of engineering with applications in multi-disciplinary wing and have adequate multi-disciplinary knowledge and conceptual skills

COURSE OUTCOMES:

The student will be able to:

CO1: Understand the fundamental programming skills and methods.**CO2:** Comprehend and apply the concepts of programming skills and methods.**CO3:** Understand and apply the concepts of programming skills with use of sensors and actuators.**CO4:** Understand and apply the knowledge for the programming applications with use of sensors and actuators**CO5:** Understand and gain the knowledge on generation of mobile robots and their design considerations.**CO6:** Describe and discuss the basic fundamentals of programming skills for various applications

UNIT – I: Robot Programming Basics, VAL and Rapid Language, VAL –II and MAL, Methods, Virtual Robot, offline & online programming and its Application

Exercise I: Basic introduction and understanding the language of Cprog

UNIT – II: Level of robot programming, Language based programming, task level programming, Robot programming synthesis, robot programming for various industrial applications..

Exercise II: Generate the code for pick and place operation using magnetic / hydraulic gripper using Cprog

UNIT – III: Robot Programming using Sensors and Actuators with ROS, SCORBOT structure, joint movements, work envelop, motors, encoders, micro switch, transmission, gripper, SCORBOT programming, Mobile Robot Programming, Industrial Robot Programming

Exercise III: Write a program for touch sensor and test it using Cprog

UNIT – IV: Robot applications-Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting.

Exercise IV: Introduction to Programming Robots using Python

UNIT – V:Introduction to Mobile robot, Microbots and, Service Robots - Recent developments in robotics- safety considerations.

Exercise V: Write a program for pick and place operation using Python

UNIT – VI: Detailed study and applications of Nanorobots, Cognitive Robots and, Medical Robots.

Exercise VI: Generate a code by performing any task of your choice using Python

TEXT BOOKS:

1. Groover. M.P. Industrial Robotics, technology, programming and application Mc-Graw Hill 2012.
2. R.K. Mittal & I.J. Nagrath, “Robotics & Control” TMH-2007.
3. Craig, J. J., Introduction to Robotics: Mechanics and Control, Pearson, 3rd Edition, 2004.

REFERENCES:

1. K.S Fu, R.C. Gonzalez, C.S.G. Lee, Robotics, McGraw Hill, 1987.
2. Asada, H., and J. J. Slotine. *Robot Analysis and Control*. New York, NY: Wiley, 1986. ISBN: 9780471830290.

FINITE ELEMENT METHODS**Subject Code: 20MEI413**

L	T	P	C
3	0	3	4.5

COURSE OBJECTIVES:

- To understand the fundamental relations of elasticity, basic concepts of variation approach and domain discretization.
- To derive element stiffness matrices for various finite element types and assemble the global stiffness matrix for calculating the nodal displacements, reaction forces, stresses and strains.
- To develop proficiency in the application of the finite element method to solve one dimensional and two dimensional problems.
- To obtain the natural frequencies and mode shapes for bars and beams using FEM.

COURSE OUTCOMES:

On completion of this course, students should be able to

- CO 1:** Explain fundamental relations of elasticity, determination of stress and strain for 3D body, concepts of potential energy and Rayleigh-Ritz method.
- CO 2:** Explain basics of domain discretization, interpolation functions and derive element stiffness matrices, assemble them for global stiffness matrix and solve system of linear equations to determine displacements, reaction forces, strains and stresses.
- CO 3:** Analyze plane trusses and solve truss structure related problems using FE methods.
- CO 4:** Analyze beams and determine deflections, slopes, SF&BM for beams using 2D beam elements
- CO 5:** Solve 2D planar area problems considering plane stress & plane strain conditions.
- CO 6:** Evaluate Eigen values and Eigen vectors for both consistent and lumped mass matrix approaches for 1D bar and beam elements.

UNIT-I

Introduction to finite element method - Stress Equilibrium equations for 3D body, strain – displacement relations for 3D body, stress – strain relations for 3D body, material matrix, plane stress and plane strain conditions for 2D body, Problems on stress-strain relations and strain-displacement relations. Basic Steps in FEM formulation - concept of potential energy, Rayleigh-Ritz method, problems on Rayleigh-Ritz method.

Experiments:

1. Determination of stress/strain matrix of 3D body for the given elastic modulus and Poisson's ratio.
2. Determination of stress/strain matrix under Plane stress and Plane Strain conditions for the given Elastic modulus and Poisson's ratio.

Software : MATLAB

UNIT-II

Finite Element Modeling: Discretization of domain, element shapes, node numbering, coordinates and shape functions, derivation of element stiffness matrix, assembly of stiffness matrices and load vector, half band width, Potential energy approach, Finite Element Equations, Imposition of boundary conditions, Solution of the FE equations using elimination and penalty approaches, calculation of nodal displacements, stress, strain and support reactions, Applications to 1-D bar elements and temperature effects.

R20 - B. Tech. - ME

Experiments:

1. Determination of nodal displacements, stresses and reactions of given axial loaded bar structure and validating with theoretically calculated FE solution.
2. Determination of nodal displacements, stresses and reactions of given axial loaded bar structure with wall gap and validating with theoretically calculated FE solution.
3. Determination of nodal displacements, stresses and reactions of given axial loaded bar structure with temperature effects and validating with theoretically calculated FE solution.

Software : ANSYS

UNIT- III

Plane Trusses: Finite element modeling - Discretization of domain of truss structures, local and global numbering scheme, Element stiffness matrix, Assembly of stiffness matrices and Load vector, Finite element equations and solution to calculate nodal displacements, strains, stresses and reactions of plane truss structures.

Experiments:

1. Determination of nodal displacements, stresses and reactions of a given element plane truss arrangement and validating the same with theoretically calculated FE solution.
2. Determination of nodal displacements, stresses and reactions of a given standard bridge plane truss structure and validating the same with theoretically calculated FE solution.

Software : ANSYS

UNIT- IV

Analysis of Beams: Introduction, Finite element formulation using 2D Hermite beam element, derivation of Hermite shape functions, derivation of stiffness matrices, derivation of load vector for concentrated and UDL, Boundary considerations, Shear force and bending moment calculations.

Experiments:

1. Static analysis of 2 DoF, determine deflections of cantilever beams, stresses and reactions with point and distributed loads, validating the same with theoretically calculated FE solution.
2. Static analysis of 2 DoF, determine deflections of simply supported beams, stresses and reactions with point and distributed loads, validating the same with theoretically calculated FE solution.
3. Static analysis of 2DoF, determine deflections of fixed beams, stresses and reactions with point and distributed loads, validating the same with theoretically calculated FE solution.

Software : ANSYS, MATLAB

UNIT-V

Two-dimensional Problems Using Constant Strain Triangles: Introduction, Finite element modeling, constant strain triangle, problem modeling and boundary conditions.

Two-dimensional Iso-Parametric Elements and Numerical Integration: Introduction to Higher order and iso-parametric elements - four-noded quadrilateral, Numerical integration & Gaussian Quadrature, Problems on 1×1 and 2×2 rules.

Experiments:

1. Static analysis of 2D planar surface area to determine the nodal displacements, stresses and reactions considering plane stress/plane strain, validating the same with theoretically calculated FE solution.

R20 - B. Tech. - ME

2. Static analysis of 2D plate to determine the nodal displacements, stresses and reactions considering plane stress/plane strain, validating the same with theoretically calculated FE solution.
3. Static analysis of 2D plate with a hole to determine the nodal displacements, stresses and reactions considering plane stress/plane strain, validating the same with theoretically calculated FE solution.
4. Numerical integration solutions of single and double integrals.

Software : ANSYS, MATLAB

UNIT-VI

Dynamic Considerations: Introduction, formulation, element consistent & lumped mass matrices, evaluation of Eigen values and Eigen vectors, Mode shapes, Free vibration problems of 1D stepped bar and 2D beam with reduced matrix of order 2×2 .

Experiments:

1. Eigen value modal analysis of 1D stepped bar to determine natural frequencies & dynamic mode shapes, validating the same with theoretically calculated FE solution.
2. Eigen value modal analysis of 2 DOF beam to determine natural frequencies & dynamic mode shapes, validating the same with theoretically calculated FE solution.

Software : ANSYS, MATLAB

TEXT BOOKS:

1. Introduction to Finite Elements in Engineering, T.R. Chandraputla, Ashok. D. Belegundu, Pearson Education Publications, 3rd Edition, 2011.
2. Textbook of Finite Element Analysis, P. Seshu, Prentice Hall Inc Publications, 1st Edition, 2012.
3. Finite Element Analysis Theory and Application with ANSYS, Saeed Moaveni, Pearson Education Publications, 3rd Edition, 2011.

REFERENCE BOOKS:

1. Concepts and Applications of Finite Element Analysis, Robert D. Cook, Wiley Publications, 4th Edition, 2007.
2. The Finite Element Methods in Engineering, S.S. Rao, Pergamon Publications, 5th edition, 2010.
3. An Introduction to the Finite element method, J.N. Reddy, Tata McGraw Hill Publications, 4th edition, 2019.
4. Finite Element Method and Computational Structural Dynamics, Manish Shrikhande, Prentice Hall Inc Publications, 1st edition, 2014.
5. Finite Element Procedures, K.J.Bathe, Prentice Hall Inc Publications, 3rd edition, 2007.

PROJECT MANAGEMENT AND OPERATIONS RESEARCH**Subject Code: 20MET414**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide basic knowledge on Project Management, CPM/PERT network analysis, Cost estimation, Financing and cost control.
- To understand formulation of linear programming problem, graphical and simplex solutions to LPP.
- To provide knowledge about the formulation and optimal solution for transportation, assignment and sequencing problems.
- To understand different replacement models and models in games theory.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1 : Understand the concepts of project management.

CO 2 : Estimate the cost of the project and identify the sources of finance.

CO 3 : Determine critical path for a given network using PERT and CPM techniques.

CO 4: Formulate and solve linear programming problems using graphical, simplex method and solve sequencing problems.

CO 5 : Solve transportation and assignment problems.

CO 6 : Solve replacement problems and problems on games theory by applying standard methods.

UNIT-I

Basics of Project Management: Introduction, Need for project management, Essentials of project management philosophy, Principles, Project identification and selection, Project organization, Project contracts.

UNIT-II

Project Cost Estimation and Financing: Cost of the project, Components of capital cost of a project, Sources of finance, Role of financial institutions, covenants attached to lending.

UNIT-III

Project Scheduling with CPM and PERT: Network diagram, Critical path method and Project evaluation and Review technique.

Project Cost Control : Project cost Vs Project completion time, Normal time and Crash time, Direct cost and Indirect cost, Total cost, Time-cost Trade-off, Crashing of project time.

UNIT-IV

Introduction to Operations Research: Definition, Characteristics of OR, OR models, Phases of OR. Introduction to linear programming problem formulation, Graphical solution, Simplex solution.

Sequencing: Introduction, Problems with n jobs and two machines, Problems with n jobs and three machines, Problems with n - jobs and m - machines, problems with 2-Jobs and m -machines (Graphical Method).

UNIT-V

Transportation Problem: Formulation, Optimal solution, Unbalanced transportation problems, Problem of degeneracy.

Assignment Problem: Formulation, Optimal solution, Travelling salesman problem.

UNIT-VI

Replacement Models: Introduction, Replacement of items that deteriorate with time, Value of money unchanging and changing, Replacement of items that fail completely.

Theory of Games: Introduction, Two-person Zero-sum games, Maximin - Minimax principle, Games without saddle points, Mixed Strategies, $m \times 2$ & $2 \times n$ games, Graphical solutions, Dominance property, Algebraic solutions to rectangular games.

TEXT BOOKS:

1. Project Management, K.Nagarajan, New Age International Publishers.
2. Introduction to Operations Research by Prem Kumar Gupta, D.S. Hira, S. Chand Publishers
3. Operations Research, S.D.Sharma,Kedarnath, Ramnath & Co Pub.

REFERENCES BOOKS:

1. PERT and CPM – Principles and Applications, L.S. Srinath, Affiliated East West Press Pub.
2. Operations Research, J.K. Sharma, Laxmi Pub.
3. Operations Research by P. Rama Murthy, New Age Pub.

INDUSTRIAL HYDRAULICS AND PNEUMATICS
(Professional Elective – IV)

Subject Code: 20MEE441

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand mechanism and calculations of various types of hydraulic pumps, motors, actuators.
- To understand working of different types of direction, pressure, flow valves, and accumulators.
- To design and draw commonly used simple hydraulic circuits.
- To understand working of various components in pneumatic and electro-pneumatic systems.
- To design and draw commonly used simple pneumatic circuits.
- To understand the objectives of Trouble shooting and applications of Hydraulics and Pneumatics.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1: Explain mechanism and calculations of various types of hydraulic pumps, motors, and actuators.

CO 2: Understand working of different types of direction, pressure, flow valves, and accumulators.

CO 3: Design and draw commonly used simple hydraulic circuits.

CO 4: Analyze workings of various components in pneumatic and electro-pneumatic systems.

CO 5: Design and draw commonly used simple pneumatic circuits.

CO 6: Explore the objectives of trouble shooting and applications of hydraulics and pneumatics.

UNIT-I

Introduction to fluid power, Applications of fluid power, Hydraulic fluids, Hydraulic fluid properties, Hydraulic symbols.

Hydraulic Pumps: Pumping Theory – Gear, Vane, Piston pumps – Hydraulic pump performance

Hydraulic Motors – Gear, vane, piston motors –Hydraulic motor performance.

Hydraulic Actuators – Types, construction, Mechanics of hydraulic cylinder loadings – 1st, 2nd, 3rd class lever systems,

UNIT-II

Direction control valves: Check valve, shuttle valve, two-way, three-way, four-way valves, Rotary valve, Spool type, sliding spool type valves.

Pressure control valves: Pressure relief valve, pressure reducing valve, unloading valve, counterbalance valve, pressure sequence valve.

Flow control valve: Needle valve, pressure compensated valves, Non-pressure compensated valves.

Accumulators: Function, types, size, applications and circuits, accessories.

Intensifiers – Applications, circuit.

UNIT-III

Design and Drawing of Hydraulic Circuits: Hydraulic clamping circuits in machine tools, speed control in one direction-meter-in & meter-out circuits, Speed control in both directions, Regenerative circuit, standard manifold for dual speed, plastic injection molding machine circuit, hydraulic press application.

UNIT-IV

Pneumatic and Electro-Pneumatic Systems: Introduction to Pneumatic systems, Pneumatic symbols, Air Compressors – types, specifications, Air preparation system.

Air control valves – pressure regulator, Check valve, Shuttle valve, Directional Control Two-Way valve, Three-Way and Four –Way Directional Control Valves.

Pneumatic actuators - pneumatic cylinders, pneumatic rotary actuator.

Basic electrical components, Pilot operated solenoid valve, PE converter, PLC applications in fluid power.

UNIT-V

Design and Drawing of Pneumatic Systems: Control air, Signal air, Numbering of valves, Basic pneumatic circuits, speed control circuits, Application of logic valves - AND, OR Gates, application of time delay valves, position and pressure sensing, pressure sequence valve, pneumatic circuit analysis.

UNIT-VI

Trouble Shooting and Applications of Hydraulics and Pneumatics:

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding applications. Pneumatic circuits for Pick and Place applications.– Hydraulic and Pneumatic power packs.

TEXT BOOKS:

1. Fluid Power with Applications, Anthony Esposito, Pearson Publishers.
2. Introduction to Hydraulics and Pneumatics, S. Ilango, V. Soundararajan, PHI Publishers.

REFERENCE BOOKS:

1. Fluid Power Control, NPTEL Webcourse Lectures.
2. Fluid Power Transmission and Control, A. Alavudeen, K.H. Syed, N. Shanmugam, Charotar Pub.
3. Oil Hydraulic Systems, S.R. Majumdar, McGraw Hill Pub.
4. Pneumatic Systems: Principles and Maintenance, S.R. Majumdar, McGraw Hill Pub.

NON CONVENTIONAL ENERGY RESOURCES

Subject Code:20MEE442

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To know the relation between sun, earth, and the application of solar energy
- Understanding the idea and process for creating geothermal energy
- Understanding the development of biomass energy and its guiding principles
- To develop the wind, tidal and ocean energy

COURSE OUTCOMES:

On completion of this course, students should be able to

- CO 1:** Analyze energy demand and energy resources of the world and nation. Understand the amount of solar radiation received by earth, and radiation measuring instruments.
- CO 2:** Apply the solar energy in applications like solar water heating, space heating, solar stills and ponds, solar refrigeration and photo-voltaic generation.
- CO 3:** Estimate geothermal potential using analytical methods.
- CO 4:** Discuss bio-energy generation including bio-conversion processes, bio-gas plant technology, biomass gasification and economics of biomass systems.
- CO 5:** Compute characteristics of wind energy conversion systems using various coefficients..
- CO 6:** Understand and implement the economics in generation of energy from OTEC plants

UNIT – I

Introduction: Energy Scenario – Classification – Need for Non-Conventional Energy Resources.
Solar Energy: The Sun – Sun-Earth Relationship – Solar radiation – Radiation measuring instruments.

UNIT – II

Solar Energy Applications: Solar water heating, Space heating – Solar stills and ponds – Solar refrigeration – Photovoltaic generation.

UNIT - III

Geothermal Energy: Structure of Earth – Geothermal Regions – Hot springs – Hot Rocks – Hot Aquifers – Analytical Methods to estimate Thermal Potential – Harnessing Techniques – Electricity Generating Systems.

UNIT -IV

Bio – Energy: Biomass Energy Sources – Plant Productivity, Biomass Wastes – Aerobic and Anaerobic bio-conversion processes – Raw Materials and properties of Bio-gas-Bio-gas plant Technology and Status –Biomass gasification.

UNIT – V**Wind Energy:**

Wind – characteristics – wind energy conversion systems – types – Betz model – horizontal and vertical axis windmills

UNIT – VI

Energy from Oceans:

OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

TEXT BOOKS:

1. Renewable Energy Resources – Basic Principles and Applications – G.N.Tiwari and M.K.Ghosal, Narosa Pub
2. Non-Conventional Energy Sources /G.D. Rai

REFERENCE BOOKS:

1. Renewable Energy Resources / John Twidell & Tony Weir
2. Biological Energy Resources / Malcolm Flescher & Chriss Lawis
3. Solar Energy / Sukhatme

TOTAL QUALITY MANAGEMENT
(Professional Elective - IV)

Subject Code:20MEE443

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the Total Quality Management (TQM) principles and the various tools available to achieve TQM
- To understand the statistical approach for quality control.
- To create an awareness about the ISO and QS certification process and its need for the industries.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1: Distinguish the tools used in quality management

CO 2: Understand the fundamentals of TQM.

CO 3: Understand the principles of total quality management.

CO 4: Understand the fundamentals and principles of quality circles

CO 5: Understand six sigma and its principles to improve the total quality of an organization

CO 6: Understand ISO and QS certification process and its need for the industries

UNIT-I

Introduction to Quality

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality-These ventools of quality - Normal distribution curve - Control charts - Process capability.

UNIT-II

Introduction to TQM

Definition - Basic concepts of TQM - TQM Framework - Features of TQM - Eight Building blocks of TQM - Contributions of Deming, Juranand Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

UNIT-III

TQM Principles

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork - Performance appraisal - Continuous process improvement- Plan Do Check Act (PDCA) cycle, 5S, Kaizen-Supplier partnership -Supplier selection, Supplier Rating.

UNIT-IV

Quality Circles, TPM

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - Total productive maintenance (TPM) - Concepts, improvement needs - Performance measures

UNIT-V

TQM Tools, SIX Sigma

New management tools - Six sigma: Concepts, Methodology, Applications to manufacturing, service sector including IT-DMAIC Stages - Benchmarking - Reason to benchmark, Benchmarking process.

UNIT- VI

Quality Management System

Introduction - Benefits of ISO Registration - ISO9000 Series of Standards - ISO 9001 Requirements - Implementation - Documentation - Internal Audits - Registration
Environmental Management System: Introduction - ISO14000 Series Standards - Concepts of ISO 14001 - Requirements of ISO 14001 - Benefits of EMS.

TEXT BOOKS:

- 1.Total Quality Management, Dale H. Besterfield et.al., 3rded, Pearson Education Pub.
- 2.Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCE BOOKS:

- 1.James R.Evans & William M.Lindsay, The Management and Control of Quality, (5thEdition, South-Western (Thomson Learning, 2002 (ISBN0-324-06680-5).
2. Total Quality Management, A.V.Feigenbaum, McGraw HillPub.
- 3.Total Quality Management, J.S.Oakland,ButterworthHeinemannPub.
4. Quality Management-Concepts and Tasks,V.Narayana,N.S.Sreenivasan,New Age International

MANUFACTURING PROCESS AND PRODUCT LIFE CYCLE MANAGEMENT
(Professional Elective – IV)

Subject Code:20MEE444

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide knowledge on the goals of product life cycle management such as time-to-market, product quality, reducing cost and sales opportunities
- To provide comprehensive understanding of manufacturing process management and execution systems

COURSE OUTCOMES:

After successful completion of the course students will be able to

- CO 1:** Know the shift from the traditional departmental paradigm to PLM paradigm in a complex changing environment due to globalization
- CO 2:** Gain knowledge on the products and its related business processes in a company's PLM environment and PLM initiative.
- CO 3:** Achieve through insight on to the product data and its activities in PLM environment.
- CO 4:** Explore various PDM systems, understand their components and also their implementation issues.
- CO 5:** Explore PLM applications, their activities and selection
- CO 6:** Understand the activities of change management and project management in PLM initiative

UNIT I

Product Lifecycle Management

P, L, and M of PLM; Scope; Paradigm; Benefits; Overcoming problems, enabling opportunities

PLM & its Environment

Issues with departmental paradigm; Product data issues; a complex and changing environment; product pains; product opportunities

UNIT II

Products

Product importance, range, instance; identifier; requirements; product structure and architecture; causes of product problems

Business Processes

Introduction; documenting process; process reality in a typical company; business process activities in the PLM initiative; learning from experience

UNIT III

Definitions & Introduction

Relevance of product data in PLM; Definitions; Product data across the lifecycle & organizing product data; Product data as a strategic resource; data model diagrams

Product Data Activities

Generic issues with product data, a generic vision for product data in PLM; Product data activities in the PLM initiative; Product data migration; Top management role with Product data.

UNIT IV

PDM systems

Relevance of PDM systems; names and acronyms; PDM system overview; Importance; benefits;

Components and Implementation Issues of PDM Systems

Eight components; Common issues; Customization and installation; Guidelines for PDM system implementation; No PDM system is an island

UNIT V

PLM Applications

Relevance of PLM applications; Introduction; Generic PLM applications; Specific PLM applications; organizing the applications

Application, Activities and Selection

Reality in a typical company; Application activities in the PLM initiative; Best practice PDM system selection; PDM system requirements; Learning from experience

UNIT VI

Change Management

Definitions & introduction; Participants in change; Reality in a typical company; OCM activities; Learning from experience

Project Management

Definitions & introduction; people in projects; Project reality in a typical company; Project management activities; Learning from experience

TEXT BOOKS:

1. John Stark, Product Lifecycle Management (Volume 1), 21st Century Paradigm for Product Realisation, Fourth Edition, Springer publications, 2020
2. Antti Saaksvuori, Anselmi Immonen, Product Life Cycle Management – Third edition, Springer publications, 2008

REFERENCE BOOKS:

1. Grieves, Michael, Product Lifecycle Management, Driving the next generation of lean thinking, McGraw-Hill Publishing Co. Ltd., 2006
2. Kari Ulrich and Steven D. Eppinger, Product Design & Development, McGraw-Hill Publishing Co. Ltd., 1999.

INDUSTRIAL AUTOMATION
(Professional Elective – V)

Subject Code:20MEE451

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To explain the general functions, types and strategies of automation.
- To classify the material transport systems in production and perform analysis of the transfer lines used in production.
- To apply line balancing techniques to improve the line balance and line efficiency.
- To distinguish various material handling and storage systems and explain their functions.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1: Explain the types and strategies of automation.

CO 2: Determine the problems and assess the performance of automated flow lines in manufacturing domain.

CO 3: Identify the bottlenecks occurred in production systems and will be able to balance the production line.

CO 4: Distinguish between different material handling systems and employ suitable material handling system.

CO 5: Explain various automated storage and retrieval systems.

CO 6: Describe the computer aided inspection methods including CMM and machine vision.

UNIT-I

Fundamentals of Automation: Introduction to automation – Definition – Types of automation & Layouts – Reasons of automation – Automation strategies – Hydraulic & Pneumatic components used in automation – Automation in Machine tools.

UNIT-II

Automated Production Lines & Analysis: Introduction – Classification of transfer lines – Work part transfer mechanisms – Work part transfer systems – Mechanical buffer storage – Control functions – Fabrication & design considerations – Analysis of transfer lines: with and without storage buffer – Terminology used in transfer line analysis – Problems – Partial automation – Implementation.

UNIT-III

Manual & Automated Assembly Systems: Assembly systems: Introduction – Types – Manual assembly systems – Automated assembly systems – Assembly processes – Line balancing – Methods of line balancing Algorithms – Line balancing improving techniques – Flexible assembly lines.

UNIT-IV

Automated Material Handling Systems: Introduction – Principles of material handling – Types of MHS – Design & Analysis of MHS – Conveyor Systems – Types – Applications of MHS – Automated Guided Vehicle systems.

UNIT-V

Automated Storage Systems: Introduction to storage systems – Applications of storage systems – Types of Storage systems – AS/RS – Types & Applications – Identification & Tracking Systems – Bar Codes – Types.

UNIT-VI

Inspection Methods: Introduction – Classification – Machine Vision - Coordinate Measuring Machine. Introduction to Lean and Agile manufacturing.

TEXT BOOKS:

1. Automation, Production Systems & Computer integrated Manufacturing Systems, M P Groover, PHI Publications.
2. CAD/CAM/CIM, Radhakrishnan, New Age International(P) Ltd. Publications

REFERENCE BOOKS:

1. Automation, W. Buekinsham, PHI Publications
2. Principles of CAD/CAM, P N Rao, Tata McGraw Hill Publications

CONDITION MONITORING
(Professional Elective - V)

Subject Code : 20MEE452

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide knowledge on maintenance types and quality circle in maintenance.
- To acquire knowledge on vibration analysis and fault diagnosis of mechanical systems.
- To understand various condition monitoring techniques.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1 : Develop suitable maintenance strategies to enhance system reliability.

CO 2 : Implement vibration data acquisition and signal processing techniques to all mechanical systems.

CO 3 : Identify faults such as imbalance, misalignment, looseness, resonance by using vibration measurements.

CO 4 : Develop an ability to interpret thermal images.

CO 5 : Investigate the mechanical systems and its condition by using ultrasonic monitoring

CO 6 : Predict machinery faults and using oil and wear debris analysis.

UNIT-I

Maintenance engineering: Quality circle in maintenance, maintenance types, breakdown, corrective, opportunity, routine, preventive and predictive, condition based systems, design out.

UNIT-II

Vibration measurement and analysis: Transducers and mounting methods, data acquisition using instrumentation recorders: data loggers, time domain signal analysis, orbit analysis, filters, frequency domain analysis (narrow band FFT analysis), Nyquist criteria.

UNIT-III

Fault diagnosis: Interpreting vibration measurements and signature analysis for common machine faults, imbalance, misalignment, mechanical looseness, bearing and gear faults, faults in induction motors, resonances, case studies, static and dynamic balancing and International standards for vibration condition monitoring.

UNIT-IV

Thermography: Basics of infrared thermography, differences in equipment, specific wavelength limitations, application of IR: electrical inspection, mechanical inspection, energy conversion – how to take good thermal images.

UNIT-V

Ultrasonic testing: Ultrasonic monitoring: leak, crack, thickness – basics of ultrasonic monitoring, ultrasonic theory, test taking philosophy, mathematics of ultrasound equipment and transducers, Inspection parameters and calibration, immersion theory, equipment quality control, flaw origins and inspection methods, UT procedure familiarization and study recommendations – application of ultrasound: air leaks, stream trap testing, bearing lubrication, electrical inspection, case studies.

UNIT-VI

Oil and wear debris analysis : Basis of oil analysis, monitoring condition of oil, lubricant analysis, physicochemical properties, moisture, TAN TBN, wear debris analysis, particle counting, spectroscopy, uses and limitations, concept of ferrography, ferrography wear particle analysis.

TEXT BOOKS:

1. Mechanical fault diagnosis and condition monitoring, R.A. Collacott, Springer publications, 2011 edition.
2. Management of industrial maintenance, by Arthur Kelly and M J Harris, Butterworths publications, 1983

REFERENCES BOOKS:

1. Maintenance engineering handbook, Lindley R Higgins, Darrin J Wikoff, R. Keith Mobley, McGraw Hill publications, eighth edition, 2014
2. Vibration monitoring handbook, Coxmoor's machine & system conditioning monitoring, Coxmoor publishing co, 1999
3. An introduction to reliability and maintainability engineering, Charles E. Ebeling, Waveland Press, Inc.; 3rd edition, 2019
4. Machinery condition monitoring: Principles and practices by Mohanty Amiya Ranjan, CRC press inc., 2014

POWER PLANT ENGINEERING
(Professional Elective – V)

Subject Code: 20MEE453

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Know various power plants & their applications.
- Explain construction & working of Steam power plants.
- Apply fundamental concepts of Gas turbine power Plants.
- Knowledge of power generation through hybrid systems.
- Understand various types of Hydro-Electrical and Nuclear Power stations working.
- Calculate and measure capital cost, operational cost and general power distribution by using power plant economics.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1: Assess various conventional and non-conventional sources of energy.

CO 2: Explain construction & working of steam power plants along with its major subsystems, mountings and accessories including combustion of coal.

CO 3: Understand the working principle of diesel and gas turbine power plants along with their auxiliary systems.

CO 4: Explain construction and working of power generation through hybrid systems.

CO 5: Describe construction and working of nuclear power plants.

CO 6: Assess the power plant economy and cost analysis.

UNIT-I

Introduction to the Sources of Energy and Non-Conventional Sources: Utilization of Solar-Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.

Direct Energy Conversion: Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

UNIT-II

Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, and Ash handling systems.

Combustion Process:– overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, Dust collectors

UNIT-III

Diesel Power Plant: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging.

Gas Turbine Plant: Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined cycle Power Plants.

UNIT-IV

Hydro Electric Power Plant: Water power –Hydrographs – storage and Pondage – classification of dams and spill ways.

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.

UNIT-V

Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation. Types of Reactors, Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

UNIT-VI

Power Plant Economics and Environmental Considerations: Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor, load curves, load duration curve.– related exercises. Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Analysis of Combustion gases, Pollution; Types, Methods to Control.

TEXT BOOKS:

1. Power plant engineering, P. K. Nag, Tata McGraw-Hill Pub.
2. Power Plant Engineering, Manoj Kumar Gupta, PHI Pub.

REFERENCE BOOKS:

1. Thermal Engineering, P. L. Ballaney, Khanna Pub.
2. Thermodynamics, Spolding and Cole.
3. A Text Book of Power Plant Engineering, R.K. Rajput, Laxmi Pub.

**ADDITIVE MANUFACTURING
(Professional Elective – V)****Subject Code:20MEE454**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To introduce students the basics of additive manufacturing/rapid prototyping and its applications in various fields, reverse engineering techniques.
- To familiarize students with different processes in rapid prototyping systems.

COURSE OUTCOMES

On completion of this course, students should be able to

- CO 1:** To understand the principles and key characteristics of additive manufacturing technologies.
- CO 2:** To provide and summarize liquid based RP techniques and report the application of 3D printing process with a case study.
- CO 3:** To understand solid based RP techniques and report the application of 3D printing process with a case study
- CO 4:** To understand powder based RP techniques and report the application with a case study
- CO 5:** Describe various CAD issues for 3D printing related to the operations for STL model manipulation through topological modeling.
- CO 6:** Formulate and solve typical problems on reverse engineering and summarize typical rapid tooling processes for quick batch production of plastic and metal parts.

UNIT – I

Introduction: Prototyping fundamentals, Historical development, Fundamentals of Rapid Prototyping, Advantages and Limitations of Rapid Prototyping, Commonly used Terms, Classification of RP process, Rapid Prototyping Process Chain

UNIT – II

Liquid-based Rapid Prototyping Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages.

UNIT – III

Solid-based Rapid Prototyping Systems: Laminated Object Manufacturing (LOM): Specifications, Process, working principle, Applications, Advantages and Disadvantages. Fused Deposition Modeling (FDM): Specifications, Process, working principle, Applications, Advantages and Disadvantages.

UNIT – IV

Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): Specifications, Process, working principle, Applications, Advantages and Disadvantages. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages.

Unit – V

Rapid Prototyping Data Formats: STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Newly Proposed Formats. Rapid Prototyping Software's: Features of various RP software's.

UNIT – VI

RP Applications: Application – Material Relationship, Application in Design, Application in Engineering, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Bio-molecules.

TEXT BOOKS

1. Gibson, I., Rosen, D.W. and Stucker, B., “Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2015.
2. Chua, C.K., Leong K.F. and Lim C.S., “Rapid prototyping: Principles and applications”, Third edition, World Scientific Publishers, 2010.

REFERENCE BOOKS

1. Liou, L.W. and Liou, F.W., “Rapid Prototyping and Engineering applications: A tool box for prototype development”, CRC Press, 2011.
2. Kamrani, A.K. and Nasr, E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006.
3. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC Press, 2000

**HRD & ORGANIZATIONAL BEHAVIOUR
(OPEN ELECTIVE)**

Subject Code:20OET411

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To co-create a comprehensive view of Human Resource Development (HRD) through assessment of theories and practices of HRD
- To familiarize the students with the components of individual and group behavior in organizational setting
- To help them learn behavioral skills in managing people at work.
- To provide basic insight into select contemporary management practices and Strategic Management.
- To learn theories of motivation and also deals with individual behavior, their personality and perception of individuals.
- To understand about organizations groups that affect the climate of an entire organization this helps employees in stress management.

COURSE OUTCOMES:

On completion of this course, students should be able to,

- CO 1:** To build an understanding and perspective of Human Resource Development as discipline appreciating learning.
- CO 2:** To learn the skills of developing a detailed plan for need and implementation of HRD program in the organization.
- CO 3:** To learn role of learning in action as an individual, group and an organization in order to develop creative strategies to organizational problems.
- CO 4:** To develop a perspective of HRD beyond organizational realities including national HRD
- CO 5:** To develop positive attitude through personality development and can equip with motivational theories.
- CO6:** To attain the group performance and grievance handling in managing the organizational culture.

UNIT – I

HRD-Macro Perspective: HRD Concept, Origin and Need, HRD as a Total System; Approaches to HRD; Human Development and HRD; HRD at Macro and Micro Climate.

UNIT – II

HRD-Micro Perspective: Areas of HRD; HRD Interventions Performance Appraisal, Potential Appraisal, Feedback and Performance Coaching, Training, Career Planning, OD or Systems Development, Rewards

UNIT – III

Employee Welfare and Quality of Work Life and Human Resource Information; Staffing for HRD: Roles of HR Developer; Physical and Financial Resources for HRD; HR Accounting; HRD Audit, Strategic HRD

UNIT- IV

Human Resource Training and Development: Concept and Importance; Assessing Training Needs; Designing and Evaluating T&D Programmes; Role, Responsibilities and challenges to Training Managers

UNIT- V

Individual Behavior: Perception-Perceptual process- Impression management- Personality development – Socialization – Attitude- Process- Formation- Positive attitude- Change – Learning – Learning organizations- Reinforcement Motivation – Process- Motives – Theories of Motivation: Maslow’s Theory of Human Needs, Douglas McGregor’s Theory X and Theory Y, Herzberg’s Two-Factor Theory of Motivation,

UNIT-VI

Group Dynamics: Types of Groups, Stages of Group Development, Group Behavior and Group Performance Factors, Organizational conflicts: Reasons for Conflicts, Consequences of Conflicts in Organization, Types of Conflicts, Strategies for Managing Conflicts, Organizational Climate and Culture, Stress, Causes and effects, coping strategies of stress.

TEXT BOOKS:

1. Nadler, Leonard :Corporat Human Resource Development, Van NostrandReinhold, ASTD, New York .
2. Rao, T.V and Pareek, Udai: Designing and Managing Human Resource Systems,Oxford IBH Pub. Pvt.Ltd., New Delhi , 2005.
3. Rao, T.V: Readings in HRD, Oxford IBH Pub. Pvt. Ltd., New Delhi , 2004.
4. Subba Rao P., Organizational Behaviour, Himalaya Publishing House.Mumbai.
5. Fred Luthans Organizational Behaviour, TMH, NewDelhi.
6. Robins, Stephen P., Fundamentals of Management, Pearson,India.

REFERENCE BOOKS

1. Viramani, B.R and Seth, Parmila: Evaluating Management Development, VisionBooks, New Delhi.
2. Werner &DeSimone (2006). Human Resource Development. Thomson Press, Network.
3. Mankin, David (2009). Human Resource Development. Delhi: Oxford University Press.
4. Hersey, Paul, Dewey E. Johnson & Kenneth H. Blanchard (2013). Management of Organisational Behaviour. PHI.

**PROJECT MANAGEMENT
(OPEN ELECTIVE)**

Subject Code: 20OET412

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To develop an understanding of Project Planning and formation.
- To make students gaining the knowledge and skills related to Project Analysis.
- To make student better understand on Selection Criteria and select the best Project.
- To develop understanding the concepts of Project Financing and Contracts.
- To familiarize the students with implementation and execution of the project.
- To make students understanding complete and close the project.

COURSE OUTCOMES:

On completion of this course, students should be able to,

CO 1 : To understand the concept of Project Planning and formation.

CO 2 : To understand the key issues in Project Analysis.

CO 3 : To understand Selection Criteria and select the best Project.

CO 4 : To understand the concepts of Project Financing and Contracts.

CO 5 : To understand how to implement and execute the project.

CO 6 : To understand how to complete and close the project.

UNIT – I

Project Planning and Formation: Project meaning and concepts – Overview of total Project Management Cycle – Classification of Projects and Project Formation –Strategic Planning and Capital budgeting – Generation and Screening of Project Ideas – Generation of Ideas – Monitoring the Environment – Corporate Appraisal – Tools for Identify Investment opportunities – Scouting for Project Ideas – Preliminary Screening – Project Rating Index.

UNIT - II

Project analysis: Issues in Project Analysis - Market and Demand Analysis–conduct of Market Survey, Demand forecasting. Technical analysis – Manufacturing Process Technology, Material Inputs and Utilities, Plant Capacity, Location and Site –Machineries and Equipment, Structures and Civil Works, Environment Aspects. Financial Estimations and projections – Cost of Projects, Means of Finance – Estimates of sales and Productions, Working capital Requirement and its financing, Profitability Projections, Projected Cash flow Statement, Projected Balance Sheet – Time Value of Money

UNIT-III

Project Selection: Selection Criteria– Net Present Value, Benefit Cost Ratio, Internal Rate of return, Urgency, Payback Period, Accounting Rate of Return, Assessment of Various Methods, Investment Evaluation in Practice. Project Selection Under Risk – Risk Analysis in Practice, How Financial Institutions Analyse Risk. Social Cost Benefit Analysis, Rationale for SCBA – UNIDO Approach.

UNIT – IV

Project Financing and Contracts: Financing of Projects – Capital Structure, Working Capital, Financing Infrastructure Projects, Public Private Partnership, Venture Capital - Private Equity, Credit Risk Management. Contracts - Definitions of contract and Contractor. Elements of contracts, offer acceptance and consideration, Valid Contracts, Department execution of work – Master Roll Form 21 – Piece work Agreement form – Work order. Types of Contracts – Lump sum Contract, Lump sum and Schedule contract, Item rate Contract, Sub Contracts, Joint ventures, Arbitration Disputes and claim Settlement. Tender -Contract system with tenders, Quotation, Earnest Money, Security Money – Tender Notice, Tender Form, Bidding – Procedure – Irregularities in Bidding – award

UNIT – V

Project Implementation: Forms of Project organisation – Human Aspects – of project Management – Pre requisites for successful project implementation –Project Monitoring and Controlling – Parameters for monitoring and Control – Process of Monitoring –Network Techniques for Project Management– Developmentof Project Network -Time Estimation – Determination of Critical path– Scheduling when Resources are Limited - PERT Model – CPM Model – Network Cost System.

UNIT – VI

Project Completion: Completion of project and Managing Transition Period – Closure of Contracts – Completion of Assets of Projects – Post Project Evaluation and Completion. Audit Report. Management – Scope of the Construction Management, Significance of Construction management, Concept of Scientific Management, Qualities of Manager, Organisation – Authority, Policy, Recruitment process and Training Development of Personal Department, Labour problems, Labour legislation in India, Workmen compensation Act 1923, and subsequent amendments, Minimum Wages Act 1948.

TEXT BOOKS:

1. Narendra Singh, Project management and Control, Himalaya Publishing House, Mumbai 5th Edition
2. Prasanna Chandra: Projects, TMH, New Delhi, 2014, 8th Edition.
3. K.Nagarajan: Project Management, New Age International, New Delhi, 2010
4. PERT and CPM – L.S Srikanth
5. PERT and CPM – Punmia
6. Construction Management and Planning – Guna and Sen Gupta, B.

REFERENCES:

1. Gray, Larson: Project Management-Tata McGraw Hill-2015
2. Jeffery K.Pinto: Project Management-Pearson Education-2015
3. Enzo Frigenti: Project Management-Kogan, 2015
4. R. Panneerselvam, P. Senthilkumar: Project Management, PHI, 2015
5. Guide to Project Management Body of Knowledge (PMBOK® Guide) of Project Management Institute,USA.

**ENTREPRENEURIAL DEVELOPMENT
(OPEN ELECTIVE)**

Subject Code:20OET413

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of this course is to expose the students to the subject of entrepreneurial development, so as to prepare them to establish a new enterprise and effectively manage the enterprise.

- To co-create a comprehensive view of Human Resource Development (HRD) through assessment of theories and practices of HRD
- To familiarize the students with the components of individual and group behavior in organizational setting
- To help them learn behavioral skills in managing people at work.
- To provide basic insight into select contemporary management practices and Strategic Management.
- To learn theories of motivation and also deals with individual behavior, their personality and perception of individuals.
- To understand about organizations groups that affect the climate of an entire organization this helps employees in stress management.

COURSE OUTCOME:

On completion of this course, students should be able to

- CO 1 :** Understand the concept of Entrepreneurship and demonstrate the ability to provide a self analysis on Entrepreneurship qualities in the context of an Entrepreneurial career.
- CO 2 :** Understanding Entrepreneurship Development programmes in India and contents for training for Entrepreneurial competencies.
- CO 3 :** Create appropriate business model and develop well presented business plan that is feasible for the student.
- CO 4 :** Understanding how to manage effectively the selected business.
- CO 5 :** Understanding how to create e-Entrepreneurship.
- CO 6 :** Explain how various disciplines of the venture can be managed.

UNIT-I : Entrepreneur and Entrepreneurship:

Nature and Scope of Business. Concept of Entrepreneur & Entrepreneurship,, characteristics of an Entrepreneur, types of Entrepreneurs, Entrepreneur. Role of Entrepreneurship in Economic development. Ethics and social responsibility of an entrepreneur. Future of Entrepreneurship in India.

UNIT-II : Entrepreneurship Development in India:

Emergence of entrepreneurial class in India, Environmental factors effecting entrepreneurship, local mobility of Entrepreneurs, Concept of women entrepreneurship and rural entrepreneurship. Development of women Entrepreneurship, problems and remedies of women Entrepreneurship. Entrepreneurship Development programme (EDP) - need and objectives of EDPs, Designing an

appropriate training programme for existing and new entrepreneurs. Institutions supporting for EDP .

UNIT -III : Creating and starting the venture :

Steps to start an MSME. Meaning of a project. Project Identification- Sources of new Ideas, methods of generating ideas, creative problem solving, and opportunity recognition. Project selection - meaning of project report (Business Plan) & Formulation of a project report, Preparation of sample project report of any one product and service.

UNIT -IV : Government and Institutional support to Entrepreneurs:

MSME Development Act-2006. Technology Incubation Centre, Business Incubation Centre, National Skill Development Corporation, Institutional finance – sources of short term and long term capital including Venture capital. Role of SIDBI, NSIC, EXIM Bank and commercial Banks, APSFC, AP Industrial policy (2020-23) - incentives and subsidies, industrial estates, AP Skill Development Corporation.

UNIT - V : e-Entrepreneurship:

Concept of e-Entrepreneurship, Difference between Entrepreneurship and e-Entrepreneurship, Purpose of Creating e-Entrepreneur, Essence of e-Entrepreneurship, e-Business Ventures in different sectors, Role of information technology in MSME, Problems and prospectus of e-Entrepreneurs in INDIA.

UNIT -VI : Managing the venture:

Types of Ownership. Concepts of working capital management, Marketing management, Human Resource management and TQM. Problems and prospects of MSME in India. Profile of Entrepreneurs.

TEXT BOOKS:

1. H.Nandan: Fundamentals of Entrepreneurship, PHI Learning, New Delhi, 2009
2. S.S.Khanka: Entrepreneurial Development, S.Chand & Company Ltd New Delhi 2009
3. Dr.C.B.Gupta and Dr.S.S.Khanka Entrepreneurship and Small Business Management: Sultan Chand & Sons:,2010
4. Narayana Reddy: Entrepreneurship, Cengage learning, New Delhi, 2010
5. Rajeev Roy: Entrepreneurship, Oxford university press, New delhi,2010
6. Vasat Desai: The Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House, 2011

REFERENCES:

1. Robert D Hisrich, Michel P Peters, Dean A Sheperd: Entrepreneurship, Tata Mc Graw Hill Education Private ltd, 2009
2. Hisrich: Entrepreneurship, TMH, New Delhi,2009
3. Prasanna Chandra: Projects, TMH, New Delhi,2012
4. K.Nagarajan: Project Management, New Age International, New Delhi,2010

**DIGITAL MARKETING
(OPEN ELECTIVE)**

Subject Code:20OET414

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To develop an understanding on the digital marketing.
- To make students gaining the knowledge and skills related to the area of search engine optimization (SEO).
- To make student better understand on Social Media Optimization (SMO).
- To develop understanding on SME (Search Engine Marketing) through AdWords.
- To familiarize the students with the Lead Management & Digital Marketing.
- To understand the contemporary concepts on digital innovation and trends.

COURSE OUTCOMES:

After completion of the course the student will be able to

CO 1: Understand the concept on digital marketing.

CO 2: Define the concept on search engine optimization (SEO).

CO 3: Describe the concept on Social Media Optimization (SMO).

CO 4: Explain the idea on SME (Search Engine Marketing) through AdWords.

CO 5: Justify the concepts and developments on lead management & digital marketing.

CO 6: Comprehend the contemporary concepts on digital innovation and trends.

UNIT -I

Introduction to Digital Marketing: Digital Marketing- Importance -Digital Marketing Platforms- Difference between Traditional Marketing and digital Marketing- Advantages of Digital Marketing. Role and functions of a Digital Marketing Manager

UNIT - II

Search Engine Optimisation: Definition, scope of SEO, on-page optimisation and Off Page Optimisation, Report Preparation- Keywords, Titles, Meta Tags

UNIT –III

Social Media Optimization (SMO): Meaning and scope of SMO. Social Media Optimization of Facebook- Twitter- LinkedIn- Pinterest: Social media services optimization.

UNIT – IV

Search Engine Marketing (SME): SME through AdWords, Keyword Selection, Create Text Ads- CPC Bidding- Navigate Ad Words- SEM Metrics & Optimization.

UNIT – V

Lead Management & Digital Marketing: Web to lead forms- Web to case forms- Lead generation techniques- Social media and lead gen Inbuilt tools for Digital Marketing

UNIT – VI

Digital Innovation and Trends: The contemporary digital revolution- Digital Transformation framework- Security and Privatization Issues with Digital Marketing- Trends in Digital Marketing

TEXT BOOKS:

1. Chaffey, D. (2019). Digital marketing. Pearson UK.
2. Chaffey, D., & Smith, P. R. (2017). Digital marketing excellence: planning, optimizing and integrating online marketing. Taylor & Francis.
3. Dodson, I. (2016). The art of digital marketing: the definitive guide to creating strategic, targeted, and measurable online campaigns. John Wiley & Sons.

REFERENCES:

1. Kaufman, I., & Horton, C. (2014). Digital marketing: Integrating strategy and tactics with values, a guidebook for executives, managers, and students. Routledge.
2. Stokes, R. (2011). E-Marketing: The essential guide to digital marketing. Quirk eMarketing.
3. Kamallesh K. Bajaj; Debjani Nag: E-commerce - The cutting edge of business, Tata Mc-Graw Hill.

**ENVIRONMENTAL IMPACT ASSESSMENT
(OPEN ELECTIVE)**

Subject Code:20OET415

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

This Course is intended to build the following objectives:

- To understand basic concepts of EIA
- To study different methodologies of EIA
- To appreciate the significance of ecosystem and environmental protection
- To prepare environmental audit reports
- To understand the legal and regulatory compliance
- To prepare EIA reports for different developmental and industrial establishments

COURSE OUTCOMES:

After studying the course, the student should be able to:

- CO 1:** Determine and demonstrate the environment and developmental issues to the public effectively.
- CO 2:** Assess and evaluate the key EIA methodologies and generate the data.
- CO 3:** Assess and diagnose the impact of developmental activities on ecosystems.
- CO 4:** Demonstrate environmental audit protocols to conduct on-site audit for the generation of reports.
- CO 5:** Demonstrate the environmental and legal compliance suitable for the developmental activities.
- CO 6:** Examine and generate comprehensive EIA reports to different developmental activities.

UNIT-I

Basic Concepts of EIA: History and guiding principles of EIA-EIA Process-types of EIA-Initial Environmental Evaluation (IEE)-elements of EIA-factors affecting EIA during impact evaluation and analysis-preparation of environmental base maps and importance-classification of environmental parameters.

UNIT-II

EIA Methodologies: Introduction-criteria for the selection of EIA methodology-EIA Methods: Ad-hoc method-matrix method-networks Method-Environmental Media Quality Index method (EMQIM)-overlay method-cost/benefit analysis.

UNIT-III

Ecosystems Assessment: Assessment of Ecosystems-Assessment of impact of development activities on vegetation and wildlife, mitigation-causes and effects of deforestation-environmental impacts of deforestation.

UNIT-IV

Environmental Auditing: Environmental audit definition-objectives of environmental audit-types of environmental audit-audit protocol-stages of environmental audit-onsite audit activities-post audit activities-evaluation of audit data and preparation of audit report.

UNIT-V

Environmental Legislations: Environmental Legislations introduction-The Environmental (Protection) Act-1986-The Water (Prevention and Control of Pollution) Act-1974-The Air (Prevention and Control of Pollution) Act-1981-The Motor Vehicles Act-1988-The Wildlife (Protection) Act-1972.

UNIT-VI

EIA Report Writing: Introduction - Case studies and preparation of Environmental Impact Assessment (EIA) statement report for coal mining activities – chemical industries – Thermal power plants.

TEXT BOOKS:

1. Environmental Science and Engineering by Suresh K. Dhameja, S. K. Kataria & Sons Publications (Recent addition), New Delhi.
2. Environmental Impact Assessment Methodologies by Y. Anjaneyulu, B. S. Publications (Recent addition), Sultan Bazar, Kakinada.

REFERENCE BOOKS:

1. Environmental Pollution and Control by Dr. H. S. Bhatia, Galgotia Publications (P) Ltd., New Delhi (Recent addition).
2. Environmental Science and Engineering by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers (Recent addition).

**ENERGY AUDIT CONSERVATION AND MANAGEMENT
(OPEN ELECTIVE)**

Subject Code:20OET416

L	T	P	C
3	0	0	3

COURSE OBJECTIVE :

To introduce basic principles of energy auditing and to know something about energy management. Also it provides immense knowledge about energy efficient motors, power factor improvement, lighting and energy instruments. Finally economic aspects are analyzed.

COURSE OUTCOMES :

After completion of the course the student will be able to

CO1: Apply principles of energy auditing and propose energy conservation schemes.

CO2: Demonstrate principle and organizing energy management program.

CO3: Demonstrate the operating principle of energy efficient motors.

CO4: Analyze power factor improvement methods,

CO5: Illumination methods and demonstrate the operation of various energy instruments.

CO6: Analyze and compute the economic aspects of energy consumption.

UNIT-I**Basic principles of energy audit**

Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes.

UNIT-II**Energy management**

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting.

UNIT-III**Energy efficient motors**

Energy efficient motors , factors affecting efficiency, loss distribution, constructional details, characteristics – variable speed , variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit.

UNIT-IV**Power factor improvement**

Power factor – Need of power factor -methods of improvement of power factor, location of capacitors.

UNIT-V**Lighting and energy instruments**

Good lighting system design and practice, lighting control, lighting energy audit. Energy Instruments wattmeter, data loggers, thermocouples, pyrometers, lux meters, tongue testers.

UNIT-VI

Economic aspects and analysis

Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis.

TEXT BOOKS:

1. Energy Management by W.R. Murphy & G. McKay Butter worth, Elsevier publications. 2012
2. Energy Efficient Electric Motors by John. C. Andres, Marcel Dekker Inc. Ltd – 2nd Edition, 1995
3. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill Publishing CompanyLtd, New Delhi.

REFERENCE BOOKS:

1. Energy management by Paulo' Callaghan, Mc – Graw Hill Book company – 1st edition, 1998
2. Energy management hand book by W.C. Turner, John wiley and son, 2001.
3. Energy management and good lighting practice: fuel efficiency booklet12 – EEO.

**OPTIMIZATION TECHNIQUES
(OPEN ELECTIVE)**

Subject Code:20OET417

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- Enumerate the fundamental knowledge of Linear Programming and Dynamic Programming problems.
- Learn classical optimization techniques and numerical methods of optimization.
- Explain Integer programming techniques and apply different optimization techniques to solve various models arising from engineering areas.

COURSE OUTCOMES

On completion of this course, students should be able to

- CO 1 :** Solve linear programming problems using simplex method and to use duality principle
CO 2 : Analyze the simplex solutions for the changes in cost coefficients constraint coefficients
CO 3 : Identify the queuing model and to solve them
CO 4 : Enumerate fundamentals of non-linear programming
CO 5 : Solve different dynamic programming problems
CO 6 : Solve problems of decision making under certainty, uncertainty and risk

UNIT I

Introduction to optimization techniques: Linear programming problem, simplex method, duality principle, Big-M method, Two phase simplex method.

UNIT II

Sensitivity analysis: Change in the constraints, cost coefficients, coefficients of the constraints, addition and deletion of variable, constraints.

UNIT III

Queuing Theory: Characteristics of Queuing models, Classification, (M/M/1:FCFS/ ∞/∞), (M/M/1:FCFS/N/ ∞), (M/M/C:FCFS/ ∞/∞) models.

UNIT IV

Introduction to Non linear programming: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi-variable optimization with constraints, method of Lagrange multipliers, Kuhn-Tucker condition.

UNIT V

Dynamic Programming: Introduction, Terminology, Bellman's Principle of optimality, Applications of dynamic programming, shortest path problem, linear programming problem, Product allocation problem, Cargo load problem.

UNIT VI

Decision Theory: Introduction, Classification of decisions, decision making under certainty, decision making under risk, decision making under uncertainty.

TEXT BOOKS:

1. Operations Research by P. Rama Murthy, New Age Pub
2. Operations Research, S.D.Sharma, Kedarnath Ramanadh Publications.
3. Operations Research by D.S. Hira and Prem Kumar gupta, S.Chand.

REFERENCES BOOKS:

1. Operations Research, J.K. Sharma, MacMilan Pub.
2. Introduction to Operations Research by V. K. Kapoor, S. Chand Publishers
3. Optimization theory & Applications / S.S .Rao / New Age International

**BLOCKCHAIN TECHNOLOGIES
(OPEN ELECTIVE)**

Subject Code:20OET418

L	T	P	C
3	0	0	3

COURSE OBJECTIVES :

To give students the understanding of emerging abstract models for Blockchain Technology and to familiarize with the functional/operational aspects of crypto currency eco-system, this course covers the technological underpinning of block Chain operations in both theoretical and practical implementation of solutions using Ethereum.

COURSE OUTCOMES :

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

CO 1: Understand block chain technology.

CO 2: Understand Crypto currency

CO 3: Understand Smart contract

CO 4: Use Remix IDE

CO 5: Develop block chain based solutions and write smart contract using Ethereum Framework.

CO 6: Deploy Open source Hyper ledger Architecture.

UNIT – I

Introduction: Overview of Block chain, History of Blockchain, Peer to Peer Network, Smart Contract, Wallet, Digital Currency, Ledgers, Types of Block chain Platform, Consensus algorithms and their scalability problems, digital cash etc.

UNIT – II

Consensus Mechanism &Crypto primitives: Atomic Broad cast, Consensus, Permission Block chain, Permission less Block chain, Hash functions, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems.

UNIT – III

Bitcoin basics: Bit coin block chain, Challenges and solutions, Different Consensus Mechanism- Proof of Work, Proof of Stake, Proof of Activity, Proof of Burn, Proof of Elapsed Time, Proof of Authority, Proof of Importance, alternatives to Bitcoin consensus, Bitcoin scripting language and their use.

UNIT – IV

Crypto currency and Wallet: Types of Wallet, Desktop Wallet, App based Wallet, Browser based wallet, Metamask, Creating a account in Metamask, Use of faucet to fund wallet, transfer of crypto currency in metamask.

UNIT – V

Contract and Ethereum: Overview of Ethereum, Writing Smart Contract in Solidity, Remix IDE, Different networks of ethereum, understanding blocks practically at blockhchain.com, how to compile and deploy smart contract in remix.

UNIT – VI

Understanding Hyperledger Fabric: Overview of Open source Hyperledger project, Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric.

TEXT BOOKS:

1. Blockchain: Blueprint for a New Economy by Melanie Swan Narayanan, Bonneau, Felten, Millerand Goldfeder, “Bitcoin and Cryptocurrency Technologies - A Comprehensive Introduction”, Princeton University Press.

REFERENCE BOOKS:

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashier.
2. Mastering Ethereum: Building Smart Contracts and DApps by Andrews Prof. Sandip Chakraborty, Dr. Praveen Jayachandran, “Blockchain Architecture Design And Use Cases”[MOOC], NPTEL: <https://nptel.ac.in/courses/106/105/106105184/>

REFERENCE LINKS:

1. Dr.Mayank Agarwal, “Blockchain”[MOOC], NPTEL: https://onlinecourses.swayam2.ac.in/aic21_ge01/preview

**IT SYSTEMS MANAGEMENT
(OPEN ELECTIVE)**

Subject Code:20OET419

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Provides extensive theoretical knowledge of IT infrastructure.
- Enhances the student's computing environment knowledge.
- Provides broad based knowledge of IT System management.
- Develops management skills required for a business environment.
- Builds upon the essential core Network Security and storage management with greater emphasis.

COURSE OUTCOMES:

After completion of the course the student will be able to

- CO 1:** Describe the business value and processes of ICT services in an organization and apply that knowledge and skill with initiative to a workplace scenario.
- CO 2:** Analyze and evaluate the impact of new and current ICT services to an organization.
- CO 3:** Describe how effective IT Infrastructure Management requires strategic planning with alignment from both the IT and business perspectives in an organization.
- CO 4:** Characteristics of the network Security that affect user operations.
- CO 5:** Define, track, and maintain data and data resources and recent trends in IT.
- CO 6:** Describe E-Commerce and Global System for Mobile Communication.

UNIT – I

IT Infrastructure: Overview: Definitions, Infrastructure management activities, Evolutions of Systems since 1960s (Mainframes-to-Midrange-to-PCs-to-Client-server computing-to-New age systems) and their Management, growth of internet, current business demands and IT systems issues, complexity of today's computing environment.

UNIT – II

Software Management : SDLC, The Waterfall Model, Advantages, Disadvantages, Conventional Software Management performance, Software Economics.

UNIT – III

Current computing environment : Complexity of current computing, multiple technologies.
IT system Management: Common tasks in IT system management, approaches for organization IT management systems context diagram, patterns for IT system Management, Service level management, Financial Management, Capacity Management, availability management.

UNIT – IV

Security Management : Computer Security, Internet Security, Physical Security, Identity Management, Access control System, Intrusion Detection.

UNIT – V

Storage Management : Types of Storage management, Benefits of storage management, backups, Archive, Recovery, Disaster recovery. Space management, Hierarchical storage management.

UNIT – VI

Emerging Trends in IT : Introduction, E-Commerce, Electronic Data Interchange , Global System for Mobile Communication.

TEXT BOOKS:

1. IT Infrastructure & Its Management, By Phalguni Gupta, Tata McGraw-Hill Education. (Unit 1,3,4,5).2009
2. Software Project Management , Walker Royce: pearson Education,2021.(Unit 2).

REFERENCE BOOKS:

1. Ivanka Menken, ITIL V3 Foundation Certification Exam Preparation Course in a Book for Passing the ITIL V3 Foundation Exam, Second Edition (The Art of Service), 2009. Van Haren, Passing the ITIL Foundation, Van Haren Publishing, 2011.

**API AND MICRO SERVICES
(OPEN ELECTIVE)****Subject Code:20OET41A**

L	T	P	C
3	0	0	3

COURSE OUTCOMES:

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

CO 1 : Understand the Spring framework concepts.

CO 2 : Develop the Spring boot application

CO 3 : Develop a Spring Data JPA application with Spring Boot

CO 4 : Implement query methods for querying the database using Spring Data JPA

CO 5 : Write RESTful services using Spring REST that consumes and produces data in different formats

CO 6 : Handle exceptions and errors in Spring REST endpoints

UNIT-I :

Spring 5 Basics : Why Spring, What is Spring Framework, Spring Framework - Modules, Configuring IoC container using Java-based configuration, Introduction To Dependency Injection, Constructor Injection, Setter Injection, What is AutoScanning

UNIT-II :

Spring Boot: Creating a Spring Boot Application, Spring Boot Application Annotation, What is Autowiring, Scope of a bean, Logger, Introduction to Spring AOP, Implementing AOP advices, Best Practices : Spring Boot Application

UNIT-III:

Spring Data JPA with Boot: Limitations of JDBC API, Why Spring Data JPA, Spring Data JPA with Spring Boot, Spring Data JPA Configuration, Pagination and Sorting

UNIT-IV:

Query Approaches, Named Queries and Query, Why Spring Transaction, Spring Declarative Transaction, Update Operation in Spring Data JPA, Custom Repository Implementation, Best Practices - Spring Data JPA

UNIT-V:

Web Services: Why Web services, SOA - Service Oriented Architecture, What are Web Services, Types of Web Services, SOAP based Web Services, RESTful Web Services, How to create RESTful Services

UNIT-VI:

Spring REST: Spring REST - An Introduction, Creating a Spring REST Controller, Request Body and Response Entity, Parameter Injection, Usage of Path Variable, Request Param and Matrix Variable, Exception Handling, Data Validation, Creating a REST Client, Versioning a Spring REST endpoint, Enabling CORS in Spring REST, Securing Spring REST endpoints.

Hardware and software configuration

- 4 or 8 GB RAM/126 GB ROM
- Swagger tool suite(opensource)
- OpenJDK 17 or Java 11,Maven 3.2 or above and MySQL 8.0 or above, Spring Tool suite, Postman

TEXT BOOKS:

1. Spring in action, 5th Edition, Author: Craig Walls, Ryan Breidenbach, Manning books

Web Links [Courses mapped to Infosys Springboard platform]:

Infosys Springboard courses:

- 1.https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01296689056211763272_shared/overview [Spring 5 Basics with Spring Boot]
- 2.https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_4313461831752789500_shared/overview [Spring Data JPA with Boot]
- 3.https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012731900963905536190_shared/overview [Spring REST].

FLUID CONTROL SYSTEMS LAB**Subject Code: 20MEL411**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To study hydraulic meter-in, meter-out, bleed-off, transverse and feed circuits.
- To study hydraulic speed, pressure and flow control along with hydraulic valves and actuators.
- To study pneumatic single and double acting cylinders, 5/2, 3/2 way valves.
- To study pneumatic AND, OR logical circuits and pneumatic control system.
- To model direct and indirect control of single and double acting cylinder.

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1: Design hydraulic actuator speed control circuit.

CO 2: Design hydraulic single and double acting cylinder circuits.

CO 3: Design hydraulic bleed-off, sequence valve, transverse and feed circuits.

CO 4: Design pneumatic single and double acting cylinder circuits.

CO 5: Work with pneumatic motor, Non return valve, 5/2, 3/2 way valves.

CO 6: Design pneumatic circuits with logic values.

LIST OF EXPERIMENTS:**Experiments using Basic Hydraulic Trainer Kit**

1. Hydraulic Meter-in & Meter-out & Bleed-off Circuits
2. Hydraulic Transverse & Feed Circuits
3. Hydraulic Speed Control, Pressure Control and Flow Control
4. Hydraulic Valves, Hydraulic Actuators, Hydraulic Power Pack

Experiments using Basic Pneumatic Trainer Kit

5. Pneumatic Cylinders: Single Acting, Double Acting
6. Different Pneumatic circuits such as AND-OR Logical circuits.
7. Pneumatic Control System
8. Construction & operation of pneumatic equipments such as 5/2 way valve, 3/2 way valve, pneumatic motor.

Experiments using Automation Studio Software

9. Basic circuit for direct control of a single acting cylinder.
10. Basic circuit for indirect control of a single acting cylinder.
11. Basic circuit for direct control of a double acting cylinder.
12. Basic circuit for indirect control of a single acting cylinder.

**ROBOT VISION AND IMAGE PROCESSING
(Honors /Minors Degree Course)**

Subject Code: 20ROT404

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- The course is aimed at providing concepts of robot vision, imaging and system design
- In this subject, the fundamental concepts of robot vision and with understanding of neural networks
- This course will help in understanding the evolving concepts of image acquisition and representation
- This course recognizes the function systems and design mechanisms with general concepts, identifications and approximations

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1: Understand the basic concepts of vision systems and computer illumination techniques

CO 2: Comprehend and fundamentals with application of vision system concepts

CO 3: Understand and apply the concepts of image acquisition and representation.

CO 4: Understand and apply the knowledge of robot design functions and methods

CO 5: Understand and gain the knowledge on approximation and robotic system identification..

CO 6: Describe and discuss the basic fundamentals of robotic mechanisms and functional systems

UNIT-I: Vision System: Basic Components - Elements of Visual Perception: Structure of Human eye, Image Formation in the Eye – Pinhole Cameras - Colour Cameras – Image Formation Model – Imaging Components and Illumination Techniques - Picture Coding – Basic Relationship between Pixels - Camera-Computer Interfaces, Low Level and High Level Vision.

UNIT-II: Computer Vision Fundamentals - Advanced Computer Vision -Neural Networks for Image Processing – Tensor Flow - Overview of Deep Neural Networks - Convolution Neural Networks.

UNIT-III: Image acquisition and representation, image transformation, filtering, restoration, morphing, Camera Models, Calibration, Single view geometry, Multiple view geometry, Epi-polar geometry, RANSAC

UNIT-IV: Robot Design Function, Appearance of Design Function, Suitable Material for Design, Design Construction Methods, Social and Environment Effects of Design.

UNIT-V: Function approximation and system identification, model systems with uncertainty, state distribution dynamics and state estimation

UNIT-VI: Functional Systems and Design Mechanism – General concepts, automatic assembly, Special means of assembly, inspection systems, and miscellaneous mechanisms.

TEXT BOOKS:

1. K.S.Fu, R.C.Gonzalez, CSG. Lee, —Robotics control, sensing, vision and Intelligencel, McGraw Hill Education Pvt. Ltd., 2013.
2. Richard D Klafter, Thomas A Chmielewski, Michael Negin, —Robotics Engineering: An Integrated Approachl, PHI Learning, New Delhi, 2009
3. Craig, J. J., Introduction to Robotics: Mechanics and Control, Pearson, 3rd Edition, 2004.

REFERENCES BOOKS:

1. Rafel C.Gonzalez, Richard E.Woods, Steven L.Eddins,||Digital ImageProcessing using MATLABl,2nd edition, Tata McGraw Hill, 2010.
2. Carsten Steger, Markus Ulrich, Christian Wiedemann, —Machine Vision Algorithms and Applicationsl, WILEY-VCH, Weinheim, 2008.
3. Asada, H., and J. J. Slotine. *Robot Analysis and Control*. New York, NY: Wiley, 1986. ISBN: 9780471830290.
4. R.K. Mittal & I.J. Nagrath, “Robotics & Control” TMH-2007.
5. Groover. M.P. Industrial Robotics, technology, programming and application Mc-Graw Hill 2012.