B. TECH. 1st, 2nd & 3rd 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 JNTUK, KAKINADA)

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 JNTUK, Kakinada. 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 JNTUK 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 researchbased 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.

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Permanently Affiliated to JNTUK, Kakinada
K. Kotturu, Tekkali, Srikakulam-532201, Andhra Pradesh, India

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 (3×10=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. (6X10M=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: **40** marks for day-to-day evaluation and **60** marks on the basis of end examination and the valuation 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 of35% 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 semesterto 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

Percentage	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 Divisionfor 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:

Equivalent Percentage = (CGPA – 0.50) x 10

Award of Divisions:

Class Awarded	CGPA Secured
First Class with distinction	≥ 7.5
First Class	≥ 6.5 and < 7.5
Second Class	≥ 5.5 and <6.5
Pass Class	≥ 5.0 and <5.5

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.

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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)

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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 connectionwith 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.

	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 (1ST B.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 AN 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	Interdisplinary 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 AN 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	Interdisplinary 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 Technology

R20 - B. Tech. - ME

I Year B. Tech. I Semester
ENGLISH

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 Heasly.Cambridge University Press. 2006.
Hugging the Trees: The Story of the Chipko Movement. Thomas Weber. Viking Publishers, New Delhi, 1988.

R20 - B. Tech. - ME

I Year B. Tech. I Semester

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.

R20 - B. Tech. - ME

I Year B. Tech. I Semester

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 &Supercapacitors, Types of Batteries (Alkaline & Lead-Acid) - Difference between Batteries and Supercapacitors.

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, DhanpatRai 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

I Year B. Tech. I Semester

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 valve.

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

R20 - B. Tech. - ME

I Year B. Tech. I Semester

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 verse
- 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 respective 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.

R20 - B. Tech. - ME

I Year B. Tech. I Semester

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.

R20 - B. Tech. - ME

I Year B. Tech. I Semester

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 colurimeter), 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 colurimeter), 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. Colurimetric 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 the 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.

R20 - B. Tech. - ME

I Year B. Tech. II Semester

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 EngineeringProfessionals.
- 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 workenvironment.
- 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 TheIndian Constitution - Amendment Procedure of The Indian Constitution.42nd amendment (Mini Constitution) - 44th amendment (1978 – JanathaGovt.)

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:

PresidentofIndia-Emergencyprovisions-NationalEmergency–Article352PresidentRules–Article356- Financial Emergency – Article 360Prime Minister and Cabinet - Supreme Court of India (IndianJudiciary)

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) - ComptrollarandAuditor General (CAG) of India (Article – 148 to 150)

UNIT – VI

FINANCE COMMISSION:

Finance Commission(Article – 280) – NeethiAayog (Planning Commission) and - PoliticalParties.

TEXT BOOKS:

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

R20 - B. Tech. - ME

I Year B. Tech. II Semester

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, 44thEdition,Tata McGraw Hill New Delhi,2014.
2. **Dr.B.S.Grewal,** Higher Engineering Mathematics, 43nd 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**.**

R20 - B. Tech. - ME

I Year B. Tech. II Semester

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, Monochromacity 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 Pubishers
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

R20 - B. Tech. - ME

I Year B. Tech. II Semester

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 – Entensive 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: ClausiusTheorem –Clausius Inequality, Concept of entropy- Principle of increase of entropy, Third Law – Zero Entropy, Disorderness

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,PhaseTransformations – Quality or Dryness fraction.
Gas Laws and TD relations: Avogadro's Law, Ideal gas – Equation of state, Universal gas constant, Deference 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,

R20 - B. Tech. - ME

I Year B. Tech. II Semester

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, Kirchhoff'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.

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I Year B. Tech. II Semester

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) Briddle 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.

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I Year B. Tech. II Semester

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 bookslinks, Vijayawada)

R20 - B. Tech. - ME

I Year B. Tech. II Semester

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.

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II Year B. Tech. I Semester

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.

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II Year B. Tech. I Semester

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.

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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 – Possion'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.

R20 - B. Tech. - ME

II Year B. Tech. I Semester

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.

R20 - B. Tech. - ME

II Year B. Tech. I Semester

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, Spheriodal 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

R20 - B. Tech. - ME

II Year B. Tech. I Semester

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 &Irrationalflows, 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 layerdisplacement, 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

R20 - B. Tech. - ME

II Year B. Tech. I Semester

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 Gaseousfuels, 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. Domukundwar, DhanpatRai 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 Mulit-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.

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II Year B. Tech. I Semester

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

II Year B. Tech. II Semester

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

a) 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.
b) Write a Python program to remove the characters which have odd index values of a given string.
c) To remove punctuations from the string
d) Write a Python program to count repeated characters in a string
e) 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

a) Implement a STACK program by using PYTHON.
b) Implement a QUEUE program by using PYTHON.
c) Implement a Python Program for creating a dictionary and display its keys alphabetically.
d) Write a Python program to convert a list into a nested dictionary of keys.
e) 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

a) To find HCF or GCD of two numbers
b) To find sum of natural numbers using recursive function

Ex 6: Write the python programs to perform the following

a) Read a file line by line into a list
b) Get filename, line count, file extension, file creation and modification date .
c) Reads and displays the content of the file
d) 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

a) Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
b) 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

a) Define a class, which have a class parameter and have a same instance parameter.

b) 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

a) implement Re.findall, re.split, re.sub, re.subn, re.search and Match.group.

b) 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

R20 - B. Tech. - ME

II Year B. Tech. II Semester

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.

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II Year B. Tech. II Semester

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:– CO_2 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, overhangingbeams 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 circularsections (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 hallow 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

II Year B. Tech. II Semester

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 onsimply 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.

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II Year B. Tech. II Semester

TRANSFORM THEORY
(INTERDISPLINARY 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- 1^{st} shift and 2^{nd} 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.

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II Year B. Tech. II Semester

ELEMENTS OF BUILDING PLANNING
(INTERDISPLINARY 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,

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II Year B. Tech. II Semester

MATHEMATICAL MODELING AND SIMULATION
(INTERDISPLINARY 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
(INTERDISPLINARY 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 Bidge, 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

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II Year B. Tech. II Semester

UNIX UTILITIES
(INTERDISPLINARY 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

II Year B. Tech. II Semester

FUNDAMENTALS OF DATA STRUCTURES
(INTERDISPLINARY 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 SortingAlgorithms: 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 onImplementation 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/

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II Year B. Tech. II Semester

COMPETITIVE PROGRAMMING - I
(INTERDISPLINARY 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 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 TheIndian 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 352President Rules – Article 356- Financial Emergency – Article 360Prime 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)

II Year B. Tech. II Semester

UNIT – V

PARLIMENTARY COMMITTEES:

Public Accounts Committee - Estimates Committee - Committee on Public. Undertakings. - Election commission of India (Article -324) - Comptrollar andAuditor 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. Poicits in India by Rajini Kothari, Orient LongMan, 2005.
3. The Indian Constitution by Madhav Khosla by Oxford University Press India, 2012.

II Year B. Tech. II Semester

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 helps 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.

R20 - B. Tech. - ME

III Year B. Tech., I Semester

HUMAN VALUES

Subject Code: 20MCT305

L	T	P	C
2	0	0	0

COURSE OBJECTIVES

- To explainthestudentshowtogoverntheprofessionalbehaviorintheircareer 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, Respectfor Others,7 Way sofMisusing Truth – Work Culture, Social Responsibility, Responsibilities as a Citizen, Co operation and Commitment, Caring andSharing Religionvs. 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--OrganizationalDisobediencebyContraryAction,byNon-Participation,by Protest – Environmental Laws and Judicial Intervention in Related Matters-Environmental Movements.

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, Riskand Public Policy- Engineers as Managers, Advisors and Experts, Engineers as Moral Leaders Problem of Bribery, Extortion, Grease Payments, Nepotism exits 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 humanismMoralandnon-moralvaluationStandardsandprinciplesValuejudgments

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 to lerance true friendship, happiness Vs suffering, love for truth. Aware of self destructive habits, Association and Cooperation, Doing best for saving nature

TEXT BOOKS:

1. CharlesEHarris,MichealJRabins,"EngineeringEthics,CengageLearning (2009)
2. Mike Martin and Rol and Schinzinger, "Ethicsin Engineering" McGrawHill, (2005)
3. Mind, Its Mysteries and Control ,Swami Sivananda ,Divine Life Society Pub (1994)
4. Chakroborty,S.K."ValuesandEthicsfororganizationsTheoryandpractice",Oxford University Press, New Delhi (1998)
5. Dr SB. Nageswararao " Humour in Management " Walnut Publications, Bhubaneswar (2022)

R20 - B. Tech. - ME

III Year B. Tech., I Semester

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 Machanical 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

R20 - B. Tech. - ME

III Year B. Tech., I Semester

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.

III Year B. Tech., I Semester

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.

R20 - B. Tech. - ME

III Year B. Tech., I Semester

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.

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. Raghuwanshi, Khanna Pub.
3. Metal Cutting Principles, Milton C Shaw, CBS Pub.
4. Metal Cutting and Machine Tools, Geoffrey Boothroyd, CRC Press.

R20 - B. Tech. - ME

III Year B. Tech., I Semester

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.

III Year B. Tech., I Semester

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. Guptha - S.Chand Publications.
5. I.C.Engines –V Ganesan
6. I.C.Engines – Mathur and Sharma

R20 - B. Tech. - ME

III Year B. Tech., II Semester

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 bounding 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.

R20 - B. Tech. - ME

III Year B. Tech. I Semester

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.

III Year B. Tech. I Semester

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 Memdani 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

R20 - B. Tech. - ME

III Year B. Tech. I Semester

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

R20 - B. Tech. - ME

III Year B. Tech. I Semester

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]**

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, Paining 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 helps 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 Langrangian Dynamic Models – 2DOF, Langrangian - 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.

R20 - B. Tech. - ME

III Year B. Tech. II Semester

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.

R20 - B. Tech. - ME

III Year B. Tech. II Semester

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: Cclassify 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

R20 - B. Tech. - ME

III Year B. Tech., II Semester

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.

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..

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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. Dukkipati, 2nd Edition, PHI Publications.
3. Mechanical Vibrations, V.P.Singh, Dhanpatrai & Co. Publications.

R20 - B. Tech. - ME

III Year B. Tech., II Semester

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 & Proximitysensors.

UNIT-III: Transformations and Robot Kinematics

Transformations: Introduction – Fundamental transformations – Properties – Homogeneoustransformations – Applicable to both 2D &3D in robotics & Problems

Forward &Inverse kinematic models: Denavit - Hartenburg (D-H) representation for rotationaljoints – 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.

R20 - B. Tech. - ME

III Year B. Tech., II Semester

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, ASTME Pub.

R20 - B. Tech. - ME

III Year B. Tech., II Semester

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 instruments.

CO 4. Explain temperature and flow measuring methods and instruments

CO 5. Explain humidity and mositure 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. Doeblin, 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: 20 MEE432

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

R20 - B. Tech. - ME

III Year B. Tech., II Semester

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 discretisaton, Discussion on consistency, stability, conservativeness boundedness and transportiveness.

Stablity 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. Implict and Explicit schemes, Iterative Solution Algorithms - Jacobi-iteration method, Gauss-Siedel 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 frotrbulent 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".

R20 - B. Tech. - ME

III Year B. Tech., II Semester

NANO MATERIALS
(Professional Elective –III)

Subject Code: 20MEE434

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.

III Year B. Tech., II Semester

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.

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III Year B. Tech., II Semester

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 Convention 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.

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III Year B. Tech., II Semester

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 ; T**ime 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 helps 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.