ACHARYA NAGARJUNA UNIVERSITY

NAGARJUNA NAGAR, GUNTUR – 522 510 ,ANDHRAPRADESH, INDIA

Syllabus

for

MECHANICAL ENGINEERING

4-Year B.Tech Degree Course(Semester System)

W.E.F: 2019-2020

Acharya Nagarjuna University

Faculty of Engineering

Academic Regulations 2019 (R19) for B. Tech (Regular)

(Applicable for the students admitted during the

Academic Year 2019-2020 and onwards)

1. Eligibility for Admission:

Admission to the above program shall be made subject to the eligibility, qualification and specialization prescribed by the University for each program from time to time.

i. Admission shall be made either on the basis of merit/rank obtained by the qualifying candidates in EAMCET/ECET or otherwise specified, whichever is relevant.

The duration of B.Tech program is of four academic years divided into eight semesters comprising of two semesters in each academic year. A student is required to choose a branch of study at the time of admission. Students under lateral entry will be admitted straightaway into Third semester of B.Tech course in the respective branch. No change of branch shall be allowed after the admissions are closed.

2. Award of B.Tech. Degree:

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

i. Regular entry students shall pursue a course of study for not less than four academic years and in not more than eight academic years.

ii. Student's who fail to fulfill all the academic requirements for the award of the degree within eight academic years (for Regular Entry) / six academic years (for Lateral Entry) from the year of their admission, shall forfeit their seat in B.Tech course and their admission is cancelled.

Completing the course of study shall mean not only satisfying the attendance requirements but also passing of all the subjects within the respective stipulated period

3. Branches of study:

The following Branches of study are offered at present for B. Tech. degree

S.No.	Branch
1.	Civil Engineering
2.	Electrical and Electronics Engineering.
3.	Mechanical Engineering.
4.	Electronics and Communication Engineering
5.	Computer Science and Engineering.
6.	Chemical Engineering

and any other branch as approved by the authorities of the University from time to time.

Each Branch will have a curriculum with a syllabi that shall consist of the following:

i. General Core Courses 1. Basic Sciences
2. Engineering Sciences
3. Humanities and social sciences

ii. Program core courses in Engineering / Technology
iii. Elective courses of Engineering / Technology / Management Entrepreneurship / Business Communication and allied fields.
iv. Open Electives/CBCS
v. Mandatory learning courses
vi. Project work

4. Credits:

i. *Academic Year:* Two consecutive (one odd + one even) semesters constitute one academic year.
ii. *Choice Based Credit System (CBCS):* The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses).
iii. *Credit:* A unit by which the course work is measured.

5. Distribution and Weightage of Marks (Internal & External):

i. The performance of a student in each semester shall be evaluated subject-wise with a maximum of 100 marks for theory and 100 marks for practical subject. In addition internship & project work shall be evaluated for 100 and 200 marks respectively.
ii. For both theory and lab subjects the distribution shall be 40 marks for Internal Evaluation and 60 marks for the External Evaluation.
iii. There shall be five units in each of the theory subjects.
iv. For theory subjects, there shall be <u>two</u> midterm examinations during the semester. Each midterm examination shall consist of assignment for 15 marks and sessional test for 20 marks with duration of 150 minutes respectively.

First midterm examination shall be conducted for 50% coverage of syllabus and second midterm examination shall be conducted for remaining 50% of syllabus. Both the midterm exams are compulsory. Final midterm examination marks for a total of 35 marks shall be arrived at, by considering the 80% weightage (28 marks) to that midterm

examination in which the student scores more marks and the remaining 20% (7 marks) for other midterm exam.

*****Note 1: The assignment test paper shall contain 6 questions of equal weightage and student is asked to answer any 3 questions randomly and shall be condensed for 15 marks, any fraction rounded off to the next higher mark.

*****Note 2: The sessional examination shall contain 3 questions out of which first question is objective(6marks) and compulsory and remaining two questions(7 marks each) having internal choice and shall be considered for 20 marks, any fraction rounded off to the next higher mark.

***Note 3: Remaining** 5 marks allotted for attendance as indicated in CLAUSE(_6)

V. For theory subjects, there will be 5 questions with following pattern in the End-Examination.

a. All Questions have to be answered compulsorily.
b. All five questions, EITHER/OR type shall be followed with 12 marks for each.
c. In each question as mentioned in (c), one, two or more bits can be set.

vii. Further, whenever any theory subject with two parts is offered (combined subject), for ex: Electrical & Mechanical Technology, then there shall be only two parts Part A, Part B in the question paper.
First question objective can be equally divided into two parts.

Part – A: shall contain two questions, EITHER/OR type shall be followed with 12 marks for each.

Part – B: shall also contain two questions, EITHER/OR type shall be followed with 12 marks for each.

viii. Model Question paper for each theory course shall be prepared by the teacher within 15 days from the commencement of the semester and the same shall be forwarded to the Controller of Examinations through the Chairman, BOS concerned.

ix. For practical subjects there shall be a continuous evaluation during the semester for 40 internal marks and 60 end examination marks. Day-to-day work in the laboratory shall be evaluated for 25 marks by the concerned laboratory teacher based on the report of experiments/jobs(10 marks for the record submitted and 15 marks for day to day work). The end examination for 15 marks (10 marks for experiment and 5 marks for viva-voce) shall be conducted by the laboratory teacher and another examiner from the same department.

*Note: Day to day performance shall be recorded in student record(each experiment carries 15 marks, at least ten experiments should be done and average marks must be taken at the end of semester).

x. For the subject having design and / or drawing, such as Engineering Drawing, Machine Drawing and Estimation, the distribution shall be 40 marks for internal evaluation and 60 marks for end examination. The Internal evaluation will be 20 marks for day-to-day work in the class that shall be evaluated by the concerned subject teacher based on the reports/submissions prepared in the class. Further, there shall be two midterm exams in a Semester for a duration of 2 hrs each, evenly distributed over the syllabi for 20 marks and the average marks of both the mid examinations shall be considered as internal test marks. The sum of day to day evaluation and the internal test marks will be the final internal marks for the subject.

xiv. Out of a total of 200 marks for the project work, 80 marks shall be for Internal Evaluation and 120 marks for the End Semester Examination (Viva-voce). The viva-voce shall be conducted by a committee consisting of Head of the Department, Project Supervisor and an External Examiner nominated by the Principal from the panel of 3 members proposed by Head of the Department. The project work shall start in IV year I semester and shall continue in the semester break. The evaluation of project work shall be conducted at the end of the IV year II semester. The Internal Evaluation shall be made on the basis of weekly progress (a minimum of 12 weeks and 3 marks for each week progress) and at least two seminars (one at the beginning of IV B.Tech II semester (20 marks) and the other before submission of project work(24 marks) given by each student on the topic of his project.

xv. The laboratory records and internal test papers shall be preserved for minimum of 2 years in the respective departments and shall be produced to the Committees of the college as and when the same are asked for.

6. Attendance Requirements:

i. A student shall be eligible to appear for end examinations if he/she acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.
ii. **Shortage of Attendance below 65% in aggregate shall in <u>NO</u> case be condoned**.
iii. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

iv. Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
v. A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester, as applicable. They may seek readmission for that semester when offered next.

vi. A stipulated fee shall be payable towards condonation of shortage of attendance to the college.
vii. A weightage in sessional marks upto a maximum of 5 marks out of 40 marks in each theory subject shall be given for those students who put in a minimum of 75% attendance in the respective subject in a graded manner as indicated below.

Attendance of 90% and above		5marks
Attendance of 85% and above		
Attendance of 80% and above		
Attendance of 75% and above	and less than 90%	3marks
	and less than 85%	2marks
	and less than 80%	1mark

7. Minimum Academic Requirements (For Regular Entry Students):

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.**6**

i. A student who could not secure a minimum of 50% aggregate from midterm examination marks is not eligible to appear for the semester end examination and shall have to repeat that semester.

ii. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, design, drawing subject or project if he secures not less than 40% of marks in the end examination and a minimum of 50% of marks in the sum total of the internal evaluation and end examination taken together. In the internship & project he/she should secure 40%. For practical examination if he secures not less than 50% of marks in the semester end examination.

iii. A student shall be promoted from I to II year only if he/she fulfils the academic requirements of attendance and internal marks as stipulated in clause 6 and 7 irrespective of back log subjects in I/IV B.Tech.

iv. A student shall be promoted from II to III year only if he/she fulfils the academic requirements of attendance and internal marks as stipulated in clause 6 and 7 and also must secure 70% of the credits of the subjects that have been studied up to I year II semester from

irrespective of whether the candidate takes the end examination or not as per the normal course of study. At the time of commencement of calss work, he must attain the re quired credits

v. A student shall be promoted from third year to fourth year only if he fulfills the academic requirements of of attendance and internal marks as stipulated in clause 6 and 7 and also must secure 70% of the credits of the subjects that have been studied upto II year II semester. At the time of commencement of class work, he must attain the required credits

And in case of getting detained for want of credits by sections ii and iii above, the student may make up the credits through supplementary exams of the above exams before the date of class work commencement of Third or Fourth year I semester respectively.

8. Minimum Academic Requirements (For Lateral Entry Students):

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.**6**

i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 40% of marks in the end examination and a minimum of 50% of marks in the sum total of the internal evaluation and end examination taken together. In the Seminar & Comprehensive viva-voce he/she should secure 40%.

ii. A student who could not secure a minimum of 50% aggregate from midterm examination marks is not eligible to appear for the semester end examination and shall have to repeat that semester.

iii. A student shall be promoted from II to III year only if he/she fulfils the academic requirements of attendance and internal marks as stipulated in clause 6 and 7 irrespective of back log subjects in II/IV B.Tech

iv. A student shall be promoted from III to IV year only if he/she fulfils the academic requirement of of attendance and internal marks as stipulated in clause 6 and 7 and also must secure **70%** of the subjects that have been studied up to III year I semester from

9. Grading:

After each subject is evaluated for 100 marks, the marks obtained in each subject will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Table – Conversion into Grades and Grade Points assigned

Range in which the marks in the subject fall	Grade	Grade points assigned
≥ 90	O (Outstanding)	10
80-89	A+ (Excellent)	9
70-79	A (Very Good)	8
60-69	B+ (Good)	7
50-59	B (Above Average)	6
45-49	C (Average)	5
40-44	D (Pass)	4
< 40	F (Fail)	0
Absent	Ab (Absent)	0

i. A student obtaining Grade F shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered.

ii. For non credit courses ‘Satisfactory’ or “Unsatisfactory’ shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

9.1. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

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

$$SGPA = \Sigma (C_i \times G_i) / \Sigma C_i$$

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

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

$$CGPA = \Sigma (C_i \times S_i) / \Sigma C_i$$

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

iii. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iv. While computing the GPA/CGPA the subjects in which the student is awarded Zero grade points will also be included.

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

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

10. Gap - Year:

Gap Year – concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I year/II year/III year to pursue entrepreneurship full time. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. An evaluation committee shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for having the Gap Year.

11. Transitory Regulations:(old regulations changed)

1. Candidates who admitted into the four year B.Tech degree course under R-15 regulations but who got detained in any year for want of attendance/minimum aggregate sessional marks may join the appropriate year /semester in the semester system applicable for that batch and be governed by the regulations of that batch from then onwards unless otherwise specified.
2. A student admitted under credit based regulations(CR) detained due to lack of sessional marks/attendance at the end of the first semester of II/IV B.Tech shall join II/IV first semester fo R-15 batch . Such students will study all the courses prescribed for that R-15 in which the student joins. However the student has to clear all the first year backlog subjects by appearing the supplementary examination. Such candidates will be governed by the regulations applicable to lateral entry candidates of R-15 batch for the award of the degree.

3. A student admitted under CR, detained due to lack of sessional marks/attendance at the end of the second semester of II/IV B.Tech /at the end of subsequent semesters shall follow the credit based regulations only (CR).

12. With–holding of results:

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

13. Award of Class:

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

Class Awarded	CGPA Secured
First Class with Distinction	≥ 8.0
First Class	≥ 6.5 < 8.0
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 4.0 < 5.5

14. Minimum Instruction Days:

The minimum instruction period for a semester is 16 weeks. The minimum instruction days including exams for each semester shall be for 90 days.

15. There shall be no branch transfers after the completion of admission process.

16. General:

i. The academic regulations should be read as a whole for purpose of any interpretation.
ii. Malpractice rules - nature and punishments is appended
iii. Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".
iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the BOS is final.
v. The University may from time to time, revise, amend or change the Regulations, Schemes of Examinations, and/or Syllabi.

17. Conduct and discipline

Students shall conduct themselves within and outside the premises of the institute in a manner befitting the students of our institution.

(b) As per the order of Honourable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.
(c) The following acts of omission and / or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging.
(i) Lack of courtesy and decorum, indecent behavior anywhere within or outside the campus.
(ii) Willful damage of college / individual property
(iii) Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.
(iv) Mutilation or unauthorized possession of library books.

(v) Noisy and unseemly behavior, disturbing studies of fellow students.

(vi) Hacking of computer systems (such as entering into other person's areas without prior permission, manipulation and / or damage of computer hardware and software or any other cyber-crime etc.)

(vii) Usage of camera / cell phone in the campus (viii) Plagiarism of any nature

(ix) Any other acts of gross indiscipline as decided by the academic council from time to time.

(d) Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute / hostel, debar from examination, disallowing the use of certain facilities of the institute, rustication for a specified period or even outright

expulsion from the institute or even handing over the case to appropriate law enforcement or the judiciary, as required by the circumstances.

(e) For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the chief warden, the head of the department and the principal respectively, shall have the authority to reprimand or impose fine.

(f) Cases of adoption of unfair means and / or any malpractice in an examination shall be reported to the principal for taking appropriate action.
(g) All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the academic council.
(h) The institute level standing disciplinary action committee constituted by the academic council shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed.

(i) The principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the programmes committee in an appropriate manner, and subsequently such actions shall be placed before the academic council for ratification. Any emergency modification of regulation, approved by the appropriate authority, shall be reported to the academic council for ratification.

(j) "Grievance and Redressal Committee" (General) constituted by the Principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters

18. Punishments for Malpractice Cases - Guidelines

The examinations committee may take the following guidelines into consideration while dealing with the suspected cases of malpractice reported by the invigilators/squad members etc; during end examinations. The punishment may be more severe or less severe depending on the merits of the individual cases.

S. No	Nature of Malpractices/Improper conduct	Punishment
1.	Possesses or keeps accessible in examination hall, any paper, note book, programmable	Expulsion from the examination hall and cancellation of the performance in

	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)	that subject only.
2.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
3.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.

4.	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any other student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
5.	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 including practical examinations and project work of that semester/year.
6.	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 including practical examinations and project work of that semester/year.
7.	Smuggles in the Answer book or takes out or arranges to send out the question paper during the examination or answer book during or after the examination	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects including practical examinations and project work of that semester/year. The student is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
8.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent /	In case of students of the college, they shall be expelled from examination halls

	any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	and cancellation of their performance in that subject and all other 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.

9.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects including practical examinations and project work of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
10.	Posseses 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 including practical examinations and project work of that semester/year. The student is also debarred and forfeits the seat.
11.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 7 to 9.	For Student of the college: Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects including practical examinations and project work 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.
12.	Impersonates any other student in connection with the examination	The student who has impersonated shall be expelled from examination hall. The student is debarred from writing the remaining exams, and rusticated from the college fur one academic year during which period the student will not be permitted to write any exam. If the imposter is an outsider, he will be handed over to the police and a case is registered against him. The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination including practicals and project work of that semsester/year. The student is rusticated from the college for two consecutive years during which period the student will not be permitted to write any exam. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat

	If any malpractice is detected which is not covered in the above clauses 1 to 12 it shall be reported to the college academic council for further action to award suitable punishment.
13.	Malpractice cases identified during sessional examinations will be reported to the examination committee nominated by Academic council to award suitable punishment.

I/IV B.Tech ME-Semester – 1(Theory - 5, Lab-4)				
S.No	**Course No**	**Course Name**	**Category**	**L-T-P-C**
1	ME 111	Mathematics I (Calculus & Linear Algebra)	BS	3-0-0-3
2	ME 112	Engineering Physics	BS	3-0-0-3
3	ME 113	Problem Solving & Programming(using C)	ES	3-1-0-4
4	ME 114	Communicative English I	HS	2-0-0-2
5	ME 115	Environmental Science	MC	3-0-0-0
6	ME 151	Physics lab	BS	0-0-3-1.5
7	ME 152	Problem solving & Programming using C	ES	0-0-3-1.5
8	ME153	English lab	HS	0-0-3-1.5
9	ME 154	Workshop I (Basic Engineering Workshop)	LC	0-0-3-1.5
			Total ==>	**18**

I/IV B.Tech ME-Semester - 2 (Theory - 6, Lab - 5)				
S.No	**Course No**	**Course Name**	**Category**	**L-T-P-C**
1	ME 121	Mathematics II (ODE and Multivariable Calculus)	BS	3-0-0-3
2	ME 122	Engineering Chemistry	BS	3-0-0-3
3	ME 123	Engineering Graphics & Design	ES	1-0-3-2.5
4	ME 124	Engineering Mechanics	ES	3-1-0-4
5	ME 125	Python Programming	ES	2-1-0-3
6	ME 126	Constitution of India	MC	3-0-0-0
7	ME 161	Chemistry Lab	BS	0-0-3-1.5
8	ME 162	2D Drafting Lab	ES	0-0-3-1.5
9	ME 163	Python Lab	ES	0-0-3-1.5
10	ME 164	Workshop (Mechanical)	LC	0-0-3-1.5
			Total ==>	**21.5**

MATHEMATICS-I(ME111)

(Calculus & Algebra)

(Common to all branches of Engineering)

L	T	P	C
3	0	0	3

Course Objectives:

- This course will illuminate the students in the concepts of calculus and linear algebra.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Bridge Course: Limits, continuity, Types of matrices

Unit I: Matrix Operations and Solving Systems of Linear Equations 10 hrs

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

Learning Outcomes:

At the end of this unit, the student will be able to

- solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigenvalues and eigenvectors, diagonal form and different factorizations of a matrix; (L3)
- identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics; (L3)

Unit II: Mean Value Theorems 6 hrs

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof);

Learning Outcomes:

At the end of this unit, the student will be able to

- Translate the given function as series of Taylor's and Maclaurin's with remainders (L3)
- analyze the behaviour of functions by using mean value theorems (L3)

Unit III: Multivariable calculus 8 hrs

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

Unit IV: Double Integrals 8hrs

Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves.

Learning Outcomes:

At the end of this unit, the student will be able to

- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)

Unit V: Multiple Integrals and Special Functions 8 hrs

Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, Beta and Gamma functions and their properties, relation between beta and gamma functions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Conclude the use of special function in multiple integrals (L4)
- evaluate multiple integrals in Cartesian, cylindrical and spherical geometries (L5)

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

References:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.

Course Outcomes:

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

- develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)
- Utilize mean value theorems to real life problems (L3)
- familiarize with functions of several variables which is useful in optimization (L3)
- Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems (L5)
- Students will become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions

ENGINEERING PHYSICS(ME112)

(Civil, Mechanical, Chemical Branches)

L	T	P	C
3	0	3	4.5

Course Objectives:

- To impart knowledge in basic concepts of Wave optics, acoustics, material properties
- Familiarize Principles of Quantum Mechanics and Laser applications

Course Outcomes:

After completing this course students will be able to

- **interpret** the interaction of energy with the matter (L2)
- **apply** the principles of acoustics for noise cancellation (L3)
- **explain** the relationship between elastic constants (L2)
- **evaluate** the energy of the electron by using Wave equation (L2)
- **identify** the Lasers for various engineering applications (L3)

- **Unit-I : Wave Optics (10 hrs)**
- Principle of Superposition-Interference of light-Theory of Interference fringes-Conditions for sustained Interference -Interference in thin films (reflected light)-Newton's Rings-Determination of Wavelength.
- Diffraction-Fraunhofer Diffraction-Single slit Diffraction -Diffraction Grating – Grating Spectrum -Determination of Wavelength.
- Polarization-Polarization by reflection, refraction and double refraction-Nicol's Prism--Half wave and Quarter wave plate- Engineering applications of Interference, Diffraction and Polarization.

Learning Outcomes:

The students will be able to

- **explain** various types of coherent sources (L2)
- **outline** the conditions for sustained interference (L2)
- **identify** applications of interference including homodyne and heterodyne detection (L3)
- **analyze** the differences between interference and diffraction (L4)
- **illustrate** the concept of polarization of light and its applications (L2)
- **classify** the production and detection of different polarized light (L4)

Unit-2: ACOUSTICS AND ULTRASONICS (9 hrs)

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption coefficient and its determination –factors affecting acoustics of buildings and their remedies.

Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications - Sonogram

Learning Outcomes:

The students will be able to

- **explain** how sound is propagated in buildings (L2)
- **analyze** acoustic properties of typically used materials in buildings (L4)

- **recognize** sound level desruptors and their use in architectural acoustics (L2)
- **identify** the use of ultrasonics in different fields (L3)

Unit-3: ELASTICITY (8 hrs)

Concepts of elasticity, plasticity, strain hardening, failure (fracture / yielding); Idealization of one dimensional stress-strain curve; Generalized Hooke's law with and without thermal strains for isotropic materials; elastic constants and their relationships; Strain energy.

Learning Outcomes:
The students will be able to

- **interpret** stress and strain curve (L2)
- **develop** the relationship between elastic constants (L2)
- **identify** the fracture / yielding of materials with different loads (L3)

Unit-4: Principles of Quantum Mechanics (9 hrs)

Dual nature of light, Matter waves & properties, de Broglie's concept of matter waves, Davisson and Germer experiment, Heisenberg's uncertainty principle and application (non-existence of electron in nucleus). One dimensional time independent Schrodinger's wave equation, Physical significance of the wave function, Particle in a box (one dimensional).

Learning Outcomes:
The students will be able to

- **identify** the necessity of Matter waves (L3)
- **explain** Behavior of electron (L2)
- **determine** the Wave equation and energy of the particle (L3)

Unit – V: Lasers (8 hrs)

Laser characteristics, Spontaneous and Stimulated emissions, Basic requirements of a laser, Population inversion – Solid state laser (Ruby laser), Gas (He-Ne) laser, Semiconductor (GaAs) laser, Applications of lasers.

Learning Outcomes:
The students will be able to

- **identify** different types of Lasers and applications (L3)
- **explain** the working principles of Lasers (L2)
- **select** Laser for different type of applications (L3)

Text Books

1. D.Kleppner and Robert Kolenkow"An introduction to Mechanics"-II -Cambridge University Press,2015
2. Gaur R.K. and Gupta S.L., "Engineering Physics"- Dhanpat Rai publishers, 2012
3. M.N.Avadhanulu&P.G.Kshirsagar"A Text book of Engineering Physics"-S.Chand Publications,2017
4. Ian R Sinclair, Sensor and Transducers 3rd eds, 2001, Elsevier (Newnes)

Reference text books:

M K Varma "Introduction to Mechanics"-Universities Press-2015.

1. D.K. Bhattacharya and A. Bhaskaran, "Engineering Physics"- Oxford Publications-2015

ME 113 Problem Solving and Programming(Using C)

L-T-P-C : 3-1-3-5.5

Course Objectives:

1. To teach problem solving through Flow charting tool – Raptor
2. To solve numerical problems using Raptor
3. To analyze problems by modular approach using Raptor
4. To understand the basic concepts and tokens of C
5. To learn the concepts of control structures, functions, arrays and pointers of C
6. To understand the concepts of structures , unions and files in C

Unit – 1: Flowchart design through Raptor

Flow chart symbols, Input/Output, Assignment, operators, conditional if, repetition, function and sub charts. Example problems(section 1) – Finding maximum of 3 numbers, Unit converters, Interest calculators, multiplication tables, GCD of 2 numbers

Example problems(section 2) - Fibonacci generation, prime number generation. Minimum, Maximum and average of n numbers, Linear search, Binary Search.

Learning Outcomes: Student should be able to

1. Select flowchart symbols for solving problems.
2. Develop basic flowcharts for performing Input, Output and Computations
3. Solve numerical problems using Raptor
4. Analyse problems by modular approach using Raptor

Unit 2: C Basics

C-Basics: C-character set, Data types, Constants, Expressions, Structure of C program, Operators and their precedence & associatively, Simple programs in C using all the operators, Type casting ,type coercion.

Learning outcomes: Student should be able to

1. Exercise concepts of control structures in C
2. Develope user defined and predefined functions in C

Unit 3: Control Structures and Functions

Control Structures, Basic input and output statements, Preprocessor directives.

Functions: Concept of a function, passing the parameters, automatic variables, scope and extent of variables, storage classes, recursion, iteration vs recursion, types of recursion, Simple recursive and non recursive programs, Towers of Hanoi problem.

Learning Outcomes: Student should be able to

1. Illustrate the flowchart and design an algorithm for a given problem and to develop IC programs using operators
2. Develop conditional and iterative statements to write C programs
3. Exercise user defined functions to solve real time problems

Unit 4: Arrays and Pointers

Arrays: Single and multidimensional Arrays, Character array as a string, string functions, Programs using arrays and string manipulation.

Pointers: Pointers declarations, Pointer expressions, Pointer parameters to functions. Pointers, Pointers and array, Pointer arithmetic.

Learning Outcomes: Student should be able to

1. Inscribe C programs that use the concepts of structures , unions in C
2. Develop programs on files and command line arguments in C
3. Inscribe C programs that use Pointers to access arrays, strings and functions.
4. Inscribe C programs using pointers and to allocate memory using dynamic memory management functions.

Unit 5: Structures and Files

Structures: Declaring and using structures, operations on structures, structures and arrays, user defined data types, pointers to structures.Command line arguments.

Files: Introduction, file structure, file handling functions, file types, file error handling, Programs using file functions.

Learning Outcomes: Student should be able to

4. Exercise user defined data types including structures and unions to solve problems
5. Exercise files concept to show input and output of files in C

Text Books:

1. https://raptor.martincarlisle.com/
2. Programming with C-Gottfried-Schaums Outline Series-TMH
3. C Programming – AnithaGoel/Ajay Mittal/E.Sreenivasa Reddy-Pearson India

Referrences:

1. Problem Solving with C- Somasekharan-PHI.
2. C Programming- Behrouz A forouzan – CENGAGE Learning
3. Test your c skills-Yaswanthkanithker
4. Let us C- Yaswanthkanithker

Communicative English-I(ME114)

B.T./CE/Ch.E./CSE/ECE/EEE/EI/IT/ME

L-T-P-C

2-1-3-3.5

Course Objectives:

The course aims to inculcate a sense of professionalism among the students while emphasizing on the basic aspects of the language learning such as grammar and vocabulary building. It also aspires to train the students to meet the global challenges.

- Adopt activity based teaching-learning methods to ensure that learners would be engaged in use of language in the classroom sessions.
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Syllabus:

UNIT-1: 6 Hrs.

1. Reading: Reading Comprehension (Skimming, Scanning & Inference)
2. Writing: Paragraph Writing
3. Grammar: Common Errors in Nouns- Pronoun Agreement
4. Vocabulary Building: Content and Functional word list -100

Learning Outcomes:

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

- identify the context, topic, and pieces of specific information (L3)
- ask & answer general questions on familiar topics (L2)
- employ suitable strategies for skimming & scanning to get the general idea of a text and specific information (L3)
- recognize paragraph structure with beginnings/endings (L3)
- form sentences using proper grammatical structures and correct word forms (L3)

UNIT- II: 6 Hrs.

1. Reading: Jumbled Sentences
2. Writing: Proposal Writing
3. Grammar: Correction of Errors in Subject- Verb Agreement
4. Vocabulary Building: Sign Post, Transition signals

Learning Outcomes:

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

- comprehend short paragraphs on general topics (L2)
- understand the use of cohesive devices for better reading comprehension (L2)
- write well-structured paragraphs on specific topics (L3)
- make necessary grammatical corrections in short texts (L3)

UNIT - III: 6 Hrs.

1. Reading: Article Review
2. Writing: Note Making, Note Taking
3. Grammar: Correction of errors in Tense Usage
4. Vocabulary Building: Synonyms and Antonyms

Learning Outcomes:

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

- Review the content with clarity & precision from an article (L3)
- infer meanings of unfamiliar words using contextual clues (L3)
- write summaries based on global comprehension of reading texts (L3)
- produce a well-organized essay with adequate details (L3)
- use correct tense forms, appropriate structures in speaking and writing (L3)

UNIT - IV: 6 Hrs.

1. Reading: Story Reflection
2. Writing: Pictorial Description
3. Grammar: Correction of Errors in Adjectives, Articles, Prepositions
4. Vocabulary Building: Root Words (200)

Learning Outcomes:

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

- Reflect the content of the story with clarity & creatively (L3)
- infer meanings of unfamiliar words using contextual clues in the story (L3)
- infer & predict about content of a discourse (L4)
- interpret graphic elements used in academic texts (L2)
- make formal written communication using effective strategies (L3)

UNIT - V: 6 Hrs.

1. Reading: Mind Mapping
2. Writing: Information Transfer
3. Grammar: Correction of Errors in Wh- questions, Question Tags
4. Vocabulary Building: One Word Substitutes

Learning Outcomes:

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

- take notes in mind while reading a text to answer questions (L3)
- edit short texts by correcting common errors (L4)
- produce a coherent paragraph interpreting a figure/graph/chart/table (L4)
- use language appropriate for description and interpretation of graphical elements (L4)

Course Outcomes:

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

- identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English (L3)
- formulate sentences using proper grammatical structures and correct word forms (L3)
- speak clearly on a specific topic using suitable discourse markers in informal discussions (L3)
- write summaries based on global comprehension of reading texts (L3)
- produce a coherent paragraph interpreting a figure/graph/chart/table (L4)

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

REFERENCE BOOKS:

1. Bailey, Stephen. *Academic writing: A handbook for International Students*. Routledge, 2014.
2. Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
3. *Skillful Level 2 Reading & Writing Student's Book Pack (B10),* Macmillan Educational.
4. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
5. Michael Swan. *Practical English Usage*, OUP. 1995.
6. F.T. Wood. *Remedial English Grammar,* Macmillan.2007
7. William Zinsser. *On Writing Well.* Harper Resource Book. 2001
8. Liz Hamp-Lyons and Ben Heasly. *Study Writing,* Cambridge University Press. 2006.
9. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad.
10. Sharon J.Gerson, Steven M.Gerson, *Technical Writing*, New Delhi: Pearson education, 2007.
11. Sanjay Kumar and Pushp Lata, *Communication Skills*, Noida: Oxford University Press, 2012.
12. Dr. Shalini Verma, *Word Power Made Handy*, S.Chand & Co Ltd., 2009.

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ME115 Environmental Science

L-T-P-C
3-0-0-0

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

UNIT – I: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES
Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

LEARNING OUTCOMES
Students will be able to

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

UNIT – II: Ecosystems, Biodiversity, and its Conservation

ECOSYSTEMS: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

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

LEARNING OUTCOMES
Students will be able to

1. get a clear picture of structure and functions of ecosystems.
2. explain why renewable and non-renewable energy resources are important.

3. get awareness about land degradation, soil erosion & desertification.
4. gain a rigorous foundation in various scientific disciplines as they apply to environmental science, such as ecology, evolutionary biology, hydrology, and human behavior.

UNIT – III: Environmental Pollution and Solid Waste Management

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

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

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

LEARNING OUTCOMES UNIT-3

Students will be able to

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

UNIT – IV: Social Issues and the Environment

SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

LEARNING OUTCOMES:

Students will be able to

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

UNIT – V: Human Population and the Environment

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

FIELD WORK : Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

LEARNING OUTCOMES

Students will have

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

TEXT BOOKS :

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

REFERENCES :

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

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

CO1	Gain a higher level of personal involvement and interest in understanding and solving environmental problems.
CO2	Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities
CO3	Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century
CO4	Recognize the interconnectedness of human dependence on the earth's ecosystems
CO5	Influence their society in proper utilization of goods and services.
CO6	Learn the management of environmental hazards and to mitigate disasters and have a clear understanding of environmental concerns and follow sustainable development practices.

ME151-ENGINEERING PHYSICS laboratory
(Civil, Mechanical, Chemical Branches)

Learning Outcomes:

The students will be able to

- **handle** optical instruments like microscope and spectrometer
- **determine** thickness of a hair/paper with the concept of interference
- **estimate** the wavelength and resolving power of different colors using diffraction grating
- **evaluate** the acceptance angle of an optical fiber and numerical aperture (L4)
- **determine** Wavelength of laser (L3)
- **measure** parameters of a given material (L5)

List of Physics Experiments

1. Determine the thickness of the fiber using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Dispersive power of a Prisam
4. Resolving power of a grating
5. Magnetic field along the axis of a circular coil carrying current.
6. Poisson's ratio of aluminium and rubber
7. Determination of thermal conductivity of good conductors (Forbe's Apparatus)
8. Determine the thermal conductivity of a bad conductor by Lee's disc method
9. Determination of acceleration due to gravity by using Compound Pendulum.
10. Determination of ultrasonic velocity in liquid (Acoustic grating)
11. To determine the wavelength of Laser source
12. Determination of Numerical Aperture of an optical fiber.
13. Photo voltaic cell - Determination of fill-factor
14. Rigidity modulus of material of wire-dynamic method (torsional pendulum)
15. Determination of a.c. Frequency – Sonometer.

References:

1. A Text book of Practical Physics, Balasubramanian S, Srinivasan M.N, S Chand Publishers, 2017
2. *https://www.egr.msu.edu/.../HeatExhchanger/Double%20Pipe%20HE%20Write%20U..*
3. https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=354&cnt=1
4. https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=802&cnt=1

Problem Solving & Programming Using C Lab (ME152)

Cycle 1:

1. Construct flowcharts to
a. calculate the maximum, minimum and average of N numbers
b. develop a calculator to convert time, distance, area, volume and temperature from one unit to another.
2. Construct flowcharts with separate procedures to
a. calculate simple and compound interest for various parameters specified by the user
b. calculate the greatest common divisor using iteration and recursion for two numbers as specified by the user
3. Construct flowcharts with procedures to
a. generate first N numbers in the Fibonacci series
b. generate N Prime numbers
4. Design a flowchart to perform Linear search on list of N unsorted numbers(Iterative and recursive)
5. Design a flowchart to perform Binary search on list of N sorted numbers(Iterative and recursive)
6. Design a flowchart to determine the number of characters and lines in a text file specified by the user

Cycle 2:

1.Exercises on data types and operators?

a) Practice exercises 3.1 to 3.16 and 4.1 to 4.17 and 14.1 to 14.20 Test your C Skills - yaswanthkanitkar text book.

b) Write a program which determines the largest and the smallest number that can be stored in different data types of like short, int., long, float and double. What happens when you add 1 to the largest possible integer number that can be stored?

c) Write a program to find greatest of three numbers using conditional operator?

d) Write a program to swap two numbers with and without temp variable?

e) Practice a program using multiple unary increment and decrement operators in arithmetic expressions?

2. Exercises on control structures?

a) Practice exercise 2.1 to 2.15 Test your C Skills - yaswanthkanitkar text book.

b)Write a program to find greatest of three numbers? Use nested if, if else if and switch statements?

c) Write a program to read marks of a student and print the sum and average?

d) Display the grade based on the sum of marks?

e) write a program to count the digits of a number? Use for loop

f) Write a program to check whether a number is perfect or not? Use do-while

g) Write a program to check whether a number is strong or not? Use while

h) Write a program to check whether a number is amstrong or not? Use for

i) Write a program to check whether a number is palindrome or not? Use for

j) Write a program to find the Fibonacci series upto the given number? Use while

k) Write a program to print the pascals triangle? Used do-while

l) Write a program to print the result of the series 1+x^2/2+x^3/3+….+x^n/n

3. Exercises on functions?

a) Practice exercise 5.1 to 5.14 Test your C skills -yaswanthkanitkar text book.

b) Write program to swap two variables using functions? Write a program to perform menu driven arithmetic operations using functions?

c) Write a program to find the factorial of a number using recursive and non- recursive functions?

d) Write a program to find the Fibonacci series using recursive functions?

e) Write a program to find the solution for towers of Hanoi using recursive function?

f) Write a program to pass parameters to a functions using call by value and call by reference?

4. Exercises on Arrays?

a) Practice exercise 9.1 to 9.17 Test your C skills - yaswanthkanitkar text book.

b) Write a program to read n numbers and sort them?

c) Write a program to find the minimum and maximum numbers of the array?

d) Write a program to read two matrices and find their sum, difference and product of them?

e)Find the transpose of a matrix?

f) Write a program to print upper and lower triangle of a given matrix?

5. Exercises on strings?

a) Practice exercise 10.1 to 10.15 yaswanthkanitkar text book.

b) Write a program to demonstrate the use of string manipulation functions?

c) Write a program to compare two strings?

d) Write a program to sort the names in Alphabetical order?

6. Exercises on pointers?

a) Practice exercise 7.1 to 8.26 yaswanthkanitkar text book.

b) Write a program to read dynamic array and sort the elements?

c) Write a program to read dynamic array and find the minimum and maximum of the elements?

d) Write a program to perform pointer arithmetic?

e) Write a program on pointers for strings?

f) Write a program to use array of pointers?

7. Exercises on structures?

a) Practice exercise 11.1 to 11.30 yaswanthkanitkar text book.

b) Write a program to create student structure and read marks of three subjects and find the sum and total of the student?

c) Write a program on arrays of structures for 60 students record using the above student structure?

d) Write a program for complex structure? Perform addition, subtraction and multiplication of two complex numbers?

e) Write a program for addition and multiplication of two polinomials?

8.Write a program on Files?

a) Practice exercise 12.1 to 12.20 yaswanthkanitkar text book.

b)write a program to append content of a file?

c)Write a program to display the content of a file?

d)Write a program to copy content of one file to other file?

e)Write a program to count the no of characters in a file?

f)Write a program to compare the contents of two files?

References:

1. Test your C Skills by – YaswanthKanithkar-BPB Publishers

2. C programming; Test your skills-A.N.Kamthane-Pearson India

Communicative English Lab –I(ME153)

(*Common to all branches)*

Lectures: 3 Periods Sessional Marks: 40

University Exam: 3 hours University Examination Marks: 60

Learning Objectives

The C***ommunicative English Lab*** mainly focuses on to improve the Linguistic Listening, Communicative Competence and Presentation Skills of the learners. Activities in the English Communication Skills Lab will simulate actual discourses that students will engage in their interaction with their peers, teachers or strangers in their day-to-day situations.

Learning Outcomes

The students will be able to

- Identify the sounds of English and able to check the correct pronunciation of the words
- Able to listen carefully to communicate effectively in cross- cultural contexts
- Capable to make the students communicate in Daily life situations
- Capable to read for content/ main idea
- Able to communicate confidently in oral presentations
- Enhance vocabulary

List of Activities

1. Identifying phonic sounds, listening to the sounds, practice and record the sounds from the English learning software
2. Common mispronounced words
3. Listening to the short audios and complete the tasks based on the audios
4. Listening to motivational speeches and answering the questions
5. Comprehending Spoken material in British English & American English
6. Situational Dialogues
7. Role plays
8. Reading comprehension exercises for GRE, TOEFL, GATE etc
9. Reading articles from newspaper
10. Specific reading for enhancing vocabulary
11. Vocabulary building exercises
12. Extempore
13. JAM sessions
14. Small talks
15. Oral presentations

Basic Engineering Workshop(ME154)
(Common to all branches)

L	T	P	C
0	0	3	1.5

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

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

a. Half – Lap joint
b. Mortise and Tenon joint
c. Corner Dovetail joint or Bridle joint

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

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

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

a. V-fit b) Dovetail fit c) Semi-circular fit
d) Bicycle tire puncture and change of two wheeler tyre

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

a. Parallel and series b) Two way switch c) Godown lighting d) Tube light
e) Three phase motor f) Soldering of wires

Course Outcomes:
After completion of this lab the student will be able to

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

Mathematics-II(ME121)

(ODE, PDE and Multivariable Calculus)

(Common to all branches of Engineering except CSE)

L	T	P	C
3	0	0	3

Course Objectives:

1) To enlighten the learners in the concept of differential equations and multivariable calculus.
2) To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

UNIT I: Linear Differential Equations of Higher Order

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

Learning Outcomes:

At the end of this unit, the student will be able to

- identify the essential characteristics of linear differential equations with constant coefficients (L3)
- solve the linear differential equations with constant coefficients by appropriate method (L3)

UNIT II: Equations Reducible to Linear Differential Equations and Applications

Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients, Applications: Mass spring system and L-C-R Circuit problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- classify and interpret the solutions of linear differential equations (L3)
- formulate and solve the higher order differential equation by analyzing physical situations (L3)

UNIT III: Partial Differential Equations – First order **8 hrs**

First order partial differential equations, solutions of first order linear and non-linear PDEs.

Solutions to homogenous and non-homogenous higher order linear partial differential equations.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply a range of techniques to find solutions of standard PDEs (L3)
- outline the basic properties of standard PDEs (L2)

UNIT IV: Multivariable Calculus (Vector differentiation)

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply del to Scalar and vector point functions (L3)
- illustrate the physical interpretation of Gradient, Divergence and Curl (L3)

UNIT V: Multivariable Calculus (Vector integration)

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

Learning Outcomes:

At the end of this unit, the student will be able to

- find the work done in moving a particle along the path over a force field (L4)
- evaluate the rates of fluid flow along and across curves (L4)
- apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals (L3)

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

References:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.

2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.

Course Outcomes:

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

- solve the differential equations related to various engineering fields (L6)
- Identify solution methods for partial differential equations that model physical processes (L3)
- interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- estimate the work done against a field, circulation and flux using vector calculus (L6)

ENGINEERING CHEMISTRY (ME122)

L	T	P	C
3	0	3	4.5

Course Objectives:

- To familiarize engineering chemistry and its applications
- To impart the concept of soft and hard waters, softening methods of hard water
- To train the students on the principles and applications of electrochemistry, polymers, surface chemistry, and cement.
- **compare** the materials of construction for battery and electrochemical sensors (L2)
- **explain** the preparation, properties, and applications of thermoplastics & thermosettings, elastomers & conducting polymers. (L2)
- **explain** the principles of spectrometry, GC and HPLC in separation of gaseous and liquid mixtures (L2)

UNIT-I: WATER TECHNOLOGY

Various impurities of Water, WHO guidelines, Hardness unit sand determination by EDTA method, water treatment for drinking purpose-sedimentation, coagulation, filtration (slow sand filter), various methods of chlorination, breakpoint chlorination.

Water treatment for industrial purpose: Boiler troubles, scales, sludges, caustic embrittlement, boiler Corrosion, priming and foaming- causes and prevention, Internal conditioning -Phosphate, Calgon and Carbonate treatment, External conditioning-Lime Soda process (simple problems), softening by ion-Exchange process, Desalination of Brackish water by Electro dialysis and Reverse osmosis.

Learning outcomes:

The student will be able to

- **list** the differences between temporary and permanent hardness of water (L1)
- **explain** the principles of reverse osmosis and electrodialysis. (L2)
- **compare** quality of drinking water with BIS and WHO standards. (L2)
- **illustrate** problems associated with hard water - scale and sludge**.** (L2)
- **explain** the working principles of different Industrial water treatment processes (L2)

UNIT-II: POLYMER CHEMISTRY

Introduction to polymers, Functionality of monomers, chain growth and step growth polymerization, Co-polymerization (Stereo specific polymerization) with specific examples and mechanisms of polymer formation.

PLASTICS: Thermoplastics and Thermosetting, preparation, properties and applications of Bakelite, Elastomers, Preparation, properties and applications of BUNA-S and BUNA-N Rubbers.

Conducting Polymers- Introduction, examples, general applications and mechanism of Conduction on Polyacetylene.

Chemistry of Nano materials: Introduction to nano chemistry, preparation of nano materials - carbon nanotubes and fullerenes and their engineering applications.

Learning Outcomes:

At the end of this unit, the students will be able to

- **explain** different types of polymers and their applications (L2)
- **demonstrate** the mechanism of conduction in conducting polymers (L2)
- **explain** the preparation, properties and applications of Bakelite, Nylon-66, and carbon fibres (L2)
- **describe** the mechanism of conduction in conducting polymers (L2)
- **discuss** Buna-S and Buna-N elastomers and their applications (L2)
- **discuss** types and preparation of Nano materials and Fullerenes(L3)

UNIT-III: ELECTRO CHEMISTRY AND APPLICATIONS

Electrodes-concepts, types of cells, electro chemical series, Nernst equation.

BATTERIES: Primary cell (Dry cell), Secondary cell (Lead-acid), Lithium batteries and their advantages, Fuel cell (H_2-O_2 cell).

Corrosion:

Types of corrosions- chemical corrosion, dry corrosion, electro chemical corrosion and wet corrosion, galvanic series, pitting and differential aeration of corrosion, factors affecting corrosion.

Corrosion control: Cathodic protection, Corrosion Inhibitors, Electro plating (Au) & (Ni).

Learning Outcomes:

At the end of this unit, the students will be able to

- **apply** Nernst equation for calculating electrode and cell potentials (L3)
- **differentiate** between pH metry, potentiometric and conductometric titrations (L2)
- **explain** the theory of construction of battery and fuel cells (L2)
- **explain** the types of corrosion, factors affecting corrosion(L2)
- **explain** protection methods of corrosion and corrosion inhibitors(L2)

UNIT-IV: INSTRUMENTAL METHODS

Electromagnetic spectrum-Absorption of Radiation: Beer-Lambert's law-Principle and applications of Ultra-Violet, Infra-Red and Nuclear Magnetic Resonance Spectroscopy. Principle and applications of Gas Chromatography and HPLC Techniques.

Learning outcomes:

After completion of Module IV, students will be able to

- **explain** the different types of spectral series in electromagnetic spectrum (L2)
- **understand** the principles of different analytical instruments (L2)
- **explain** the different applications of analytical instruments (L2)
- **explain** the principles of spectrometry, GC and HPLC in separation of gaseous and liquid mixtures (L2)

UNIT-V: (i) Cement and Concrete Chemistry

Introduction to Building Materials, Portland Cement, Constituents, Manufacturing Process, Setting and Hardening Cement.

(ii) Organic reactions and synthesis of a drug molecule:

Introduction to reactions involving substitution (SN_1 and SN_2), elimination reactions (E_1 and E_2), Synthesis of commonly used drug molecule – Aspirin and Paracetmol.

Learning Outcomes:

At the end of this unit, the students will be able to

- **explain** the manufacturing of portland cement (L2)
- **demonstrate** the scheme of concrete formation (L2)
- **identify** the constituents of portland cement (L2)
- **enumerate** the reactions at different temperatures in the manufacture of cement (L2)
- **explain** substitution and elimination reactions(L2)
- **explain** the synthesis of aspirin and paracetmol drug molecules(L2)

Prescribed Text Books

1. Engineering Chemistry, P.C. Jain and M. Jain - Dhanapathi Rai & Sons, Delhi
2. A text book of Engineering Chemistry, S.S. Dara - S. Chand & Co. New Delhi
3. Engineering Chemistry, B.K. Sharma - Krishna Prakashan, Meerut
4. Shashi chawla,A text book of engineering chemistry,3rd Edition,Dhanpat rai & co new delhi,2007.
5. Gurudeep raj & chatwal anand , "Instrumental methods of analysis ", 7th edition,CBS publications,1986.
6. Quantitative analysis by day&underwood.
7. A Text book of Instrumental methods by Skoog and West.
8. H.W. Wilard and demerit, "Instrumental methods of analysis ", 7th edition,CBS publications,1986.
9. Text book of Nano Science and Nano technology, B.S. Murthy and P. Shankar, University press.

Course Outcomes:

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

- **demonstrate** the corrosion prevention methods and factors affecting corrosion (L2)
- **explain** the preparation, properties, and applications of thermoplastics & thermosettings, elastomers & conducting polymers. (L2)
- **explain** calorific values, octane number, refining of petroleum and cracking of oils (L2)
- **explain** the manufacturing of portland cement **and** concrete formation (L2)
- **explain** the principles of spectrometry, GC and HPLC in separation of gaseous and liquid mixtures (L2)

I YEAR II SEM

L	T	P	C
1	0	3	2.5

Engineering Graphics & Design(ME123)

Course Objectives:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Instruct the utility of drafting & modeling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modeling.
- Instruct graphical representation of machine components.

UNIT-I

Introduction to Engineering graphics: Principles of Engineering Graphics and their significance-Conventions in drawing-lettering - BIS conventions. Dimensioning principles and conventional representations

a) Conic sections including the rectangular-hhyperbola- general method only,

b) Cycloid, epicycloids and hypocycloid

c) Involutes **(2L + 6P hrs)**

UNIT-II

Projection of points, lines and planes: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces. . **(2L + 6P hrs)**

UNIT-III

Projections of solids: Projections of regular solids inclined to one or both planes by rotational. **(1L + 3P hrs)**

Sections of solids: Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections. **(1L + 3P hrs)**

UNIT-IV

Development of surfaces: Development of surfaces of right regular solids-prism,

cylinder, pyramid, cone and their sectional parts. **(1L + 6P hrs)**

Isometric Projections: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, figures, simple and compound solids. **(2L + 6P hrs)**

UNIT-V

Orthographic Projections: Systems of Projections, Orthographic Projection (Simple Figures)

(3L+9P hrs)

UNIT-VI

(DEMONESTRATION ONLY)

Computer Aided Drafting(Using any standard package): Setting up a drawing: starting ,main menu (New, Open, Save, Save As etc.), Opening screen, error correction on screen,units, co-ordinate system, limits, grid, snap, ortho.

Tool bars: Draw tool bar, object snap tool bar, modify tool bar, dimension tool Bar

Practice of 2D Drawings: Exercises of Orthographic views for simple solids using all commands in various tool bars.

TEXTBOOKS

1. K.L.Narayana&P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

Reference Books:

1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009
2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
3. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013
5. BasantAgarwal&C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.
6. Youtube: http-sewor,Carleton.cag,kardos/88403/drawings.html conic sections-online, red woods.edu

ENGINEERING MECHANICS(ME124)

Course Objectives:

L	T	P	C
3	0	3	4

- Explain the effect of force and moment in the different engineering applications.
- Teach centre of gravity and moment of inertia of solids and surfaces.
- Familiarize frictional forces in mechanical applications.
- Analysis of rigid bodies under dynamic conditions.

Unit I **12 hours**

Introduction to Engineering Mechanics: Composition and resolution of forces, parallelogram law, principle of transmissibility, types of force systems - concurrent and concurrent coplanar forces, resultant of coplanar force systems couple, moment of a force Varignon's theorem, concept of free body diagrams, concept of equilibrium of coplanar force systems.

Friction: Laws of friction, types of friction, equilibrium of force systems involving frictional forces, wedge friction. Free body diagrams involving frictional forces.

Learning Outcomes:

At the end of this unit, the student will be able to

- resolve the forces in mechanical systems (L2)
- identify the moments and forces (L3)
- draw free body diagram (L3)

Unit II **10 hours**

Analysis of Structures: Introduction to plane trusses, analysis of plane trusses by method of joints and method of sections.

Properties of Surfaces and Volumes: Centroid and center of gravity, derivation of centroids from first moment of area, centroids of composite sections, center of gravity of common volumes - cylinder, cone, sphere, theorem of Pappus-guidinus.

Learning Outcomes:

At the end of this unit, the student will be able to

- identify different types of trusses. (L2)
- analyze the plane trusses by method of joints and the method of sections. (L4)
- demonstrate equilibrium of ideal system. (L2)
- estimate the work done by a force and work done by a couple. (L3)

Unit III **10 hours**

Moment of Inertia: Area moment of inertia of plane and composite shapes, parallel axis theorem, perpendicular axis theorem, polar moment of inertia, mass moment of inertia of common volumes -thin plates, thin rod, cylinder, cone, sphere, rectangular prism, radius of gyration.

Learning Outcomes: At the end of this unit, the student will be able to

- identify the centre of gravity of composite sections. (L3)
- determine the centre of gravity of common solids. (L3)
- determine moment of inertia for composite volumes. (L3)

UnitIV **10 hours**

Kinematics: Equations of motion for rigid bodies, constant and variable acceleration, rectilinear and curvilinear motion, motion under gravity -projectile motion, use of rectangular coordinates, tangential and normal coordinates.

Learning Outcomes:

At the end of this unit, the student will be able to

- write equations of motion for rigid bodies. (L3)
- find velocity and acceleration in rectilinear and curvilinear motions (L4)
- trace the path of projectile. (L3)

Unit V **10 hours**

Kinetics: Principles of dynamics - Newton's Laws of motion, D'Alembert's principle in rectilinear translation, principle of work and energy.

Ideal Systems: Principle of conservation of energy, concept of power, conservation of linear and angular momentum, principle of momentum and impulse.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply D'Alembert's principle in rectilinear translation. (L3)
- relate principle of work and energy in dynamic systems. (L3)
- make use of principle of momentum and impulse to dynamic bodies. (L4)

Course Outcomes:

Upon successful completion of the course, the students will be able to

- resolve forces and couples in mechanical systems. (L3)
- identify the frictional forces and its influence on equilibrium. (L3)

- find the centre of gravity and moment of inertia for various geometric shapes (L3)
- develop equations for different motions. (L4)
- determine the displacement, velocity and acceleration relations in dynamic systems (L4)
- relate the impulse and momentum (L4)

Textbook:

1. N H Dubey, Engineering Mechanics: Statics and Dynamics, McGraw Hill, 2014.

2. S Timoshenko, DH Young, JV Rao, SukumarPati, Engineering Mechanics (in SI units), 5/e, McGraw Hill, 2013.

3. S SBhavikatti, Engineering Mechanics, 4/e, New Age International, 2008.

Reference Books:

1. Basudeb Bhattacharya., Engineering Mechanics, 2/e, Oxford University Press (India), 2015.

2. Irving Shames, G K M Rao, Engineering Mechanics: Statics and Dynam-ics, 4/e, Pearson, 2009.

3. K L Kumar, Veenu Kumar, Engineering Mechanics, 4/e, Tata McGraw Hill, 2010.

Python programming (ME125)

L	T	P	C
2	1	3	4.5

Course Objectives:

- To understand software development life cycle
- To learn the basics of Python Programming
- Apply a solution clearly and accurately in a program using Python.
- Apply the best features of mathematics, engineering and natural sciences to program real life problems.

Unit 1:

Context of software development: Software, Development tools, Learning programming with Python, Writing a python program.

Values and Variables: Variables and assignments, identifier, Control codes within Strings, User Input, The eval function, the print function.

Expressions and Arithmetic: Expressions, Operator precedence and Associativity, Comments, Errors, More arithmetic operators.

Learning Outcomes: The students will be able to

- Learn how to design and program Python applications.
- Learn how to write loops and decision statements in Python.
- Acquire programming skills in core Python.

Unit 2:

Conditional Execution: Boolean Expressions, Simple if and if else,nested conditionals, multiway decision statements, conditional expressions, errors in conditional statements.

Iteration: While statements, for statement, definite loops and indefinite loops, nested loops, abnormal loop termination, infinite loops, iteration examples: computing square root, drawing a tree, printing prime numbers.

Learning Outcomes: The students will be able to

- Develop write functions and pass arguments in Python.
- Exercise custom and standard functions of Python programming

Unit 3:

Functions: Introduction, standard mathematical functions, time functions, Random numbers, main function, parameter passing, Function examples: Better organized prime number, Command Interpreter, Restricted Input, Better Die rolling simulator, Tree-Drawing Function, Floating –Point equality, Custom functions Vs Standard functions.

More on Functions: Global variables, Default Parameters, recursion, Making functions reusable, documenting functions and modules, functions as data.

Learning Outcomes: The students will be able to

- Exercise usage of Lists in Python programming
- To learn processing of Lists in Python programming

Unit 4:

Lists: Using Lists, List assignment and equivalence, list bounds, Slicing, Lists and functions, Prime generation with a list

Lists processing: Sorting, flexible sorting, search, list permutations, randomly permuting a list, reversing a list.

Learning Outcomes: The students will be able to

- Develop programs on Lists in Python programming
- Develop programs on processing Lists using Python

Unit 5:

Objects: Using Objects, String Objects, List Objects.

Custom types: geometric points, Methods, Custom type examples, Class inheritance.

Handling Exceptions: Motivation, Exception examples, Using Exceptions, Custom Exceptions.

Learning Outcomes: The students will be able to

- Understand String and List Objects
- Exercise on exception handling in Python applications

Text books:

1. LEARNING TO PROGRAM WITH PYTHON Richard L. Halterman
2. Core Python Programming by Dr. R.Nageswara Rao, dreamtech, second edition

Constitution of India(ME126)

L-T-P-C
3-0-0-0

Course Objectives:

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

UNIT-I

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

LEARNING OUTCOMES:

After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History, features of Indian constitution
- Evaluate Preamble Fundamental Rights and Duties

UNIT-II

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

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

UNIT-III

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

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the structure of state government
- Analyze the role Governor and Chief Minister
- Explain the role of state Secretariat
- Differentiate between structure and functions of state secrateriate

UNIT-IV

A.Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy -

(Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyze the role of Myer and elected representatives of Municipalities
- Evaluate Zilla panchayat block level organisation

UNIT-V

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

LEARNING OUTCOMES:- After completion of this unit student will

- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissiononerate
- Analyze role of state election commission
- Evaluate various commissions of viz SC/ST/OBC and women

REFERENCES:

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

E-RESOURCES:

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

Course Outcomes: At the end of the semester/course, the student will be able to have a clear knowledge on the following:

- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government.

- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

1. Know the sources, features and principles of Indian Constitution.
2. Learn about Union Government, State government and its administration.
3. Get acquainted with Local administration and Pachayati Raj.
4. Be aware of basic concepts and developments of Human Rights.
5. Gain knowledge on roles and functioning of Election Commission

ENGINEERING CHEMISTRY LABORATORY(ME161)

L	T	P	C
0	0	3	1.5

Course Objectives:

- Verify the fundamental concepts with experiments

LIST OF EXPERIMENTS:

1. **Determination of hardness of water by EDTA method**
2. **Estimation of Mohr's salt by Permanganometry**
3. **Estimation of Mohr's salt by Dicrometry**
4. **Determination of alkalinity of water**
5. **Percentage of purity of washing soda**
6. **Determination of available chlorine in bleaching powder**
7. **Preparation of Urea-formaldehyde resin**
8. **Determination on strength of NaoH using HCl conductometrically**
9. **Acid-Base titration by P^H meter**
10. **Acid-Base titration by Potentiometer**
11. **Determination of viscosity of lubricating oil**
12. **Determination of Surface tension**

Course Outcomes:

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

- **measure** the strength of an acid present in secondary batteries (L3)
- **determine** the cell constant and conductance of solutions (L3)
- **prepare** advanced polymer materials (L2)
- **determine** the physical properties like surface tension, adsorption and viscosity (L3)
- **estimate** the Iron and Calcium in cement (L3)
- **calculate** the hardness of water (L4)

2D DRAFTING LAB (ME162)

L T P C

1 0 3 1.5

COURSE EDUCATIONAL OBJECTIVE: The main objectives of this course are to familiarize various commands used in Auto-CAD and to visualize the orthographic views of any solid object.

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

CO1: Understand the Auto-CAD basics and apply to solve practical problems used in industries where the speed and accuracy can be achieved.

CO2: Understand the principle of Orthographic projections of points, lines, planes.

CO3: To draw 2D Draftings

At least 10 Exercises are to be conducted using Auto Cad software: BASIC AUTO CAD

COMPUTER AIDED DRAFTING: (DEMONSTRATION) (3L hrs)

BASIC AUTO CAD COMMANDS: (1L + 6P hrs)

1. Basic drawing commands (line, circle, arc, ellipse, polygon, and rectangle).
2. Edit commands (copy, move, erase, zoom).
3. Array commands (polar array, rectangular array, P-edit, divide a line, offset).
4. Hatching &line commands (hatching with different angles& different types of lines).
5. Mirror & trim commands (mirror an object, trim, extend a line, chamfer& fillet, explode).
6. Dimensioning & text commands (linear, angular, radius, diameter& text).

Drafting of Simple Figures (Practice) (3L + 6P hrs)

ORTHOGRAPHIC PROJECTIONS: (3L + 6P hrs)

1. Conversion of plane objects. 2. Conversion of circular objects. 3. Conversion of both Combination of plane figures and circular objects.

REFERENCES

1. M. Kulkarni, A.P Rastogi, and A.K. Sarkar, Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi, 2009.

2. Bethune, Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi, 2009.

3. N. D. Bhatt, Engineering Drawing, 51th Revised and Enlarged Edition, Charotar Publishers, 2012.

Python Programming Lab (ME163)

L	T	P	C
0	0	3	1.5

1. Design a Python script to convert a Binary number to Decimal number and verify if it is a Perfect number.
2. Design a Python script to determine if a given string is a Palindrome using recursion
3. Design a Python script to sort numbers specified in a text file using lists.
4. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format(0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.
5. Design a Python Script to determine the Square Root of a given number without using inbuilt functions in Python.
6. Design a Python Script to determine the time difference between two given times in HH:MM:SS format.(0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59)
7. Design a Python Script to find the value of (Sine, Cosine, Log, PI, *e*) of a given number using infinite series of the function.
8. Design a Python Script to convert a given number to words
9. Design a Python Script to convert a given number to roman number.
10. Design a Python Script to generate the frequency count of words in a text file.
11. Design a Python Script to print a spiral pattern for a 2 dimensional matrix.
12. Design a Python Script to implement Gaussian Elimination method.
13. Design a Python script to generate statistical reports(Minimum, Maximum, Count, Average, Sum etc) on public datasets.
14. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorising them into distinction, first class, second class, third class and failed.
15. Design a Python script to search an element in the given list.
16. Design a Python script on *str* methods and *list* methods.

Mechanical Engineering Workshop (ME164)

L	T	P	C
0	0	3	1.5

Course Objectives:

1. Familiarize moulding and casting skills.
2. Train on different types welding joints.
3. Develop assemble or disassembly skills.
4. Make plastic components.
5. Familiarize with use power tools.

Foundry Practice: (2 Sessions)

i. a) Determination of average grain size for sand sample using sieve shaker
   b) Preparation of a green sand mould using single piece pattern

ii. Preparation of a green sand mould using split piece pattern with core and demonstration of casting.

Welding Practice: (2 Sessions)

i. Lap joint, butt joint and T joint using arc welding.
ii. a) Lap joint using resistance spot welding

b) Lap and butt joints using gas welding

Assembling/Disassembling Practice: (3 Sessions)

i. Bicycle
ii. Clutch and carburetor
iii. Two wheeler engine

Manufacture of a Plastic Component (2 Sessions)

i. Use of injection moulding machine
ii. FRP composite using hand layup method
iii. Joining of plastic components

Design and manufacture any two domestic utility products with any material (2 Sessions)

Use of Power Tools (2 Sessions)

Course Outcomes:

After completion of this lab student will be able to

- make moulds for sand casting. (L3)
- develop different weld joints. (L3)
- assemble or disassemble of machine components. (L3)
- make plastic components. (L3)

- use power tools for different applications. (L3)
- find applications of hydraulic and pneumatic circuits. (L3)

ACHARYA NAGARJUNA UNIVERSITY
B.TECH. MECHANICAL ENGINEERING
(w.e.f. the batch of students admitted from the academic year 2018-2019)
II/IV B.Tech

II/IV B.Tech. -SEMESTER I

S.No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	ME 211	Engineering Mathematics-III(Probability and Statistics)	BS	3	0	0	40	60	3
2	ME 212	Strength Of Materials-I	PC	3	1	0	40	60	3
3	ME 213	Material Science And Metallurgy	PC	3	0	0	40	60	3
4	ME 214	Basic Thermodynamics	PC	3	1	0	40	60	3
5	ME 215	Basic Electronics & Micro Processors	ES	3	1	0	40	60	3
6	ME 251	Machine Drawing Lab	PC	0	0	3	40	60	1.5
7	ME 252	Basic Electrical& Electronics Engineering Lab	ES	0	0	3	40	60	1.5
8	ME 253	Communication Skills Lab-2	HS	0	0	3	40	60	1.5
9	ME254	CATIA-2D Drafting	Skill Course	0	0	3	40	60	2
Total Credits									21.5

II/IV B.Tech. -SEMESTER II

S.No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	ME 221	Strength Of Materials-II	PC	3	0	0	40	60	3
2	ME 222	Kinematics of Machines	PC	3	1	0	40	60	3
3	ME 223	Fluid Mechanics & Hydraulic Machines	PC	3	1	0	40	60	3
4	ME 224	Manufacturing Process	PC	3	1	0	40	60	3
5	ME 225	Applied Thermodynamics	PC	3	0	0	40	60	3
6	ME226	Essence of Indian Traditional Knowledge	MC	3	0	0	100	0	0
7	ME 261	Fluid Mechanics & Strength of Materials Lab	PC	0	0	3	40	60	1.5
8	ME 262	Manufacturing Process Lab	PC	0	0	3	40	60	1.5
9	ME 263	Modelling Lab	PC	0	0	3	40	60	1.5
10	ME 264	Matlab for Mechanical Engineering	Skill Course	0	0	3	40	60	2
Total Credits									21.5`

3-1-0

ME 211 Mathematics-III

(Probability and Statistics)

II Year B.Tech. (Mech) First Semester

Lectures / Tutorials	*:*	*3+1 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*: 60*

UNIT - I

Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

UNIT - II

Continuous and Bivariate Probability Distributions: Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

UNIT - III

Basic Statistics: Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

UNIT - IV

Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas andmore general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

UNIT- V

Small samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Text / References:

1. E. Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, “Introduction to Probability Theory”, Universal Book Stall, 2003.
3. S. Ross, “A First Course in Probability”, Pearson Education India, 2002.
4. W. Feller, “An Introduction to Probability Theory and its Applications”, Vol. 1, Wiley, 1968.
5. N.P. Bali and M. Goyal, “A text book of Engineering Mathematics”, Laxmi Publications, 2010.
6. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 2000.
7. T. Veerarajan, “Engineering Mathematics”, Tata McGraw-Hill, New Delhi, 2

3-1-0

ME 212 STRENGTH OF MARETIALS-I

II Year B.Tech. (Mech) First Semester

Lectures / Tutorials :	*3+1 Periods / week*	*Sessional Marks*	*: 40*
University Exam. :	*3 hrs.*	*University Exam. Marks*	*: 60*

UNIT I

Tension, Compression and Shear : Introduction, Normal Stress and Strain, Stress- Strain Diagrams, Elasticity and Plasticity, Linear Elasticity and Hooke's Law, Shear Stress and Strain, Allowable Stresses and Loads.(6)

Axially Loaded Members: Introduction, Deflections of Axially loaded Members, Displacement diagrams (6)

UNIT II

Statically Indeterminate Axially Loaded Members: Statically indeterminate structures (Flexibility method and Stiffness method) (7)

Temperature and Pre-strain effects, Strain energy of axially loaded members subjected to static load, Dynamic loading (5)

UNIT III

Torsion : Introduction, Torsion of Circular Bars, Pure Shear, Relationship between Moduli of Elasticity E and G, Transmission of power by circular shafts, Strain Energy in pure Shear and uniform Torsion for Statically determinate Members.(7)

Springs: Close coiled helical springs, axial load, torque, and leaf springs. (5)

UNIT IV

Shear Force and Bending Moment : Types of Beams, Shear Force and Bending Moment, Relationships between Load, Shear Force and Bending Moment, Shear Force and Bending Moment Diagrams.(12)

UNIT V

Stresses in Beams: Introduction, Normal Strains in Beams, Normal Stresses in Beams Strain Energy, Shear Stresses in Rectangular Beams, Shear Stresses in Webs of Beams with flanges.(6)

Analysis of Stress and Strain: Plane Stress, Principal Stresses and Maximum Shear Stress, Mohr's Circle for Plane Stress, Hooke's Law for Plane Stress, Unit Volume change, Strain Energy Density. Plane Strain, Mohr's Circle for Plane Strain. (6)

TEXT BOOKS:

1. Mechanics of Materials by Gere and Timoshenko, C B S Publishers
2. Mechanics of Solids by Singh, Pearson Education.

REFERENCE:

1. Strength of materials by Sadhu Singh, Khanna Publishers.

3-1-0

ME 213 MATERIAL SCIENCE & METALLURGY

II Year B.Tech. (Mech) First Semester

Lectures / Tutorials :	*3+1 Periods / week*	*Sessional Marks*	*: 40*
University Exam. :	*3 hrs.*	*University Exam. Marks*	*: 60*

UNIT I

Crystallography: Classification of crystals – Bravi's lattices – Miller Indices – Packing factor in cubic systems – coordination number – crystal imperfections – crystal deformation – Slip and Twinning. (6)

Phase Diagrams: Binary phase diagrams – Phase rule – one component system, two component system, isomorphous, eutectic, eutectoid, peritectic and peritectoid systems,concept of Ternary diagrams. (6)

UNIT II

Heat Treatment of Steels: Iron–Iron carbide equilibrium diagram, TTT diagrams for eutectoid, hypo and hyper eutectoid steels, martensite and bainitic transformation. (6)

Heat Treatment: Annealing, normalizing, hardening, tempering, surface hardening, age hardening, austempering, martempering and hardenability concept and experimental determination. (6)

UNIT III

Strengthening Mechanisms: Strain hardening, solid solution strengthening, grain refinement, dispersion strengthening. (6)

Composite Materials: Properties and applications of Particulate-reinforced composites, fibre reinforced composites, Laminar composites and metal matrix composites. (6)

UNIT – IV

Powder Metallurgy: Powder metallurgy process, preparation of powders, characteristics of metal powders, mixing, compacting, sintering, Applications of Powder Metallurgy. Forming and shaping of plastics – Extrusion and Injection moulding. (12)

UNIT – V

Ferrous And Non Ferrous Materials: Composition, properties and application of ferrous and non ferrous metals and their alloys. Brief study of cast iron, steels, copper, aluminum, Nano materials – Introduction and Applications (12)

TEXT BOOKS:

1. Introduction to Physical Metallurgy - Avner, McGrawHill
2. Material Science and Metallurgy - V. Raghavan, Pearson Education / PHI.
3. Material Science and Metallurgy - R.B.Choudary - Khanna Pub.

REFERENCE BOOK:

1. Material Science and Metallurgy - Dr.V.D.Kodgire, Everest Publishers
2. Nano materials – J.Dutta&H.Hofman
3. Manufacturing Engineering & Technology – Kalpak Jain &Schmid, Pearson / PHI

3-1-0

ME 214 BASIC THERMODYNAMICS

II Year B.Tech. (Mech) ---First Semester

Lectures / Tutorials	:	*3+1 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	:	*3 hrs.*	*University Exam. Marks*	*: 60*

UNIT I

Fundamental Concepts and Definitions: Introduction, Macroscopic and microscopic points of view, Thermodynamic system and control volume, Perfect gases, properties and state of a substance, Thermodynamic equilibrium and Quasi-static Process, thermodynamic path, reversible and irreversible processes, factors that render a process irreversible, cycle, Zeroth law of thermodynamics, concept of temperature. (8)

Work and Heat: Definitions and units, system, closed system, open system, surrounding, universe, Work done at the moving boundary of a system,Work done in various non-flow processes, comparison of heat and work.(4)

UNIT II

First Law of Thermodynamics for Non-Flow Systems: First law for a system undergoing a cycle and for a change in state of system, internal energy and enthalpy, constant volume and constant pressure specific heats and their relation to internal energy and enthalpy of ideal gases. (8)

First Law of Thermodynamics for Flow Systems*:* Control mass and control volume, first law of thermodynamics for a control volume, Steady flow energy equation and itsApplication to engineering equipment. (4)

UNIT III

Second Law of Thermodynamics: Limitations of first law, PMM of first kind**,** Heat engines and Refrigerators, Statements of Second law, PMM of second kind, Carnot cycle and Carnot theorems, Thermodynamic temperature scale. (8)

Pure Substance: Definition**,** process of steam generation, P-v, T-s and h-s diagrams,Properties of saturated and superheated steam,Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction (4)

UNIT IV

Entropy: Inequality of Clausius, Entropy change in reversible process, T-ds relations,Entropy change of a system during an irreversible process, Principle of increase of entropy,Applications, Entropy change of an ideal gas, Availability, Maximum work. (12)

UNIT V

Gas Power Cycles: Air standard Carnot cycle, Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle, Brayton Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.(12)

TEXT BOOKS:

1. Engineering Thermodynamics- P.K.Nag, TMH, New Delhi.
2. Thermal Science and Engineering- D.S.kumar, S.K.Katariapubl, New Delhi.
3. Thermodynamics—Rajput, LaxmiPubl, New Delhi.

REFERENCE BOOKS:

1. Fundamentals of Engineering Thermodynamics-Rathakrishnan-PHI, New Delhi.
2. Thermodynamics -- J.P.Holman, MGH, New York.
3. Engineering Thermodynamics—Cengel& Boles, TMH

Note: Use of Steam Tables is permitted in University Examinations

ME 215 Basic Electrical Engineering

II Year B.Tech. (Mech) ---First Semester

Lectures / Tutorials	*: 3+1 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	*: 3 hrs.*	*University Exam. Marks*	*: 60*

UNIT – I: DC & AC Circuits

Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Nodal and loop analysis. Thevenin's and Superposition Theorems

Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits. Series Resonance and band width.

.UNIT-II: Poly phase & Magnetic circuits

Generation of 3-phase voltages - phase sequence - star & delta connections - voltage, current & power in star & delta connected systems - analysis of 3-phase balanced circuits - measurement of 3-phase power by 2 wattmeter method.

Faraday's Laws of Electromagnetic Induction .Dynamically induced EMF –Statically induced EMF – Self Inductance – Mutual Inductance - Coefficient of coupling –Inductances in Series – Inductances in parallel – Dot convention.

UNIT-III: DC Machines

Principle and operation of DC Generator - EMF equation - OCC characteristics of DC generator – Principle and operation of DC Motor – Performance Characteristics of DC Motors - Speed control of DC Motors.

UNIT-IV: AC Machines:

Principle and operation of Single Phase Transformer - EMF equations-losses in transformers, regulation and efficiency. OC and SC test on transformer – auto transformer.

Principle, operation and construction of Three phase Induction Motor –torque equation and torque slip characteristics-power losses and efficiency.

UNIT-V:Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup

Text Books:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

References:

1. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

ME 251 MACHINE DRAWING LABORATORY

II Year B.Tech. (Mech) First Semester

Practicals	*:*	*3 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*: 60*

MACHINE DRAWING:

1. **Sectional views :** Introduction, full & half section

2. **Screwed fasteners:** Screw thread nomenclature – types & classification of screw threads, Square & Hexagonal headed bolted joints.

3. **Keys, Cotters and Pin joints** : Saddle & Sunk Keys, Cotter Joint with sleeve ,Knuckle Joint

4. **Assembly Drawings** : Stuffing Box , Screw Jack , Eccentric .

Text Book:

1. Machine Drawing by K.L.Narayana, P.Kannaiah&K.Venkata Reddy

Reference Books:

1. Machine Drawing by K.R.Gopala Krishnan

ME252 BASIC ELECTRICAL & ELECTRONICS LABORATORY

II/IV B.Tech (Mech.) :: First Semester

Practicals	*: 3 periods / week*	*Sessional Marks*	*: 40*
University Exam	*: 3 hrs*	*University Exam Marks*	*: 60*

Note: *Minimum* ***Four*** *Experiments from Electrical Stream and* ***Eight*** *Experiments from Electronics Stream should be performed*

Electrical Engineering:

1. Verification of KCL / KUL
2. OCC of a DC Shunt Generator
3. Load Test on DC Shunt Generator
4. Speed Control of DC Shunt Motor
5. Swin burn Test

Electronics Engineering

1. VI characteristics of Si / Ge junction diode
2. VI characteristics of Zener diodes
3. Half wave rectifier (with and without filter).
4. Transistor Configuration – CE Characteristics.
5. Characteristics of JFET
6. Logic gates using discrete components
7. Logic gates using universal gate (NAND gate)
8. Combinational Circuits (half adder, full adder, half subtractor)
9. Verification of Flip-Flop (JK & D etc.,)
10. Code converters (Gray to Binary & Binary to Gray)
11. Addition and Substraction of two numbers using Microprocessor
12. Stepper Motor Control using Microprocessor
13. Traffic Signal Control using Microprocessor

ME253 Communication Skills Lab-II

Lectures: 3 Periods Sessional Marks: 40

University Exam: 3 hours University Examination Marks: 60

Course Objectives:

The main course objective of ***Advanced English Communication Skills Lab*** is to develop the student's Non-Verbal Communication, Cognitive and Poignant Skills, Interview Skills, Employability and Interpersonal skills, which relate to situations in the work place. The skills imparted to the learners are body language, leadership, time management, team management, assertive skills, group discussions, interview techniques and positive work ethics ...etc.

The methodology includes Interactive sessions, Role Play, Team Work/Group Work/Pair Work and Peer Evaluation. The emphasis is on learning by doing to improve the learners' life skills.

Course Outcomes:

CO1	To realize the importance of communication skills in job arena To enhance the students ability to communicate
CO2	Able to learn vocabulary for GRE, TOEFL, IELTS,IES etc
CO3	Capable to participate in all recruitment procedures
CO4	Able to communicate effectively over a phone and proficient to demonstrate telephoning skills
CO5	Able to describe procedures and improves analytical thinking
CO6	Able to know the importance of personality development

Module-l Communication Skills

I. Verbal

a) Types of Communication
b) Barriers to Communication
c) Strategies for effective communication

II. Nonverbal Skills -

a) Body Language – Voluntary and Involuntary

b) Kinesics
c) Facial Expressions
d) Proxemics
e) Oculesics
f) Haptics and Chronemics

Module-2: Advanced Vocabulary

a) Word list (GRE & TOEFL related)
b) One Word Substitutes
c) Idioms

Module-3: Employability Skills (Ref: 6)

a) Interview Skills
b) Group Discussion
c) Resume Writing

Module-4: Telephonic Skills

a) Formal &Informal interaction
b) Receiving Messages & Complaints
c) Tone modulation

Module-5: Descriptions

a) Process Description
b) Pictures
c) Narration

Module-6: Behavioural Skills

a) Emotional Intelligence
b) Positive Attitude
c) Team Work
d) Organization Skills

ME254 CATIA 2D DRAFTING

(Skill Course)

II/IV B.Tech (Mech.) :: First Semester

Practicals	*: 3 periods / week*	*Sessional Marks*	*: 40*
University Exam	*: 3 hrs*	*University Exam Marks*	*: 60*

Sketcher

1. Introduction to CATIA, History, Basics, GUI, Use of mouse buttons, Sketcher, constraints, profile, setting workbench

2. Standard toolbar, how to open sketcher, sketch details and important toolbar for sketch

3. Profile toolbar, Types of constraints, constraint application, and constraint colour

4. Sketch constraint, view toolbar, Operation toolbar

5. Specification tree use, selecting toolbars

6. Sketch toolbar, Visualisation toolbar

7. Toolbar setting, plane size setting, graphics properties toolbar.

8. 3D introduction, important toolbar

9. Sketch based features toolbar

ME 221 STRENGTH OF MATERIALS- II

II Year B.Tech. (Mech) Second Semester

Lectures	:	*4 +1 Periods / week*	*Sessional Marks*		*: 40*
University Exam.	:	*3 hrs.*	*University Exam. Marks*		*: 60*

UNIT I

Deflections of Beams : Introduction, Differential Equations of the Deflection Curve, Deflections by Integration of the Bending Moment Equation, Deflections by integration of the Shear Force and Load equations. Introduction to Moment Area Method, Macaulay's Method (10)

UNIT II

Columns : Buckling and Stability, Columns with Pinned ends, Columns with other support conditions, Limitations of Euler's Formula, Rankine's Formula, Columns with eccentric Axial Loads, Secant formula. (8)

UNIT III

Statically Indeterminate Beams : Statically indeterminate Beams, Analysis by thedifferential equations of the Deflection curve, Moment Area Method. (9)

Continuous Beams : Clapeyron's theorem of three moments, Beams with constant andvarying moments of inertia. (9)

UNIT IV

Pressure Vessels: Thin Spherical and Cylindrical Pressure Vessels [Biaxial Stresses], Thick Cylinders: Lame's theory, Radial Deflection, Compound Cylinders. (8)

Curved Beams : Stresses in Beams of small and large initial curvature, The Winkler-Bachtheory, Stresses in Crane Hook and C-Clamp with Rectangular, Circular and Trapezoidal cross-sections. (10)

UNIT V

Shear Centre : Bending Axis and Shear Centre, Position of Shear Centre, Shear flow,

Shear Centre of Channel section, Angle section, T- section and I- section. (9)

Centrifugal Stresses : Introduction, Rotating Ring, Rotating Disc, Rotating Disc of uniformstrength.(9)

TEXT BOOK :

1. Mechanics of Materials by Gere and Timoshenko, CBSPublishers& Distributors.
2. Mechanics of Solids by Singh, Pearson Education.

REFERENCE:

1. Strength of materials by Sadhu Singh, Khanna Publishers
2. Advanced Solid Mechanics by L.S. Srinath

3-1-0

ME 222KINEMATICS OF MACHINES

II Year B.Tech. (Mech) Second Semester

Lectures / Tutorials :	*3+1 Periods / week*	*Sessional Marks*	*: 40*
University Exam. :	*3 hrs.*	*University Exam. Marks*	*: 60*

UNIT I

Introduction: Mechanisms and machines, Rigid and resistant bodies, Link, Kinematic pair, Degrees of Freedom, Classifications of Kinematic pairs, kinematic-chain, Linkage, Mechanism, and structure, Classification of mechanisms, Equivalent Mechanisms, Four -
Link (bar) Mechanism, Inversions of Slider - Crank Chain, Double – Slider Chain.(6)

Instantaneous centre: Notation, Number of I - Centres, Kennedy's theorem, Locating I - Centres, Angular velocity by I - Centre Method. (6)

UNIT II

Velocity Analysis: Introduction, Absolute and Relative Motion, Vectors, Addition and subtraction of Vectors, Motion of a Link, Four Link Mechanism, Angular Velocity of Links, Velocity of Rubbing, Slider - Crank Mechanism, Crank and Slotted Lever Mechanism. (12)

UNIT III

Acceleration Analysis: Acceleration, Four-Link Mechanism, Angular acceleration of Links, Acceleration of Intermediate and offset points, slider-Crank Mechanism, Coriolis acceleration component, Crank and slotted lever Mechanism. (12)

UNIT IV

Cams Definitions of cam and followers - their uses - types of followers and cams - types of follower motion - uniform velocity, simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above three cases. (8)

Analysis of motion of followers: Tangent cam with Roller follower - circular arc cam with straight, concave and convex flanks. (4)

UNIT V

Gears: Introduction, Classification gear terminology, Law of Gearing, Velocity of Sliding, Forms of Teeth, Cycloidal Profile Teeth, Involute Profile Teeth, Path of contact, Arc of contact, Number of pairs of Teeth in contact, Interference in Involute Gears, Minimum number of Teeth, Interference between Rack and Pinion, Undercutting, Comparison ofCycloidal and Involute tooth forms. (8)

Gear Trains: Introduction, simple Gear Train, Compound Gear Train, Reverted Gear train, Planetary or Epicyclic Gear Train, Analysis of Epicyclic Gear Train, Torques in Epicyclic Trains. Tabular method (4)

TEXT BOOKS:

1. Theory of Machines of by S.S.Rattan. TMH.
2. Theory of Mechanisms and Machines by C.S.Sharma, KamleshPurohit, PHI

REFERENCE BOOK:

1. Theory of Mechanisms and Machines by Ghosh and Mallik

2. Mechanism and Machine Theory by J.E. Shigley, MGH

ME 223 FLUID MECHANICS & HYDRUALIC MACHINES

II Year B.Tech. (Mech) Second Semester

Lectures / Tutorials : 4+1 Periods / week Sessional Marks : 40

University Exam. : 3 hrs. University Exam. Marks : 60

UNIT I

Introduction: Definition of fluid, Properties of a fluid – density, specific weight, specific gravity, viscosity, compressibility, surface tension, capillarity, vapor pressure, Classification of fluids. (5)

Fluid Statics: Pressure, variation of pressure in fluid, measurement of pressure – simple and differential manometers, pressure head, Pascal's law, Total pressure and center of pressure on submerged plates, Buoyancy and Metacentric height. (7)

UNIT II

Fluid Kinematics: Type of fluid flow, flow patterns, Rotation and irrotational flow, velocity potential, stream function, flow net, continuity equation & Bernoulli's equation (4)

Fluid Dynamics: Introduction, Euler's equation of motion, Bernoulli's equation, Pitot tube, Venturimeter, Orifice meter, orifice-various coefficients of an orifice (6)

Impulse Momentum Equation: Impulse momentum Principle, Equation and Application,Force on pipe bend. (2)

UNIT Ill

Flow Through Pipes: Laws of fluid friction, minor losses, hydraulic gradient line, total energy line, pipes in series and parallel, water hammer (7)

Impact Of Jets: Introduction, Force exerted by a fluid jet on stationary and moving flat plate and curved vanes, flow over radial curved vanes.(5)

UNIT IV

Hydraulic Turbines: Elements of hydro-electric power plants: Heads and Efficiencies of Pelton wheel, Francis turbine and Kaplan turbine. (6)

Performance Of Turbines: Performance under unit quantities, Performance under specific conditions - Specific speed, Performance characteristic curves.(4)

Pumps: Working principles of Centrifugal and Reciprocating Pumps. (2)

UNIT V

Dimensional Analysis & Model Similitude: Introduction, Buckingham's Pi theorem, Types of similarities, Force ratios, Dimensionless numbers, Model Laws-Reynolds and Froude law, Types of models, Scale effect.(Qualitative treatment only) (7)

Boundary Layer Concepts: Introduction, boundary layer thickness, displacement thickness, momentum thickness, energy thickness, boundary layer growth on a flat plate, separation of boundary layer. (5)

TEXT BOOK:

1. Hydraulics and Fluid Mechanics --P.N.Modi& S.M. Seth,
2. Fluid Mechanics & Fluid Power Engineering - D.S.Kumar, SK Kataria&sons, New Delhi.
3. Fluid Mechanics and Fluid machines – Agarwal, TMH.

REFERENCE BOOKS:

1. Fluid Mechanics & Hydraulic Machines - R.K.Bansal
2. Fluid mechanics including Hydraulic machines - A.K.Jain.

3. Fluid Mechanics-K.L.Kuma

4-0-0

ME224 MANUFACTURING PROCESSES

II Year B.Tech. (Mech) Second Semester

Lectures	*:*	*4 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*: 60*

UNIT I

Metal Casting: Introduction, advantages of Casting method, pattern: types, materials and allowances. Sand moulding procedure, Moulding materials and equipment. Preparation, control and testing of moulding sands.Cores, Cupola: Description, operation and zones. (12)

UNIT- II

Gating Design: Design Considerations

Special Casting Methods: Permanent Mould Casting, Die Casting, Centrifugal casting, Investment casting, shell moulding, CO_2 process and continuous casting. Fettling of castings, casting defects : causes, remedies and testing.(12)

UNIT- III

WELDING: Gas and arc welding - Principles of oxy-acetylene welding, oxyacetylene flame cutting, MMAW(Manual metal arc welding), TIG, MIG, submerged arc welding. Resistance welding principles - Butt welding, Spot welding, Seam welding. Thermit Welding, Electro slag welding. Laser beam welding. Brazing & Soldering, welding defects - causes and remedies.(12)

UNIT- IV

Metal Working Processes: Introduction, Hot and Cold working of metals.

Rolling : Types of rolling mills, roll passes

Forging : Types, description and types of forging, defects in forged parts.

Extrusion : Classification, description and application of extrusion process Tube making, Swaging Spinning, Coining, Embossing and Wire drawing

Explosive forming and electro hydraulic forming.(12)

UNIT- V

Additive manufacturing: Rapid prototyping and rapid tooling(5)

Unconventional Machining Processes: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters, Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining (7)

Text Books:

1. Manufacturing Technology-Vol- I by PN Rao,TMH
2. Workshop Technology Vol.1 by S.K.HazraChowdary. Khanna Publishers
3. A course in Work shop technology, Vol-I by B.S.Raghuvanshi, Dhanpatrai& Sons.

Reference Books:

1. Welding Technology by Little, TMH
2. Principles of Metal Casting by Heine, Loper, Rosenthal, TMH.
3. Manufacturing Engineering & Technology, Kalpakjain, Pearson Education / PHI

ME 225 APPLIED THERMODYNAMICS

II Year B.Tech. (Mech) Second Semester

Lectures	:	*4+1 Periods / week*	*Sessional Marks*	:	*40*
University Exam.	:	*3 hrs.*	*University Exam. Marks*	:	*60*

UNIT I

Vapor Power Cycles: Rankine cycle, Effect of pressure and temperature on the Rankine cycle, reheat cycle, regenerative cycle. (8)

Steam Boilers: Function, classification, working of Babcock and Wilcox boiler, Mountings & Accessories.(4)

UNIT II

Steam Nozzles: Types of nozzles, isentropic flow through nozzles, Effect of friction, Nozzle efficiency, Critical pressure ratio and maximum discharge, calculation of throat and exit areas using Mollier diagram. (7)

Steam Condensers: Jet and Surface condensers, condenser vacuum and vacuum efficiency, Condenser efficiency, Thermodynamic analysis, Air pumps, Capacity of air extraction pump. (5)

UNIT III

Steam Turbines: Types of steam turbines, Impulse turbines, pressure and velocity compounding, velocity diagrams, work output, power, blade efficiency and stage efficiency, Reaction turbines, velocity diagrams, degree of reaction, work output, power, blade efficiency and stage efficiency, Governing of turbines, Overall efficiency and reheat factor.(12)

UNIT IV

Refrigeration: Need for Refrigeration, Definitions, Methods of refrigeration, Working of Refrigerator& Heat pump, Bell - Coleman cycle, Refrigerating effect, COP , vapor compression refrigeration system, influence of various parameters on cycle performance, Vapor absorption refrigeration cycle. (12)

UNIT V

Psychrometry and Air Conditioning: -Introduction, Psychrometricproperties, Psychrometric chart, Psychrometric processes, Applications of Psychrometric processes. Types of Air conditioning systems. (12)

TEXTBOOKS:

1. Treatise on Heat Engineering-V.P.Vasandani and D.S.Kumar, Metropolitan Book co, New Delhi.
2. Thermal Engineering ---Rajput, LaxmiPubl, New Delhi.
3. Thermal Science and Engineering- D.S.kumar, S.K.katariaPubl, New Delhi.

REFERENCE BOOKS:

1. Engineering Thermodynamics----Cengel and Boles, TMH.
2. Refrigeration and Air Conditioning -- C.P. Arora, TMH.
3. Engineering Thermodynamics—Achuthan, PHI, New Delhi.

Note: Use of Steam Tables and Refrigeration and Air-Conditioning Tables is permitted in University Examinations.

ME 226 Essence of Indian Traditional Knowledge

II Year B.Tech. (Mech) Second Semester

Lectures	*:*	*4 Periods / week*	*Sessional Marks*	*: 100*
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*: 00*

Course Objectives:

The course will introduce the students to:

1. To get a knowledge in Indian Culture
2. To know Indian languages, literature and the fine arts in India.
3. To explore the science and scientists of Medieval and Modern India.

UNIT I:

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II:

Indian Languages, culture and Literature: The role of Sanskrit, Significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of South India.

UNIT III:

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious reform movements in Modern India(selected movements only).

UNIT IV:

Fine Arts in India: (Arts, Technology & Engineering): Indian painting, Indian handicrafts, music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (Ancient, Medieval and Modern), Science and Technology in India, development of science in ancient, medieval and modern India.

UNIT V:

Education system in India: Education in Ancient, Medieval and Modern India, aims of Education, subjects, languages, science and scientists of Ancient India, Medieval and Modern India.

Reference Books:

1. Kapil Kapoor, "Text and Interpretation: The India Tradition", ISBN: 81246033375, 2005
2. "Science and Samskrit", SamskritaBhartiPublisher, ISBN 13:978-8187276333, 2007
3. NCERT, "Position paper on Arts, Music, Dance and Theatre", ISBN: 81-7450 494- X, 200

Course Outcomes:

After successful completion of the course the students will be able to

1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature.
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists in different eras.

ME 261 FLUID MECHANICS &STRENGTH OFMATERIALS LABORATORY

II Year B.Tech. (Mech) Second Semester

Lectures / Tutorials :	*3 Periods / week*	*Sessional Marks*	*: 40*
University Exam. :	*3 hrs.*	*University Exam. Marks*	*: 60*

Note: A minimum of 5 experiments are to be performed

1. Verification of Bernoulli's theorem
2. Venturimeter&Orificemeter:: Determination of coefficient of discharge
3. Orifices: Determination of coefficient of discharge by steady and unsteady flow methods.
4. Mouthpieces: Determination of coefficient of discharge by steady and unsteady flow methods.
5. Characterization of laminar and turbulent flows by Reynolds apparatus
6. Determination of friction factor of pipes
7. Determination of loss of head in pipes due to bends, sudden contractions and sudden expansion.
8. Measurement of force due to impact of jets on vanes of different types
9. Performance studies on Pelton turbine
10. Performance studies on Francis turbine / Kaplan turbine
11. Performance studies on single stage centrifugal pump
12. Performance studies on Reciprocating pump.

Note : A minimum of 5 experiments shall be conducted done and record.

1. To study the stress – strain characteristics of mild steel bars by UTM.
2. To find young's modulus of the given material (steel or wood) by conducting bending test on simply supported beam.
3. To find modulus of rigidity by conducting torsion test on solid circular shaft.
4. To find the hardness of the given material by Brinnel's Hardness Tester.
5. To determine the hardness of the given material by Vicker's / Rockwell hardness tester.
6. To find impact resistance of the given material by conducting Charpy / Izod test on impact testing machine.
7. To determine the ultimate shear strength of steel rod in single and double shear.
8. To determine the modulus of rigidity of the spring.
9. Compression test on wood.
10. To determine fatigue strength of Mild steel.
11. To determine stress concentration factor.
12. Compression test on concrete Cubes.

0-0-4

ME 262 BASIC MANUFACTURING PROCESSES LABORATORY

II Year B.Tech. (Mech) Second Semester

Practicals	*:*	*3 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*: 60*

PATTERN MAKING : Solid pattern , Split pattern .

MOULDING : Stepped cone pulley, Hand wheel, Bush.

FITTING : Six Standard Exercises

TURNING: Plain, Step and Taper turning, Right-hand and Left-hand threads, Eccentric turning, Knurling and contour turning.

ME 263 MODELLING LABORATORY

II Year B.Tech.(Mech.) Second Semester

Practicals	*: 3 Periods / week*	*Sessional Marks: 40*
University Exam.	*: 3 hrs.*	*University Exam. Marks: 60*

3D modelling using any of the modelling packages like CATIA, Creo, Uni-Graphics, Solid Works, Ideas, AutoDesk Inventor etc.

List of Modules to be Covered:

SKETCHER

PART MODELLING

WIREFRAME MODELLING

SURFACE MODELING

ASSEMBLY MODELLING

DRAFTING

with examples of Assembly drawings.

1) **Screw Jack**. 2) **Stuffing Box.** **3) Eccentric.**

Parts and Assemblies can be chosen from

1. A Text book of "Machine Drawing" by K. L. Narayana, P. Kannaiah, K. Venkata Reddy.

2. Pro/Engineer (CREO Parametric 2.0) for Engineers and Designers, by Prabhakar S.T.

Dream Tech Press

ME264 MATLAB for Mechanical Engineering

(SKILL COURSE)

II Year B.Tech.(Mech.) Second Semester

Practicals	*: 3 Periods / week*	*Sessional Marks: 40*
University Exam.	*: 3 hrs.*	*University Exam. Marks: 60*

1. Introduction to MATLAB
2. MATLAB Syntax and Commands
3. Use of MATLAB to Solve Engineering Problem & Algorithms, Conditional Statement,Repetition Loops, Subprograms, Matrix Manipulation.
4. Write MATLAB commands to analyse arithmetic, logical and Boolean operations.
5. Write MATLAB commands to analyse vector operations and magic matrix's.
6. Write a MATLAB program to demonstrate if and else if statement for comparing Two numbers.
7. Analyze the following operations in MATLAB.

   a) Colon operator b) Line Plotting c) 2D plotting
8. Write MATLAB code to observe Regression and Polynomial functions.

ACHARYA NAGARJUNA UNIVERSITY
B.TECH. MECHANICAL ENGINEERING
(w.e.f. the batch of students admitted from the academic year 2018-2019)
III/IV B.Tech.

III/IV B.Tech. -SEMESTER I

S.No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	ME 311	Design of Machine Elements	PC	3	1	0	40	60	3
2	ME 312	Dynamics of Machines	PC	3	1	0	40	60	3
3	ME 313	Metal cutting & Machine tools	PC	3	0	0	40	60	3
4	ME 314	Job Oriented Elective-I	OE/JOE	3	1	0	40	60	3
5	ME 315	Professional Elective-I	PE	3	1	0	40	60	3
6	ME 351	Machine Shop Practice Laboratory	PC	0	0	3	40	60	1.5
7	ME 352	Fuels & I.C Engines Laboratory	PC	0	0	3	40	60	1.5
8	ME 353	Delmia&Simulia Lab	Internship	0	0	3	40	60	1.5
9	ME354	Soft Skills Lab	Skill Course	0	0	3	40	60	2
Total Credits									21.5

Job Oriented Elective-I

A. I.C Engines & Gas Turbines
B. Elements of Aerospace Engineering
C. Computional Fluid Dynamics

Professional Elective-I

A. Operations Research
B. Process Planning and Cost Estimation
C. Total Quality Management

ME 311 DESIGN OF MACHINE ELEMENTS

IlI Year B.Tech. (Mech) First Semester

Lecturers / Tutorials: 4+1 periods / Week *Sessional Marks : 30*

University Exam: 3 hrs *University Exam Marks : 70*

UNIT I

Basics: Basic procedure of machine design, requirements and design of machine elements, traditional design methods. Design synthesis, use of standards in design, manufacturing considerations in machine design, preferred numbers and significance. (6)

Materials & their Properties : Mechanical properties of materials, Common engineering materials and their properties. (4)

Design for Static Strength : Simple Stresses - Combined stresses - Torsional and Bending stresses - stress strain relation, various theories of failure - Factor of safety and its importance in design. (5)

UNIT II

Design for Fatigue Strength : Stress concentration, stress concentration factors, reduction of stress concentration, fluctuating stresses, fatigue failure, endurance limit, low cycle and high cycle fatigue, notch sensitivity, endurance – approximate estimation, reversed stresses – design for finite and infinite life, cumulative damage in fatigue, Soderberg and Goodman lines, modified Goodman diagrams, Gerber equation, fatigue design under combined stresses, impact stresses. (9)

UNIT Ill

Fasteners: Riveted joints, Boiler Joints & Lozenge Joint, Design of joints under eccentric loading, Welded joints, Eccentrically loaded welded joints. (15)

UNIT IV

Threaded Joints – basic types, bolt of uniform strength, materials and manufacture, eccentrically loaded bolted joints in shear, eccentric load perpendicular to axis of bolt, eccentric load on circular base. (11)

UNIT V

Power Screws: Types - Mechanics of power screws, efficiency, Design of Screw Jack and turnbuckle. (6)

Cotter Joints: Sleeve and Socket & Spigot cotter joints, Gib & cotter joint.. (4)

TEXT BOOKS:

1. Design of machine elements by Bhandari, Tata McGraw Hill book Co.
2. Machine Design by P.C. Sharma & D.K. Agarwal.
3. Design of Machine Elements by Sharma & Purohit ,PHI

HAND BOOKS TO BE ALLOWED IN UNIVERSITY EXAMINATION:

1. Design data book, P.S.G. College of Technology, Coimbatore
2. Design data book, Mahadevan &Balaveera Reddy - CBS Pub.

ME312 DYNAMICS OF MACHINES

III Year B.Tech. (Mech) First Semester

Lectures / Tutorials	*:*	*3+1 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*: 60*

UNIT I

Dynamic Force Analysis : Introduction, D'Alembert's Principle, Equivalent Offset Inertia Force, Dynamic Analysis of Slider - Crank mechanism (Using Analytical method) Velocity and Acceleration of piston, Angular velocity and Angular Acceleration of Connecting Rod, Piston Effort (Effective Driving Force), Crank Effort. Turning Moment on Crankshaft, Inertia of connecting Rod. , Turning Moment diagrams, Fluctuation of energy and Flywheels (10)

UNIT II

Governors: Introduction, Types of Governors, Watt Governor, Porter Governor, Hartnell Governor, Sensitiveness of a Governor, Hunting, Isochronism, Stability, Controlling force, Power of a Governor (8)

Gyroscopes : Angular Velocity, Angular Acceleration, Gyroscopic Torque, Gyroscopic Effect on Naval Ships, Stability of a two wheel vehicle.(6)

UNIT III

Balancing : Introduction, Static balancing, Dynamic balancing, Transferring of a Force from one plane to another, Balancing of Several Masses in Different planes, Primary & Secondary Balancing of Reciprocating Mass , Balancing a locomotive, effect of Partial Balancing, Balancing of In line Engines and V Engines.(12)

UNIT IV

Fundamentals of Vibration:- Introduction, Definitions, Vector method of representing Harmonic Motions, Addition of two simple Harmonic motion of the same frequency. (6)

Undamped Free Vibrations of Single Degree of Freedom Systems:- Introduction, Derivations of differential equations, solution of differential equation, Torsional vibrations, Equivalent stiffness of spring combinations, Energy method. (6)

Damped Free Vibrations of Single Degree of Freedom Systems:- Introduction, Different types of damping, Free vibrations with viscous damping, Logarithmic Decrement, Viscous dampers, Coulomb damping, Structural damping, Interfacial damping. (6)

UNIT V

Forced Vibrations of Single Degree of Freedom Systems:- Introduction, Forced vibrations with constant Harmonic excitation, Forced vibration with rotating and reciprocating unbalance, forced vibrations due to excitation of the support, Critical speed of a light shaft having a single disc without damping, critical speed of a light shaft having a single disc with damping, Vibration, isolation and transmissibility, vibration measuring instruments.(14)

Two Degrees of Freedom Systems: Introduction, Principal modes of vibration, undamped dynamic vibration absorber.(4)

TEXT BOOKS:

Theory of Machines by S.S. Rattan

Mechanical Vibrations – G.K.Groover

Mechanical Vibrations – Rao V.Dukkipati, J.Srinivas, PHI

REFERENCE BOOKS:

Theory of Machines by T. Bevan

Theory of Mechanisms and Machines by A. Ghosh and A.K. Mallik.

Mechanical Vibration – S.S.Rao.

ME313 METAL CUTTING AND MACHINE TOOLS

III Year B.Tech. (Mech) First Semester

Lectures: 3 Periods / week	*Sessional Marks : 40*
University Exam. : 3 hrs.	*University Exam. Marks : 60*

UNIT I

Machining Processes and Machine Tools: Introduction, Primary and Auxiliary Motions in machine tools, parameters defining working motions of a machine tool. (3)

Lathe: Constructional details, specifications, classification of lathes**. (3)**

Lathe Mechanisms: Spindle speed Mechanisms in Belt driven and All Geared Head stock,Apron and Half-nut mechanisms. Lathe accessories – various work holding devices. Lathe operations including taper turning and thread cutting and related problems. (9)

UNIT II

Drilling Machines: Types and specifications, spindle feed mechanism, drilling operations, drilling time.

Shaping and Planing: Constructional details, types of shapers and planers, specifications, Quick Return Mechanism and automatic feed mechanisms. (4)

UNIT III

Grinding Machines: General Principles, Wheel materials, Selection and specification of grinding wheels, Truing and Dressing of grinding wheels, types of grinding machines. (7)

Surface Finishing Operations: Honing and Lapping operations. (3)

UNIT IV

Milling Machines: Working Principle, Size and Specification, Up and Down Milling, Typesof milling machines, Description and working of Universal Milling machine, Milling operations, Milling cutters, Indexing methods and Indexing Head, related problems. (12)

Cutting Tool Materials: Requirements of Tool materials and types, economics of machining. (3)

UNIT V

Theory of Metal Cutting: Introduction, Basic elements of machining, Nomenclature ofsingle point cutting tool, Tool Geometry, Mechanics of chip formation, Types of chips. Determination of shear angle and chip thickness ratio, stress and strain in the chip, velocity relations, Merchant's theory of orthogonal cutting forces, related simple problems. (6)

Tool wear, Tool life and Tool life criteria. (3) Heat Generation and temperature distribution in metal cutting,cutting fluids- types and required characteristics. (3)

TEXT BOOKS:

1. Workshop Technology Vol. II by HazraChowdary
2. Production Engineering by P.C. Sharma, S.Chand& Co.

REFERENCE BOOKS:

1. Materials and Processes in Manufacturing by E.Paul De Garmo, J.T.Black and Ronald A.Kohser.
2. Machining and machining process by PN.Rao, TMH.
3. Manufacturing Science by Ghosh &Mallick.

ME 314/A I.C. ENGINES & GAS TURBINES

III Year B.Tech. (Mech) First Semester

Lecture : 3+1 Periods / week Sessional Marks : 40

University Exam. 3 hrs. University Exam.Marks : 60

UNIT I

I.C. Engines: Introduction, Basic engine nomenclature, Review and classification of I.C.Engines, working principles of S.I. and C.I. Engines (both 4 stroke and 2-stroke) - valve timing and Port Timing diagrams - Differences between S.I. & C. I. and 2 stroke & 4 stroke engines.

UNIT II

Fuel Supply Systems: S.I. Engines- Chemically correct air-fuel ratio, Air-fuel mixture requirements, Carburetion, Simple float type carburetor, injection system, types, electronic fuel injection system, MPFI
C. I. Engines-Air- fuel requirements, fuel supply and injection systems, Bosch fuel pump, electronic injection system, CRDI.
Combustion Processes: S.I. Engines- Normal combustion, abnormal combustion, Knock rating and Octane number.C.I. Engines-Ignition delay, combustion knock in C.I. engines, Knock rating and Cetane number

UNIT III

Testing of I.C. Engines: Indicator diagram, evaluation of Indicated Power, Brake power, Fuel consumption, SFC, Mechanical & thermal efficiencies, mean effective pressure, air-fuel ratio, Heat balance, Engine performance curves, Variables affecting engine performance for both S.I. & C.I. Engines.

UNIT IV

Reciprocating Air Compressors: Classification, Operation, Effect of clearance volume, compression ratio, volumetric efficiency, power input, Single-stage and Multi-stage compressors, Effect of inter-cooling, optimum intermediate pressure in a two-stage compressor.
Rotary Compressors: Introduction, Types and their applications, principles of working, static and total head values, Centrifugal compressor- velocity vector diagrams, pressure coefficient, pre whirl, Axial flow compressor - polytropic efficiency, Surging, Choking and Stalling, Centrifugal compressor versus axial flow compressor.

UNIT V

Gas Turbines: Closed and Open cycle gas turbines, analysis of closed cycle gas turbine, efficiencies of Compressor and turbine, cycles with inter-cooling, reheat and regeneration.

Jet & Rocket Propulsion: Basic principles of Jet propulsion - specific thrust, propulsive efficiency and overall thermal efficiency of a jet engine, Principles of Rocket propulsion, Types of rocket propulsion.

TEXT BOOKS:

1. Treatise on heat Engineering -Vasandani& Kumar-Metropolitan Book Company, Delhi
2. Thermal Engineering- Rajput - Laxmi Pub, New Delhi
3. Fundamentals of I.C.Engines – H.N. Gupta, PHI, New Delhi.

REFERENCE BOOKS:

1. Fundamentals of I.C. Engines - P.W. Gill, J.H. Smith &Ziurys- IBH & Oxford publ,
2. A Course in I.C. Engines - M.L.Mathur&R.P.Sharma - Dhanpat Rai & Sons-New Delhi.
3. Gas Turbine Theory - Cohen, Rogers and Sarvanamuttu.
4. I.C. Engines -V.Ganesan - T.M.H., New Delhi.

ME 314/B ELEMENTS OF AEROSPACE ENGINEERING

III Year B.Tech. (Mech) First Semester

Lecture : 3+1 Periods / week Sessional Marks : 40

University Exam. 3 hrs. University Exam.Marks : 60

UNIT I

HISTORICAL EVOLUTION AND AIRCRAFT CONFIGURATIONS: History- Early Planes-Developments in aerodynamics- Multi-planes, biplanes and monoplanes-Components of an Airplane and Their functions, Types of Flight Vehicles, Classification-Standard Atmosphere, Altitude, Hydrostatic Equation, Geopotential and Geometric Altitudes FLIGHT VEHICLE STRUCTURES: Introduction, Fuselage-Monocoque, Semi-Monocoque Structures, Components of Wing-Spars, Ribs, Longerons, Stringers, Bulkheads, Aircraft Materials-Metallic and Non-Metallic Materials, Use of Aluminium Alloy, Titanium, Stainless Steel and Composite Materials.

UNIT II

BASIC AERODYNAMICS: Continuity equation, Incompressible and Compressible flow, Momentum equation, Energy equation, Speed of sound, Measurement of air speed, Compressible flow, Compressibility, Introduction to viscous flow, Laminar and Turbulent boundary layer, compressibility effect on Skin friction, Flow separation- Introduction-Airfoils - Airfoil Nomenclature, Classifications of NACA Airfoils, Wing Geometry, Aerodynamic Forces, Lift, Drag and Moment Coefficients, Co-Efficient of Pressure, Centre of Pressure, Aerodynamics Centre, Pressure Distribution Over Aerofoil, Types of Drag. UNIT III

PROPULSION: Introduction, Propeller, Reciprocating Engine, Jet Propulsion-The Thrust Equation, Elements of Turbojet Engine-Turbofan Engine-Rocket Engine, Rocket Propellants- Liquid Propellants, Solid Propellants, Rocket Staging

UNIT IV

ELEMENTS OF AIRPLANE PERFORMANCE: Introduction: The Drag polar, Equations of Motion-Thrust required for Level, Unaccelerated Flight, Thrust available and Maximum Velocity-Power required for Level, Unaccelerated Flight, Power available and Maximum velocity- Altitude effects on Power required and Available, Rate of Climb, Gliding Flight, Absolute and Service Ceilings, Time of Climb, Range and Endurance-Propeller Driven Airplane , Jet Airplane

UNIT V

PRINCIPLES OF STABILITY AND CONTROL: Introduction, Definition of Stability and Control – Static stability, Dynamic stability, Control- Moments on the Airplane-Absolute angle of attack, Criteria for Longitudinal Static Stability Directional static stability –Lateral Static stabililty SPACE FLIGHT: Introduction, Orbit Equation, Basic Aspects of Space Vehicle Trajectories, Kepler's Laws, Earth and Planetary Entry,Space Explorations- Space Vehicles and Its Types, Reusable Space Vehicles, Space Shuttle, Satellites, Types of Satellites and Their Functions.

TEXT BOOK:

Anderson. J. D, Introduction to Flight, Eighth Edition, McGraw-Hill Education,2017.

REFERENCE BOOKS:

1. Houghton. E. L., Carpenter P.W., Aerodynamics for Engineering Students, Seventh Edition, Butterworth-Heinemann,2017.
2. Kermode. A. C, Mechanics of Flight, Eleventh Edition, Pearson Education,2007.
3. Kermode, A.C., "Flight without Formulae", McGraw Hill, 1987.
4. Clancy, L.J., "Aerodynamics", Pitman, 1986

WEB RESOURCES:

http://nptel.ac.in/

ME 314/C COMPUTIONAL FLUID DYNAMICS

III Year B.Tech. (Mech) First Semester

Lecture : 3+1 Periods / week Sessional Marks : 40

University Exam. 3 hrs. University Exam.Marks : 60

UNIT I

Importance and applications of CFD, Models of flow, governing equations of fluid flow – Navier Stokes and Euler's equations: Continuity, Momentum and Energy equations in differential form, Physical boundary conditions.

UNIT II

Classification of partial differential equations, Discretization techniques- FDM, FEM, FVM, Finite Difference equations- Taylor series, order of accuracy, forward, backward and central differences for first order and second order differential equations.

UNIT III

Difference equations, Explicit and Implicit approaches, Thomas Algorithm (TDMA). Analysis of stability, VN stability criteria for parabolic (1-D unsteady heat equation) and Hyperbolic (1st order wave equation) equations, Courant number.

UNIT IV

Simple CFD techniques: Lax-Wendroff technique, MacCormack's technique and Iterative and Relaxation techniques.

UNIT V

Pressure correction technique, staggered grid, SIMPLE algorithm, Boundary conditions for pressure correction method. Applications of CFD. CFD Software packages

TEXT BOOKS:

1. Computational Fluid Dynamics - Basics with Applications - John. D. Anderson, JR. McGraw Hill Education (India) Edition 2012.

2. Computational Fluid Dynamics - T. J. Chung, Cambridge University Press, 2nd Edition, 2014.

REFERENCE BOOKS:

1. Introduction to computational fluid mechanics - Niyogi, Chakravarty, Laha, Pearson pub. 1st Edition, 2009.

2. Numerical heat transfer and fluid flow - S.V. Patankar, Hemisphere Pub., 1st Edition.

3. Computational Fluid flow and Heat transfer - K. Muralidhar and T. Sundararajan-, Narosa Pub. 2nd Edition, 2003

WEB RESOURCES:

1. http://ocw.mit.edu/courses/mecharlical-engineering/2-29-numerigal-fluidmechanicsfall2011/
2. http:/inptel.ac.in/courses/112105045/ (IIT Kharagpur)
3. http://nptel.ac.in/courses/112107080/ (IIT Roorkee)
4. http://nptel.ac.in/courses/112104030/ (IIT Kanpur)

ME 315/A OPERATIONS RESEARCH

III Year B.Tech. (Mech) First Semester

Lectures / Tutorials	*: 3+1 Periods / week*	*Sessional Marks*	*: 40*
University Exam.:	*3 hrs.*	*University Exam. Marks*	*: 60*

UNIT I

Linear Programming: Definition and Scope of Operations Research, Mathematical formulation of the problem, graphical method, Simplex method, artificial basis technique, duality, dual Simplex method. Degeneracy, alternative optima, unbounded solution, infeasible solution.(18)

UNIT II

Transportation Problem: Introduction to the problem, LP formulation of a transportation problem. Basic feasible solution by north-west corner method, Vogel's approximation method, least cost method. Finding optimal solution by MODI method, degeneracy, unbalanced transportation matrix and Maximization in transportation model. ( )

Unit III

Assignment Problem: Introduction to the problem, LP formulation of a Assignment problem. One-to-one assignment problem, optimal solution, unbalanced assignment matrix. Flight scheduling problems, Traveling salesman problem. ()

UNIT IV

Queing Theory: Queuing systems and their characteristics. Analysis of Markovian chains, Transition diagram, M/M/1 : FCFS/ μ / μ and M/M/1 : FCFS/ μ / N queuing models.

Project Planning Through Networks: Arrow (Network) Diagram representation. Rules for constructing an arrow diagram, Pert and CPM, Critical path calculations, earliest start and latest completion times, Determination of critical path, determination of floats, Probability considerations in project (18)

UNIT V

Simulation: Definition and applications. Monte-Carlo simulation. Random numbers and random number generation: Mixed congruential method, additive congruential method and multiplicative congruential method. Application problems in queuing and inventory.

Game Theory: Definition of Game, Strategy, pure strategy, mixed strategy, pay off matrix, Maxmin and Minmax criteria of optimality. Two person zero sum games: Pure and Mixed strategies, Dominance Property, Arthimatic method, algebraic method for 2x2 games, solution of 2xn or mx2 games (18)

TEXT BOOKS:

1. Operations Research – H.A. Taha

2. Introduction to Operations Research – Hiller and Liberman

REFERENCES:

1. Introduction to Operations Research – Phillips, Ravindran, James Solegerg.

2. Optimization Theory and Applications – S.S. Rao
3. Operations Research – S.D. Sharma
4. Operations Research – Gupta and Hira

Pert and CPM Principles and Applications – L.S. Srinath

ME 315/B PROCESS PLANNING AND COST ESTIMATION

III Year B.Tech. (Mech) First Semester

Lectures / Tutorials	*: 3+1 Periods / week*	*Sessional Marks*	*: 40*
University Exam.:	*3 hrs.*	*University Exam. Marks*	*: 60*

UNIT I

Introduction of Process Planning- methods of process planning, drawing interpretation, material evaluation, steps in process selection, production equipment and tooling selection

UNIT II

Process planning activities- process parameter calculation for various production processes,selection of jigs and fixtures, selection of quality assurance methods, documents for processplanning, economics of process planning, case studies

UNIT III

Introduction to cost estimation- importance of costing and estimation, methods of costing,elements of cost estimation, types of estimates, estimating procedure, estimation of laborcost, material cost, allocation of overhead charges, calculation of depreciation cost, break even analysis and related problems

UNIT IV

Machining time estimation- importance of machine time calculation, machining time fordifferent lathe operations, drilling and boring time calculations, Machining time calculation for Milling, Shaping, Planing and Grinding

UNIT V

Production costs- different production processes for different jobs, estimation of forging cost,estimation of welding cost, estimation of foundry cost, estimation of machining cost

TEXT BOOKS:

1. Peter Scalon, Process Planning, Design/ Manufacture Interface, Elsevier Sci.&Tech. 2002.

2. Ostwaal P.F. and Munez J., Manufacturing Processes and Systems, 9th ed., John Wiley 1998.

3. Chitale A.V. and Gupta R.C., Product Design and Manufacturing, 2nd ed., Prentice Hall 2002

ME 315/CTOTAL QUALITY MANAGEMENT

III Year B.Tech. (Mech) First Semester

Lectures / Tutorials	*: 3+1 Periods / week*	*Sessional Marks*	*: 40*
University Exam.:	*3 hrs.*	*University Exam. Marks*	*: 60*

UNIT I

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions ofmanufacturing and service quality. Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II

TQM PRINCIPLES- Leadership – Strategic quality planning, Quality statements - Customer focus– Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employeeinvolvement– Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performanceappraisal.

UNIT III

Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering,Supplier selection, Supplier Rating.
The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology,applications to manufacturing, service sector including IT.

UNIT IV

Bench marking– Reason to bench mark, Benchmarking process – FMEA – Stages, Types.
Quality circles – Quality Function Deployment (QFD) – the voice of the customer, house of quality, QFDprocess.

UNIT V

TPM Concepts, improvement needs – Cost of Quality – Taguchi quality loss function -Performance measures.Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS9000 – ISO 14000 – Concepts, Requirements and Benefits Case studies of TQM, Implementation inmanufacturing and service sectors including IT.

TEXT BOOK:

1. Dale H.Besterfiled, at., “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint (2006).

REFERENCE BOOK(s):

1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, 3 rd Edition, 2003.
3. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd.,2006.
4. Janakiraman,B and Gopal, R.K, “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt.
5. Girish Pathak ,”Total Quality Management- Macmillan publishers India Ltd.

ME351 MACHINE SHOP PRACTICE LABORATORY

III Year B.Tech. (Mech) First Semester

Practicals	*:*	*3 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*: 60*

TURNING :

Multi-start threading, Drilling, Boring and Internal threading

DRILLING &TAPPING :

Drilling and Tapping of Different threads

MILLING :

Key-way, Spur and Helical Gear Milling, Gear Hobbing.

SHAPING :

At least three models involving production of flat surface, Stepped surface, Cutting dovetail and rectangular grooves.

PLANING AND SLOTTING :

Working on Planing and Slotting Machines

GRINDING :

At least one model on surface grinder, cylindrical grinder or tool and cutter grinder.

ME 352 FUELS& I.C. ENGINES LABORATORY

III Year B.Tech. (Mech) First Semester

Practical: 3 periods / Week	*Sessional Marks : 40*
University Exam: 3 hrs	*University Exam Marks : 60*

Any **Ten** Experiments out of the following are to be performed:

1. Viscosity Measurement using Redwood No.I or No. II viscometer
2. Viscosity Measurement using Saybolt viscometer
3. Carbon residue test using Conradson's carbon residue apparatus.
4. Calorific value of gas using Junker's gas calorimeter.
5. Measurement of flash point using Pensky Martin's and Abel's apparatus.
6. Measurement of flash and fire points using Cleveland's apparatus.
7. Valve timing and port timing diagrams.
8. Air compressor - To determine Volumetric and Isothermal efficiencies.
9. Blower test Rig. - To determine Overall efficiency.
10. Single cylinder Diesel engine - Load test and Heat Balance Test.
11. Multi cylinder Petrol engine - Load Test, Heat Balance and Morse test
12. Multi cylinder Petrol engine - Economic speed test and variable speed test.
13. Single cylinder Diesel engine - variable compression ratio test.
14. Multi cylinder Diesel engine - Load test and Heat Balance test.
15. Two stroke petrol engine - Load test and Heat Balance test.

ME 353 DELMIA & SIMULIA LABORATORY

III Year B.Tech. (Mech) First Semester

Practical: 3 periods / Week	*Sessional Marks : 40*
University Exam: 3 hrs	*University Exam Marks : 60*

1	Course Requisites: DELMIA Manufactured Item Definition Essentials
2	Creating the Manufacturing Bill of Materials Structure
3	Creating Groups
4	Reusing a Manufacturing Assembly Structure
5	DELMIA Process Planning Essentials
6	Setting the Preferences
7	Creating the Process Planning
8	Creating Automatic Line Balancing
9	Managing a Multi-model
10	DELMIA Equipment Allocation Essentials
11	DELMIA Assembly Evaluation Essentials
12	Static simulation of a model
13	creating meterial
14	structural model creation
15	structural senario

ME 354SOFT SKILLSLABORATORY

III Year B.Tech. (Mech) First Semester

Practical: 3 periods / Week	*Sessional Marks : 40*
University Exam: 3 hrs	*University Exam Marks : 60*

Unit I Self-Development

Introduction to soft skills, Self-Management: Self-Evaluation, Self-Discipline, Self-Criticism, Self-awareness, Self-Esteem, Positive Thinking, Perceptions and Attitudes, Values and Belief Systems, Personal success factors, Handling failure, Knowing Yourself, identifying one‘s strengths and weaknesses, SWOT analysis, Career Planning & Goal setting

Unit II Presentation & Public Speaking

Presentation skills: Professional Presentation, Nature of Oral Presentation, Planning a Presentation, Preparing the Presentation, Delivering the Presentation.

Public Speaking, Group discussion, Interview preparation, Book Review and PPT (a review on any book in form of PPT 5 slides)

Unit III Writing Skills

Business Writing: Letter writing, Writing Formal Letters, Technical Report Writing, Memo, Notices/Circulars Agenda and Minutes of a Meeting, E-Mail, Job Application, Preparation of CV and Resume writing.

Unit IV Stress and Time Management

Introduction, Stress in Today‘s Time: Identify the Stress Source, Signs of Stress, Ways to Cope with Stress : Healthier Ways to Combat Stress, Steps to be Taken in the Organizations : Open communication, Time Management, Working towards Your Goals, Smart Work, Prioritize your Tasks,4 Ds of Decision Making

Unit V Ethics, Etiquette and Mannerism

Professional Etiquette: Etiquette at Meetings, Etiquette at Dining. Involuntary Awkward Actions, Public Relations Office(PRO)‘s Etiquettes, Technology Etiquette : Phone Etiquette, Email Etiquette, Social Media Etiquette, Video Conferencing Etiquette, Interview Etiquette, Dressing Etiquettes : for Interview, offices and social functions, Ethical Values: Importance of Work Ethics, Problems in the Absence of Work Ethics.

ACHARYA NAGARJUNA UNIVERSITY
B.TECH. MECHANICAL ENGINEERING
(w.e.f. the batch of students admitted from the academic year 2018-2019)
III/IV B.Tech.

III/IV B.Tech. -SEMESTER II

S.No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	ME 321	Design of Transmission Elements	PC	3	1	0	40	60	3
2	ME 322	Heat Transfer	PC	3	1	0	40	60	3
3	ME 323	Manufacturing Engineering	PC	3	1	0	40	60	3
4	ME 324	Job Oriented Elective-II	OE/JOE	3	1	0	40	60	3
5	ME 325	Professional Elective-II	PE	3	1	0	40	60	3
6	ME 361	Computer Applications in Mechanical Engineering Laboratory	PC	0	0	3	40	60	1.5
7	ME 362	Design & Metrology Lab	PC	0	0	3	40	60	1.5
8	ME 363	Heat Transfer Laboratory	PC	0	0	3	40	60	1.5
9	ME364	Automotive Product Design Lab	Skill Course	0	0	3	40	60	2
Total Credits									21.5

Job Oriented Elective-II

A. Industrial Engineering & Management.
B. Production Planning and Control
C. Product Lifecycle Management

Professional Elective-II

A. Mechanical Measurements & Metrology
B. Composite Materials
C. Farm Machinery and Equipment

ME 321 DESIGN OF TRANSMISSION ELEMENTS

III Year B.Tech. (Mech)Second Semester

Lectures / Tutorials:	*3 + 1 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	*: 3 hrs.*	*University Exam. Marks*	*: 60*

UNIT I

Shafts: Design of solid and hollow shafts for strength – For Bending, Torsion, Combined bending and torsion and combined bending, torsion and axial loads. (7)

Keys: Introduction, Design of square and flat keys (3)

UNIT II

Shaft Couplings: Regid couplings – Muff Coupling, Flange coupling, Flexible coupling – Modified Flange coupling (5)

UNIT III

Bearings and Lubrication: Lubrication, Types of lubrications, types of lubricants, properties of lubricants, types of Bearings, Bearing materials, Journal bearing design (using Mckee's equation and Raymond and Boyd charts & tables) (8)

Ball and Roller Bearings: Static load, Dynamic load, Equivalent radial load, selection of ball and roller bearings (7)

UNIT IV

Belt Drives : Flat and V-belts, Belt constructions, Geometrical relationships, Analysis of belt tensions, condition for maximum power, Selection of V-belts – Selection of Pulleys.(11)

CHAIN DRIVES: Introduction, Chain drives, Advantages of chain drives over belt drives, Polygonal effect, Selection of roller chains. (4)

UNIT V

Spur Gears : Classification of gears, Terminology of spur gear, standard systems of Gear Tooth, Force analysis, Gear tooth failures, Selection of material, Beam Strength of gear teeth, lubrication, Lewis Equation. (6)

Helical Gears: Terminology of helical gears, virtual number of teeth, Tooth proportions, force analysis, Beam Strength of helical gears, effective load on gear tooth, wear strength of helical gears. Lewis Equation. (3)

Bevel Gears: Terminology, force analysis, Beam Strength of bevel gears, wear strength. Lewis Equation. (3)

Worm Gears: Terminology, Force analysis, Strength rating of worm gears, Wear rating of worm gears. (3)

TEXT BOOKS:

1.Design of machine elements by Bhandari, Tata McGraw Hill book Co.

2.Machine Design by P.C. Sharma & D.K. Agarwal.

HAND BOOKS TO BE ALLOWED IN UNIVERSITY EXAMINATION:

1. Design data book, P.S.G. College of Tech, Coimbatore
2. Design data book, Mahadevan &Balaveera Reddy - CBS Pub.

ME 322 HEAT TRANSFER

III Year B.Tech. (Mech)Second Semester

Lectures	*:*	*3+1 Periods / week*	*Sessional Marks: 40*
University Exam.	*:*	*3 hrs.*	*University Exam. Marks: 60*

UNIT I

Introduction: Basic Modes and Laws of Heat transfer, thermal conductivity, Steady stateHeat Conduction, General conduction equation in Cartesian, Cylindrical and Sphericalcoordinates, initial and boundary conditions. (5)

One-Dimensional Steady State Heat Conduction: Heat flow through plane wall andcylinder with constant thermal conductivity, Heat flow through composite slab and Cylinders, Thermal resistance, Electrical analogy, Thermal contact resistance, problems on variablethermal conductivity, critical insulation thickness, uniform heat generation in slabs.(8)

UNIT II

Extended Surfaces: Types, Applications, Fin materials, Heat transfer from fins with uniformcross section, Fin efficiency and Effectiveness.(5)

Transient Heat Conduction: (One dimensional only) - Lumped heat capacity systems. (4)

UNIT III

Forced Convection: Introduction, Principles of convection, Mass, Momentum and Energyequations for boundary layer, Hydrodynamic and thermal boundary layers and their thicknesses, concept of turbulence. Correlations for heat transfer in Laminar and Turbulent flows over a flat plate, and in pipes, relation between fluid friction and heat transfer in laminar & turbulent flows-Reynolds-Colburn Analogy. (14)

UNIT IV

Natural Convection: Approximate analysis for laminar film on a vertical plate, Correlations for vertical plates, horizontal plates, vertical and horizontal cylinders, inclined surfaces. (9)

RS: Classification, types of heat exchangers, Flow arrangement, Temperature distribution,Overall heat transfer coefficient, Fouling factor, LMTD and NTU methods of Heat exchanger analysis, correction for LMTD for use with multi pass and cross flow Heat Exchangers, Effectiveness. (9)

UNIT V

Radiation: Fundamentals of Radiation: Basic Concepts and definitions, Absorptivity,Reflectivity, Transmissivity, concept of Black body, Laws of Radiation, Kirchhoff's law, Planck's law, Wein's law, Stefan Boltzman's law. (9)

Radiant Heat Transfer: Heat Exchange by radiation between two finite parallel surfaces,Electrical analogy, solid angle and Radiation intensity, radiant heat transfer between two finite black and gray surfaces, shape factor, Radiation shields. (9)

TEXT BOOKS:

1. Heat and Mass Transfer – Sachdeva, New Age India, New Delhi
2. Heat Transfer—Rajput, Laxmipubl, New Delhi.

REFERENCE BOOKS:

1. Heat transfer - J.P.Holman, MGH, New York.
2. Heat transfer - S.P.Sukhatme, TMH.
3. Heat Transfer – Cengel and Boles, TMH, New Delhi

NOTE: Heat and Mass Transfer Data Book by Kothandaraman and Subramanian to be allowed in University Examination.

ME323 MANUFACTURING ENGINEERING

III Year B.Tech. (Mech) Second Semester

Lectures	*:*	*3+1 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*: 60*

UNIT – I

Jigs &Fixtures: Introduction, design considerations in jigs & fixtures. The principle of sixpoint location, locating pins. Clamping and clamping devices. A few examples of drilling jigs like box type, template jig, Inverted jig, indexing jig, fixtures-Lathe, milling. (8)

UNIT – II

Gear Manufacturing: Introduction to various gear manufacturing methods, gear shaping, gear hobbing, bevel gear generation-principles and methods, gear finishing methods. (5)

Thread Manufacturing Processes: Thread rolling, thread milling, thread grinding. (2)

UNIT – III

SURFACE TREATMENT: Scope, Cleaners, Methods of cleaning, Surface coating types, ceramic and organic methods of coating, and economics of coating. Electro forming, Chemical vapor deposition, Physical vapor deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT – IV

Press Working Tools : Major components of a press, shear action in die cutting operation, Blanking and Punching operations, clearance and shear as applied to punching / blanking operations, centre of pressure and its calculation, crap strip layout for blanking, simple related problems. (6)

Types of Dies-compound die, combination die, progressive die. (3)

Drawing die – Calculation of blank size, number of draws, percentage reduction, radius on punch and die, total drawing force. (3)

Bending die – Bending methods, spring back, bending allowance, bending force.(3)

UNIT – V

Computer Aided Inspection: Types of CMM (Coordinate Measuring Machines), CMM construction, CMM operation and programming, CMM software, Flexible inspection systems, CMM applications and benefits. (8)

Machine vision: principle and introduction to stages in machine vision, image acquisition and digitization, image processing and analysis, interpretation, machine vision applications.(7)

Text Books:

A Text book of Production Engineering by P.C.Sharma, S.Chand& Co.

Manufacturing Science by Ghosh &Mallik,

Reference Books:

Manufacturing engineering & technology by Kalpak Jain, Pearson Education / PHI

Engineering metrology by R.K.Jain, Dhanpathrai& Sons

Automation, production systems & CIM by M.P.Groover, Pearson Education / PHI.

ME324/AINDUSTRIAL ENGINEERING AND MANAGEMENT

III Year B.Tech. (Mech) *Second Semester*

Lectures	:	*3+1Periods / week*	*Sessional Marks*		*: 40*
University Exam.	:	*3 hrs.*	*University Exam. Marks*		*: 60*

UNIT -I

Forecasting: Forecasting variables, forecasting procedure, methods of forecasting: moving average, least squares, simple exponential smoothing, linear regression, correlation coefficient, problems. (6)

Production systems: Continuous and intermittent production. Mass and flow production, batch production, job order production. (3)

Plant Location and Facilities layout: Necessary factors governing plant location, principles of plant layout, types of layouts (3)

UNIT – II

Materials Management and MRP: Functions of materials management, purpose of inventories, types of inventories, relevant costs in inventory control, ABC and VED analysis, Single period inventory model. (6)

Materials requirement planning (MRP): Importance of MRP and CRP, MRP system inputs and outputs, bill of materials, MRP logic (3)

Productivity: Definition, methods to measure productivity, measures to improve productivity. (3)

UNIT – III

General Management: Principles of scientific management, Principles of general management, Levels of Management, Managerial skills, brief treatment of managerial functions: planning, organizing, staffing, directing, coordinating and controlling. (6)

Forms of Business Organization: Salient features of sole proprietorship,partnership, Joint Stock Company: private limited and public limited companies. (6)

UNIT – IV

Marketing Management: Concept of selling and marketing – differences, functions of marketing, market research, Purchasing methods,selection of vendor,advertising and sales promotion methods, distribution channels-types, product life cycle. (6)

Financial Management: Functions of finance, simple and compound interest, depreciation, common methods of depreciation: straight line method , declining balance method, sum of years digits method,Types of depriciation (6)

UNIT-V

Supply Chain Management: Introduction, need for supply chain management, Elements of supply chain management, Logistics, E-commerce, Steps in creating an effective supply chain, supplier management. (6)

Personnel Management: The personnel Management function, job analysis and job design, job description, job specification,recruitment,selection, performance appraisal. (6)

Text Books :

1. Introduction to work study – ILO
2. Engineering Economy – Theusen&Theusen
3. Fundamentals of Marketing – Williams J Stanton

4.Operations Management – Joseph G.Monks, Tata McGraw Hill

5.Production and Operations Management by Stevenson

Reference Books :

1. Materials Management – Gopalakrishnan and Sudhakaresan

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ME324/B PRODUCTION PLANNING AND CONTROL

III Year B.Tech. (Mech) *Second Semester*

Lectures	:	*3+1 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	:	*3 hrs.*	*University Exam. Marks*	*: 60*

UNIT I

INTRODUCTION: Definition – Objectives of production Planning and Control – Functions of production planning and control – Elements of production control – Organization of production planning and control departmentProduction systems: Continuous and intermittent production. Mass and flow production, batch production, job order production, production functions (12)

UNIT II

Project Planning through networks: Arrow (Network) diagram representation, rules for constructing an arrow diagram, PERT, CPM, Critical path calculations, Determination of critical path, Determination of floats, Probability considerations in project.(12)

UNIT III

Introduction to CrashingMaterials Management, inventory control and MRP: Functions of materials management, inventory control, Inventory control techniques - ABC, VED and FSN analysis. Materials requirement planning (MRP): Importance of MRP, MRP system inputs and outputs, bill of materials, MRP logic. (12)

UNIT IV

Aggregate planning: Long range, intermediate range and short range plans, the aggregate planning problem, aggregate planning methods, mathematical planning models, theoretical planning models (LDR) and heuristic and computer search models, problems. Master Production Schedule; Master Schedule formation – inputs and outputsRouting: Routing procedure – Route sheets– Factors affecting routing. (12)

UNIT V

Scheduling –definition –Difference with loading, Scheduling and loading guidelines, Standard scheduling methods – forward scheduling and backward scheduling, Johnson‘s rules.Dispatching – activities of dispatcher – dispatching procedure – follow up –definition –for existence of functions – types of follow up, applications of computer in production planning and control. (12)

TEXT BOOK(s):

1. Elements of Production, Planning and Control by Samuel Eilon
2. Operations management by Joseph G.Monks,Tata McGraw-Hill Inc,

REFERENCE BOOK(s):

1. Production and Operations management by R.Pannerselvam,PHI, 2nd edition, 2006.
2. Production and Operations Management by S.N.Chary, TMH(4th edition).
3. Production Planning and Control, Mukhopadyay, PH

ME324/CPRODUCT LIFECYCLE MANAGEMENT

III Year B.Tech. (Mech) Second Semester

Lectures	*:*	*3+1 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*: 6*

UNIT I

INTRODUCTION TO PRODUCT LIFE CYCLE MANAGEMENT (PLM) Definition, PLM Lifecycle model, Threads of PLM, Need for PLM, Opportunities and benefits of PLM, Views, Components and Phases of PLM, PLM feasibility study, PLM visioning –PLM Concepts, Processes and Workflow: Characteristics of PLM, Environment driving PLM,PLM Elements, Drivers of PLM, Conceptualization, Design, Development, Validation, Production, Support of PLM (12)

UNIT II

PRODUCT DATA MANAGEMENT (PDM) PROCESS AND WORKFLOW PDM systems and importance, reason for implementing a PDM system, financial justification of PDM implementation. Versioning, check-in and checkout, views, Metadata, Lifecycle, and workflow. Applied problems and solution on PDM processes and work flow Collaborative Product Development: Engineering vaulting, product reuse, smart parts, engineering change management, Bill of materials and process consistency, Digital mock-up and prototype development, design for environment, virtual testing and validation, marketing collateral. (12)

UNIT III

TOOLS OF COMMUNICATION FOR COLLABORATIVE WORK Creation of 3DXML and CAD drawing using CAD software. Creation of an animation for assembly instructions on 3D via composer, creation of an acrobat 3D document. Applied problems and solutions on tools of communication for collaborative work.(12)

UNIT IV

KNOWLEDGE AND OPTIMIZATION OF DESIGN PRODUCTS Know how, best practices, parameterization of design, Applied problems and Solution on optimization of products using power copy, publication, parameters, formula, rule, check, design table, configuration, reaction. (12)

UNIT V

DIGITAL MANUFACTURING – PLM Digital manufacturing, benefits manufacturing, manufacturing the first-one, Ramp up, virtual learning curve, manufacturing the rest, production planning. Developing a PLM strategy and conducting a PLM assessment: Strategy, Impact of strategy, implementing a PLM strategy, PLM initiatives to support corporate objectives. Infrastructure assessment, assessment of current systems and applications. (12)

TEXT BOOKS:

1. Grieves, Michael. “Product Lifecycle Management”, McGraw-Hill, 2006.
2. Burden, Rodger “PDM: Product Data Management”:, Resource Pub, 2003

REFERENCE BOOKS:

1. Fabio Guidice, Guido La Rosa, “Product Design for the environment- A life cycle approach”, Taylor and Francis 2006
2. Robert J. Thomas, “New product development: managing and forecasting for strategic success”, J.Wiley, 1993.
3. Gerd Hartmann, Ulrich Schmidt, “Product life cycle management” with SAP, Galileo Press, Incorporated, 2005.

ME 325/A MECHANICAL MEASUREMENTS &METROLOGY

III Year B.Tech. (Mech) Second Semester

Lectrures: 3+1 Periods / week *Sessional Marks: 40*

University Exam .: 3 hrs University *Exam. Marks: 60*

UNIT - I

Metrology: Introduction, Elements of engineering measurements, Linear and angular measurements, standards of length, end and line standards.(7)

Linear and Angular Measurements: Precision measurement, bore gauges, straight edges, slip gauges, angle gauges, sine bars, spirit levels, auto collimator. (8)

UNIT – II

Strain Measurement: Introduction, electrical resistance strain gauges principle, Method offixing and bridge circuits for measuring strain changes, Gauge factor, Temperaturecompensation strain gauge. Rosette, Strain gauge applications.(8)

Pressure Measurement: Introduction, pressure measurement terms, Pressure units, Bourdontube pressure gauge, Diaphragm and Bellows, Bridgeman gauge, Low pressure measurement: McLeod gauge, thermal conductivity gauge. (7)

UNIT – III

Comparators: Mechanical comparators, Reed comparator, Sigma comparator, electrical and electronic comparators, solex pneumatic gauge, projectors, tool makers microscope. (7)

Metrology of Screw Threads And Gears: Measurement of various elements of threads, major, minor and effective diameter, thread micrometer, measurement of pitch, gear inspection, measurement of tooth thickness, gear tooth caliper. (8)

UNIT – IV

Limits, Fits and Gauges: Limits, fits, tolerance and allowance, theory of limits and fits and their selection, hole bass and shaft basis system, Indian standard system of limits and fits, simple problems. Inter changeability, selective assembly, limit gauges, Taylor's principle of limitgaugeing, plug gauges, ring gauges. (15)

UNIT – V

Measurement Of Surface Finish: Surface texture, roughness, waviness, Indian standard terminology, Methods of measuring surface finish, Taylor Hobson Talysurf. (8)

Interferometry: NPL flatness interferometry and gauge length interferometer. (3)

Static & Dynamic Alignment Tests : Alignment tests on Lathe, Drilling Machine and Milling Machine. (4)

TEXT BOOKS:

1. Metrology - R.K.Jain , Khanna publishers
2. Hand Book of Industrial Metroloyg by ASTME
3. Mechanical Measurements by R.S.Sirohi&H.C.Radhakrishna

REFERENCE BOOKS:

1. Engg.Metrology – D.M.Antony
2. A text book of Engg.Metrology – I.C.Gupta.
3. Mechanical Measurements – T.B.Beckwith&N.L.Buck

ME 325/BCOMPOSITE MATERIALS

III Year B.Tech. (Mech) Second Semester

Lectrures: 3+1Periods / week *Sessional Marks: 40*

University Exam .: 3 hrs University *Exam. Marks: 60*

UNIT I

INTRODUCTION TO COMPOSITES Fundamentals Of Composites – Need For Composites – Enhancement Of Properties – Classification Of Composites – Matrix-Polymer Matrix Composites (PMC), Metal Matrix Composites (MMC), Ceramic Matrix Composites (CMC) – Reinforcement – Particle Reinforced Composites, Fibre Reinforced Composites. Applications Of Various Types Of Composites. Fiber Production Techniques For Glass, Carbon And Ceramic Fibers

UNIT II

Polymer Resins – Thermosetting Resins, Thermoplastic Resins – Reinforcement Fibres – Rovings – Woven Fabrics – Non Woven Random Mats – Various Types Of Fibres. PMC Processes – Hand Lay Up Processes – Spray Up Processes – Compression Moulding – Reinforced Reaction Injection Moulding – Resin Transfer Moulding – Pultrusion – Filament Winding – Injection Moulding. Fibre Reinforced Plastics (FRP), Glass Fibre Reinforced Plastics (GFRP).

UNIT III

Laminates- Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates.- Applications Of PMC In Aerospace, Automotive Industries

METAL MATRIX COMPOSITES Characteristics Of MMC, Various Types Of Metal Matrix Composites Alloy Vs. MMC, Advantages Of MMC, Limitations Of MMC, Reinforcements – Particles – Fibres. Effect Of Reinforcement – Volume Fraction – Rule Of Mixtures.

UNIT IV

Processing Of MMC – Powder Metallurgy Process – Diffusion Bonding – Stir Casting – Squeeze Casting, A Spray Process, Liquid Infiltration In-Situ Reactions-Interface-Measurement Of Interface Properties- Applications Of MMC In Aerospace, Automotive Industries

UNIT V

CERAMIC MATRIX COMPOSITES AND SPECIAL COMPOSITES Engineering Ceramic Materials – Properties – Advantages – Limitations – Monolithic Ceramics – Need For CMC – Ceramic Matrix – Various Types Of Ceramic Matrix Composites- Oxide Ceramics – Non Oxide Ceramics – Aluminium Oxide – Silicon Nitride – Reinforcements – Particles- Fibres- Whiskers. Sintering – Hot Pressing – Cold Isostatic Pressing (CI Ping) – Hot Isostatic Pressing (HI Ping). Applications of CMC In Aerospace, Automotive Industries Carbon /Carbon Composites – Advantages Of Carbon Matrix – Limitations Of Carbon Matrix Carbon Fibre – Chemical Vapour Deposition Of Carbon On Carbon Fibre Perform. Sol-Gel Technique- Processing of Ceramic Matrix Composites

TEXTBOOKS:

1. Mathews F. L. And Rawlings R. D., “Composite Materials: Engineering And Science”, 1st Edition, Chapman And Hall, London, England, 1994.

2. Chawla K. K., “Composite Materials”, Second Edition, Springer – Verlag, 1998.

REFERENCE BOOKS:

1. Clyne, T. W. And Withers, P. J., “Introduction To Metal Matrix Composites”, Cambridge University Press, 1993.

2. Strong, A.B., “Fundamentals Of Composite Manufacturing”, SME, 1989.

3. Sharma, S.C., “Composite Materials”, Narosa Publications, 2000.

ME 325/C FARM MACHINERY AND EQUIPMENT

III Year B.Tech. (Mech) Second Semester

Lectrures: 3+1 Periods / week *Sessional Marks: 40*

University Exam .: 3 hrs University *Exam. Marks: 60*

UNIT I

Objectives of farm mechanization. Classification of farm machines. Materials of construction& heat treatment. Principles of operation and selection of machines used for production of crops. Field capacities & economics.

UNIT II

Tillage; primary and secondary tillage equipment. Forces acting on tillage tools. Field operation patterns. Draft measurement of tillage equipment: Earth moving equipment: their construction & working principles viz Bulldozer, Trencher, Excavators etc.; sowing, planting & transplanting equipment - their calibration and adjustments

UNIT III

Fertilizer application equipment. Weed control and Plant protection equipment: sprayers and dusters, their calibration, selection, constructional features of different components and adjustments. Work physiology of men and women.

UNIT IV

Principles & types of cutting mechanisms. Construction & adjustments of shear &impact-type cutting mechanisms. Crop harvesting machinery: mowers, windrowers, reapers, reaper binders and forage harvesters. Forage chopping & handling equipment.

UNIT V

Threshing mechanics & various types of threshers. Threshers, straw combines & grain combines, maize harvesting & shelling equipment, Root crop harvesting equipment: potato, groundnut etc., Cotton picking & Sugarcane harvesting equipment.

TEXT BOOKS:

1. Bosoi, E.S. (1990). Theory, Construction and Calculation of Agricultural Machines (Vol. 1 and 2). Oxonion Press Pvt. Ltd., New Delhi.
2. Donnel Hunt. Farm Machinery and management. Iowa State University Press, Ames, USA
3. Ghosh, P.K, and Swain, S. (1993). Practical Agricultural Engineering. Naya Prokash, Calcutta.
4. Kelnin, N.I.,Popov, I.F., and Sakun, V.A. (1985). Agricultural Machines. Amerind Publishers, New Delhi 5. Srivastava, A.C. (1990). Elements of Farm Machinery. Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

REFERENCE BOOKS:

1. Kepner, R.A., Bainer Roy, and Barges, E.C. (1978). Principals of Farm Machinery, . CBS Publishers and Distributors, Delhi-17.
2. Kurtz,G.L., Thompson and Claer, P. (1984). Design of Agricultural Machinery. John Wiley & Sons, New York

ME 361 COMPUTER APPLICATIONS IN MECHANICAL ENGINEERING LABORATORY

III Year B.Tech. (Mech) Second Semester

Practicals	*:*	*3 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*: 60*

Note : Develop programs for the following problems using C- language

SIMULATION EXERCISE: [Any TWO]

- Hart Mechanism
- Paucellier Mechanism
- Robert Mechanism
- Scott Russel Mechanism
- Watt Mechanism
- Pantograph Mechanism
- Four Bar Mechanism
- Slider Crank Mechanism
- Tchibicheff Mechanism

COMPUTER APPLICATIONS: [ANY FOUR]

- Numerical Methods
- Differential Equation solution
- Gauss elimination: General Matrix and skyline.
- Two dimensional stress analysis
- Cylinder subjected to internal pressure.
- 1 D Heat Transfer (conduction)
- 2 D Heat Transfer (conduction)
- O.R. applications like L.P., Queing Theory, CPM, PERT etc..

APPLICATIONS PACKAGES: [ANY ONE]

Simple packages for Fluid flow like fluent, Star CD etc., O.R. Packages like TORA, LINDO, PRIMAERA, Etc., MAT Lab. Any application package in Mechanical Engineering.

ME 362 DESIGNS& METROLOGY LABORATORY

III Year B.Tech. (Mech)Second Semester

Practicals : 3 periods / Week *Sessional Marks : 40*

University Exam : 3 hrs *University Exam Marks : 60*

*Any **Ten** Experiments should be performed:*

1. Angle and taper measurement by Bevel Protractor & Sine Bar.
2. Internal and External taper measurement using Ball & Rollers
3. Measuring effective dia. Of thread using 2 wire, 3 wire method.
4. Measuring gear tooth thickness using gear tooth vernier.
5. Measuring internal dia. using bore dial gauge.
6. Alignment test on lathe machine
7. Alignment test on drilling machine
8. Alignment test on milling machine
9. Measuring external diameters using Micrometer& Plot X & R Charts
10. Measurement of surface finish using surf tester
11. Measuring different parameters of a thread / gear using tooth profile projector
12. Vibration measurements
13. Gyroscope
14. Balancing
15. Whirling of shafts
16. Governor
17. CAM Analysis
18. Wear & Friction measurement
19. Force & Torque measurement
20. Journal Bearing
21. Photo elastic Bench
22. Measurement of cutting forces using lathe tool dynamometer
23. Measurement of cutting forces using drill tool dynamometer.

ME 363 HEAT TRANSFER LABOBORATORY

III Year B.Tech.(Mech.) Second Semester

Practicals	*: 3 Periods / week*	*Sessional Marks: 40*
University Exam.	*: 3 hrs.*	*University Exam. Marks: 60*

*Tests on Any **Ten** of the Following are to be conducted:*

1. Refrigeration Test Rig
2. Air Conditioning Test Rig
3. Heat Exchanger – Parallel Flow
4. Heat Exchanger – Counter Flow
5. Composite Slab / Metal Rod
6. Critical Heat flux Apparatus
7. Emissivity Apparatus
8. Pin fin – Natural Convection
9. Pin fin – Forced Convection
10. Insulating powder Apparatus
11. Drop wise and film wise condensation Apparatus
12. Forced Convection Apparatus
13. Stefan – Boltzmann's Apparatus
14. Lagged pipe Apparatus

ME 364 Automotive Product Design Lab

III Year B.Tech.(Mech.) Second Semester

Practicals	*: 3 Periods / week*	*Sessional Marks: 40*
University Exam.	*: 3 hrs.*	*University Exam. Marks: 60*

Vehicle Architecture

1 Various Stages of Concept Creation

2 Introduction:End to End Body Process

3 Vehicle Architecture Challenges

4 Architecture with 3D Experience

5 Explaning Training Objectives

6 Customer situations

7 Differentiation

8 Steps involved in Developing the body

9 Setting up the environment

10 Step 0: Modify the vehilce Dimensions

11 Step1: Update and modify the cockpit

12 Step 2: Update and modify concept surfaces

13 Step 3: Update the concept BIW

14 Step 4: Design the Roof Member

15 Step 5: Packaging checks, DMU

16 Step 6: A-Pillar optimization

17 Step 7: Windshield Study

18 Step 8: Indirect Vision

19 Step 9: Introduction to Ergonomics study

20 Project: Class A surface Development

ACHARYA NAGARJUNA UNIVERSITY
B.TECH. MECHANICAL ENGINEERING
(w.e.f. the batch of students admitted from the academic year 2019-2020) (R-19)
IV/IV B.Tech.

IV/IV B.Tech. -SEMESTER I

S.No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	ME 411	Advanced Machine Design	PC	3	1	0	40	60	3
2	ME 412	Automation & Computer Aided Manufacturing	PC	3	1	0	40	60	3
3	ME 413	Finite Element Methods	PC	3	1	0	40	60	3
4	ME 414	Program Elective-III	PE	3	1	0	40	60	3
5	ME 415	Open Elective/Job Oriented Elective-III	OE/JOE	3	1	0	40	60	3
6	ME 416	Energy Recourses & Utilization	BS	3	0	0	40	60	3
7	ME 451	Computer Aided Manufacturing Lab	Skill Oriented Course	0	0	3	40	60	2
8	ME 452	Industrial/ Research Internship (2 Months)	PC	0	0	3	100	0	2
Total Credits									22

PROGRAM ELECTIVE COURSE-III

D. Refrigeration & Air conditioning
E. Automobile Engineering
F. Computer Graphics

OPEN ELECTIVE (OE)/ Job Oriented Elective-III

A. Operations Research
B. Robotics
C. Fluid Power & Control systems.

ACHARYA NAGARJUNA UNIVERSITY
B.TECH. MECHANICAL ENGINEERING
(w.e.f. the batch of students admitted from the academic year 2019-2020) (R-19)
IV/IV B.Tech.

IV/IV B.Tech. -SEMESTER II

S.No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	ME 461	Project Work	Project	0	0	0	50	100	8
2	ME 462	Seminar	Seminar	0	0	0	50	0	2
3	ME 463	MOOC's	MOOC's	0	0	0	100	0	2
Total Credits									12

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ME 411 ADVANCED MACHINE DESIGN

IV Year B.Tech. (Mech): First Semester

Lectrures : 3 +1 Periods / week *Sessional Marks : 40*

University Exam .: 3 hrs University *Exam. Marks : 60*

UNIT – I

Springs: Introduction; Materials; Types of springs, Helical springs under axial load, Fatigue loading, Torsion springs, Spiral springs, leaf springs. (12)

UNIT – II

Brakes and Clutches:- Introduction to Brakes, Types, Analysis and design of block brakes, band brakes, block and band brakes; Internal shoe brakes, external shoe brakes, pivoted shoe brakes, Temperature rise, Friction materials, Clutches, Analysis and design of simple and multiple disc clutches, cone clutches and centrifugal clutches, friction materials; comparison of brakes and clutches. (12)

UNIT – III

Flywheel: Introduction, construction, Torque analysis, solid flywheel, Rimmed flywheel, stresses in rimmed flywheel, Design of flywheel. (8)

System design: Introduction, Human aspects of design, Standardization, Practical tips for problems encountered in design with examples. (4)

UNIT – IV

I.C.Engine Components: Introduction, Design of trunk type piston, connecting rod and crank shaft. (8)

Reliability and life expectances: Introduction, Method of achieving reliability, Series, Parallel and series and parallel reliability, Analysis (4)

UNIT – V

Optimum design: Optimization function of single variable and multi variables, optimization techniques, Interval halving and Golden section methods, optimum design of tension bar for minimum deflection, cost and weight, Torsion member for minimum deflection, cost and weight. (12)

TEXT BOOKS:

1. Design of machine elements by Bhandari, Tata McGraw Hill book Co.
2. Machine Design by Sharma &Purohit.
3. Machine Design by Khurmi&Guptha

HAND BOOKS TO BE ALLOWED IN UNIVERSITY EXAMINATION:

1. Design data book, P.S.G. College of Tech, Coimbatore
2. Design data book, Mahadevan&Balaveera Reddy - CBS Pub.

ME 412 AUTOMATION& COMPUTER AIDED MANUFACTURING

IV Year B.Tech. (Mech) First Semester

Lectures	:	3+1 Periods / week	Sessional Marks	:	40
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*:*	*60*

UNIT – I

Automation:Automation in production systems – automated manufacturing systems,computerized manufacturing support systems, reasons for automating, merits and demerits, automation principles and strategies, manufacturing industries and products, manufacturingoperations – processing and assembly operations, other factory operations.(8)

Introduction to Computer IntegratedManufacturing.(2)

Computer Aided Process Planning:Introduction, retrieval CAPP system, generative CAPPsystems, benefits of CAPP.(3)

UNIT - II

Industrial Robotics:Introduction, robot anatomy, joints and links, common robot andconfigurations, joint drive systems, robot control systems, end effectors, sensors in robotics,applications of robots – material handling, processing, assembly and inspection. (7)

UNIT –III

Numerical Control :Introduction, basic components of an NC system, classifications of NCsystems, nomenclature of NC machine axes, interpolation methods, features of CNC, the machine control unit for CNC, CNC software, direct numerical control, distributed numerical control, applications of NC, advantages and disadvantages of NC, adaptive control machining.(15)

UNIT –IV

NC Part Programming: NC coding systems, manual part programming, simple exampleson drilling, milling and turning operations, computer assisted part programming, part programming with APT language, simple examples in drilling and milling operations.(15)

UNIT – V

Group Technology & Cellular Manufacturing:Introduction, part families, partsclassification and coding, features of parts classification of coding system, OPITZ ,MICLASS, Product Flow Analysis, composite part concept, machine cell design,applications.(6)

Flexible Manufacturing Systems:Introduction, types of FMS, components, FMS layoutconfigurations, computer control system, human resources, applications and benefits. (4)

TEXT BOOK:

1. Automation, Production systems and Computer Integrated Manufacturing by M.P.Groover, Pearson Education / PHI.

REFERENCE BOOKS:

1. CAD/CAM by M.P.Groover and E.W.Zimmers, Pearson Education / PHI.
2. CAD/CAM by P.N.Rao, TMH

ME 413 FINITE ELEMENT METHODS

IV Year B.Tech. (Mech) First Semester

Lecturers/ Tutorials: 3+1 periods / Week *Sessional Marks : 40*
University Exam: 3 hrs *University Exam Marks : 60*

UNIT I

Fundamental Concepts: Introduction, historical background, Analysis of 3-D stresses &strains, stress-strain relations, stress cubic, principal stress caliculations, temperature effects, potential energy and equilibrium, the Rayleigh-Ritz method, Weighted Residual Method,Galerkin's method, Saint venant's principle, Von Mises stress. (18)

UNIT II

Basic Concepts of F.E.M. and One Dimensional Problems : Fundamental concepts, FiniteElement Modeling, Coordinates and Shape functions, The Potential Energy Approach, The Galerkin Approach, Assembly of the Global Stiffness Matrix and Load Vector, Properties of Global Stiffness Matrix, The Finite Element equations; Treatment of boundary conditions,Examples of Axially Loaded Members. (9)

Analysis Of Plane Trusses: Introduction,*Plane Trusses:*Local and Global Coordinate systems, Element Stiffness Matrix, Stress Calculations, Example of plane Truss with three members. (9)

UNIT III

Two Dimensional Problems : Introduction, Plane Stress and Plane Strain, Finite ElementModeling, Constant Strain Triangle (CST); Iso-parametric representation, Potential Energy Approach, Element Stiffness, Force terms, Galerkin Approach, Stress calculation, Problem modeling and boundary conditions, Examples of plane Stress and plane Strain problems withthree degrees of freedom using CST Element.(12)

Definitions of Iso-parametric and sub-parametric Elements. (6)

UNIT IV

Stiffness of Beam Element.

Axi-Symmetric solids subjected to Axi-Symmetric loading: Introduction, Axi-Symmetric formulation, FEM using triangular element, problem modeling and boundary conditions. (7)

UNIT V

Scalar Field Problems : Introduction, steady-state heat transfer, one-dimensional heatconduction, governing equation, boundary conditions, the one dimensional element, functional approach for heat conduction.(11)

Text Books:

1. Introduction to Finite Elements in Engineering by Chandrupatla&Belegundu, PHI.
2. Finite Element Analysis by P.Seshu, PHI publications

References:

1. Finite Element Analysis by C.S.KrishnaMoorthy.
2. Finite Element Analysis by L.J.Segerlind.
3. David V. Hutton, "Fundamentals of Finite Element Analysis "Mc Graw Hill Company

ME 414/A REFRIGERATION & AIRCONDITIONING

IV Year B.Tech. (Mech) First Semester **[Program Elective –III]**

Lectures	*:*	*3+1 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*: 60*

UNIT I

Introduction to Refrigeration: Necessity and applications, unit of refrigeration and C.O.P,mechanical refrigeration, types of ideal cycle of refrigeration, Refrigerants- desirable

properties, commonly used refrigerants, nomenclature.(6)

Air Refrigeration: Bell Coleman cycle and Brayton cycle, Open and Dense air systems,Actual refrigeration system, refrigeration needs of aircrafts, adoption of air refrigeration, Justification, types of systems, problems. (9)

UNIT II

Vapour Compression Refrigeration: Working principle, essential components of plant,simple vapor compression refrigeration cycle, Multi pressure systems – multistage compression, multi evaporator system, Cascade system, use of p – h charts, problems

System Components: Compressors- general classification, comparison, advantages anddisadvantages, Condensers - classification, working, Evaporators - classification, working, Expansion devices - types, working. (7)

UNIT III

Vapour Absorption System: Calculation of max COP, description and working of NH_3-water system, Li - Br, H_2O system, principle of operation of three fluid absorption system andsalient features.(10)

Steam Jet Refrigeration: Principle of working, application, merits and demerits.(2)

UNIT IV

Non-Conventional Refrigeration Methods: Principle and operation of thermoelectric refrigerator and Vortex tube or Hirsch tube.(3)

Introduction to Air Conditioning: Psychrometric properties and processes, sensible andlatent heat loads, S–load characterization and SHF, need for ventilation, infiltration, concepts of RSHF, ASHF, ESHF & ADP, concept of human comfort and effective temperature,comfort air conditioning. (9)

UNIT V

Industrial air conditioning requirements, air conditioning loadcalculations. (4)

Air Conditioning Systems: Classification of equipment, cooling, heating, humidificationand

dehumidification, filters, grills and registers, deodorants, fans and blowers, heat pump, heat sources, different heat pump circuits, application.(8)

TEXT BOOKS:

1. Refrigeration and air conditioning - C.P.Arora, TMH.
2. Refrigeration and Air conditioning - Manohar Prasad, New Age India, New Delhi.
3. A course in refrigeration and air conditioning - S.C.Arora&Domkundwar, Dhanpat Rai& sons, New Delhi.

REFERENCE BOOKS:

1. Principles of Refrigeration -Dossat.
2. Refrigeration and air conditioning - Stoecker.

NOTE: Refrigeration and Air conditioning Data book by Manohar Prasad is allowed in the University Examination

ME 414/B AUTOMOBILE ENGINEERING

IV Year B.Tech. (Mech) First Semester **[Program Elective-III]**

Lectures	:	*4 Periods / week*	*Sessional Marks*	:	*40*
University Exam.	:	*3 hrs.*	*University Exam. Marks*	:	*60*

UNIT I

Introduction: Classification of vehicles – applications, options of prime movers, transmission and arrangements. (4)

Engine: Engine Classifications - number of strokes, cylinders, types of combustion chambersfor petrol and diesel engines, valves, valve arrangements and operating Mechanisms, Piston - design basis, types, piston rings, firing order; Crankshafts, Flywheel.(8)

UNIT II

Assorted Equipment: Fuel supply pumps, Mechanical and Electrical type Diaphragm pumps, Air and Fuel Filters, super chargers, Mufflers.(4)

Cooling Systems: Need for cooling system, Air and water cooling.(4)

Lubricating Systems: Various lubricating systems for I.C. Engines.(4)

UNIT III

Electrical System: Ignition system, Spark plugs, Distributor, Electronic Ignition,Alternator, cutout, Current and voltage regulators, charging circuit, starting motors, lighting, instrumentsand accessories. (6)

Chassis & Transmission Systems: Introduction to Chassis & Transmission, Clutches –Single-plate and Multi-plate clutches, Centrifugal clutches, wet and dry type, actuating mechanisms.(6)

UNIT IV

Transmission: Gear Box - Theory, Four speed and Five Speed Sliding Mesh, Constant mesh& synchromesh type, selector mechanism, automatic transmission, overdrive, propeller shaft, differential - principle of working. (12)

UNIT V

Suspension Systems: Need for suspension systems, springs, shock absorbers, axles – front and rear, different methods of floating rear axle, front axle and wheel alignment. (6)

Vehicle Control: steering mechanisms and power steering, types of brakes and brake actuation mechanisms (air and hydraulic).(6)

TEXT BOOKS:

1. Automobile Engineering -G.B.S.Narang.
2. Automobile Engineering - R.B.Gupta
3. Automobile Engineering - Vol I & II - Kirpal Singh

REFERENCE BOOKS:

1. Automotive Mechanics - Joseph Heitner
2. Automobile Engineering - S.Srinivasan

ME 414 /C COMPUTER GRAPHICS

IV Year B.Tech. (Mech) *First Semester* **[Program Elective-III]**

Lectures	*:*	*4 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*: 60*

UNIT I

Geometry and Line Generation: Introduction, Lines, Line segments, Perpendicular Lines, Distance between a point and a Line, Vectors, Pixels and Frame Buffers. (6)

Graphic Primitives: Introduction, Display devices, Primitive operations, The Display-File Interpreter, Normalized Device Coordinates, Display-File structures. (6)

UNIT II

Point Plotting Techniques: Coordinate system, Incremental methods, Line Drawing Algorithms, Circle generators.(6)

Line Drawing Displays: The CRT, Inherent-Memory devices, The storage-Tube display, The Refresh Line-Drawing Display.(6)

UNIT III

Polygons: Introduction to Polygons, Polygon representation, Polygon Interfacing Algorithms, Filling Polygons, Filling with a pattern, Initializing, Antialiasing.(6)

Transformations: Introduction, Scaling Transformations, Rotation, Homogeneous Coordinates and Translations, Coordinate Transformations, Rotation about an Arbitrarypoint, Inverse Transformations.(6)

UNIT IV

Segments: ***(Algorithmic Approach only)*** **:**Introduction, The Segment table, Segment creation, Closing a Segment, Deleting a Segment, Renaming a Segment. (12)

UNIT V

Windowing and Clipping: Introduction, The Viewing Transformation, Viewingtransformation implementation, Clipping, The Cohen-Sutherland Algorithm, Clipping of Polygons. (12)

TEXT BOOK:

Computer Graphics by Steven Harrington.

REFERENCE BOOKS:

1. Procedural elements for Computer Graphics by Rogers.

2. Principles of Interactive Graphics by Newman and Sproull.

ME 415/A OPERATIONS RESEARCH

(Open Elective offered to other branches)

IV Year B.Tech. (Mech)::First Semester

Lectures : 3 +1Periods / week *Sessional Marks: 40*

University Exam. : 3 hrs. *University Exam. Marks: 60*

UNIT I

Linear Programming: Definition and Scope of Operations Research, Mathematical formulation of the problem, graphical method, Simplex method, artificial basis technique, duality, dual Simplex method. Degeneracy, alternative optima, unbounded solution, infeasible solution.(12)

UNIT II

Transportation Problem: Introduction to the problem, LP formulation of a transportation problem. Basic feasible solution by north-west corner method, Vogel's approximation method, least cost method. Finding optimal solution by MODI method, degeneracy, unbalanced transportation matrix and Maximization in transportation model. (12)

Unit III

Assignment Problem: Introduction to the problem, LP formulation of a Assignment problem. One-to-one assignment problem, optimal solution, unbalanced assignment matrix. Flight scheduling problems, Traveling salesman problem. (12)

UNIT IV

Queing Theory: Queuing systems and their characteristics. Analysis of Markovian chains, Transition diagram, M/M/1 : FCFS/ μ / μ and M/M/1 : FCFS/ μ / N queuing models. (4)

Project Planning Through Networks: Arrow (Network) Diagram representation. Rules for constructing an arrow diagram, Pert and CPM, Critical path calculations, earliest start and latest completion times, Determination of critical path, determination of floats, Probability considerations in project (8)

UNIT V

Simulation: Definition and applications. Monte-Carlo simulation. Random numbers and random number generation: Mixed congruential method, additive congruential method and multiplicative congruential method. Application problems in queuing and inventory. (6)

Game Theory: Definition of Game, Strategy, pure strategy, mixed strategy, pay off matrix, Maxmin and Minmax criteria of optimality. Two person zero sum games: Pure and Mixed strategies, Dominance Property, Arthimatic method, algebraic method for 2x2 games, solution of 2xn or mx2 games (6)

TEXT BOOKS:

3. Operations Research – H.A. Taha

4. Introduction to Operations Research – Hiller and Liberman

REFERENCES:

5. Introduction to Operations Research – Phillips, Ravindran, James Solegerg.

6. Optimization Theory and Applications – S.S. Rao
7. Operations Research – S.D. Sharma
8. Operations Research – Gupta and Hira

Pert and CPM Principles and Applications – L.S. Srinath

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ME 416/B ROBOTICS

(Open Elective offered to other branches)

IV Year B.Tech. (Mech):: First Semester

Lectures	:	*3+1 Periods / week*	*Sessional Marks: 40*
University Exam.	:	*3 hrs.*	*University Exam. Marks: 60*

UNIT – I

Introduction to Robotics, major component so a robot, robotic like devices, classification of robots – Classification by coordinate system and by control method, Specifications of robots,fixed versus flexible automation, economic analysis, overview of robot application. (12)

UNIT – II

Robot End Effectors: Introduction, end effectors, interfacing, types of end effectors, grippers and tools, considerations in the selection and design of remote centered devices. (12)

UNIT – III

Robotic Sensory Devices : Objective, Non-optical position sensors – potentiometers, synchros, inductocyn, optical position sensors – opto interrupters, optical encoders (absolute & incremental) [6]

Proximity Sensors : Contact type , non contact type – reflected light scanning laser sensors. [6]

UNIT – IV

Touch & Slip Sensors : Touch sensors – proximity rod & photo detector sensors, slip sensors – Forced oscillation slip sensor, interrupted type slip sensors, force and torque sensors. [12]

UNIT – V

Transformations and Kinematics: Objectives, homogenous coordinates, basictransformation operations, forward solution – DenavitHartenberg procedure. Simple problems involving planar manipulators, inverse or backward solution – problems involved, techniques. (12)

TEXT BOOKS :

1. Robotic Engineering by Richard D.Klafter
2. Industrial Robotics by MikellP.Groover

REFERENCE BOOKS :

1. Introduction to Robotics – John J.Ceaig
2. Robotics – K.S.Fu, Gonzalez &Hee
3. Robotics for Engineers by YoramKoren.

ME 415/C FLUID POWER & CONTROL SYSTEMS

(Open Elective offered to other branches)

IV Year B.Tech. (Mech) :: Second Semester

Lectures	*:*	*3+1 Periods / week*	*Sessional Marks*	*: 40*
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*: 60*

UNIT I

Hydraulic Pumps & Pressure Regulation: Pressure regulation, pump types: Gear Pump,Vane Pump, Piston Pump, Combination Pumps. selection and specification of pumps, pump characteristics (12)

UNIT II

Air Compressors: Types: Piston, Screw rotary and Dynamic compressors .(6)

Hydraulic & Pneumatic Actuators: Linear and Rotary Actuators-Selection, Specification and Characteristics, (6)

UNIT III

Hydraulic and pneumatic accessories (4)

Control and Regulation Elements: Pressure-direction and flow control valves, relief valves,non return and safety valves-actuation systems.(8)

UNIT IV

Hydraulic Circuits: Reciprocation, quick return, Sequencing synchronizing circuits-accumulator circuits-industrial circuits-press circuits-hydraulic milling machine-grinding, planning, copying, forklift (12)

UNIT V

Applications, Advantages and Disadvatages of Hydraulics and pneumatics (4)

Earth mover circuits-design and selection of components-safetyand emergency mandrels. (8)

TEXT BOOK:

1. Andrew Parr, "Hydraulics and Pneumatics", (HB), Jaico Publishing House, 1999

REFERENCES:

1. Antony Espossito, "Fluid power with Applications", Prentice Hall, 1980
2. DudleytA.Pease and John J.Pippenger, "Basic Fluid Power", Prentice Hall, 1987
3. S.Ilango and V.Soundarajan “Introduction to Hydrualics And Pneumatics” PHI Publisher 2014
4. R.Srinivasan“Hydrualics and Pneumatic Controls” Vijay Nicole Imprints PVT. LTD 2004

ME 451 COMPUTER AIDED MANUFACTURING LABORATORY

IV Year B.Tech. (Mech) :: First Semester

Practicals	*: 4 periods / Week*	*Sessional Marks*	*: 40*
University Exam: 3 hrs		*University Exam Marks*	*: 60*

*Any **Ten** Experiments should be performed:*

1. Manual Part Programming examples in plain turning, step turning, taper turning, contour turning, thread cutting, drilling, boring, taper boring, counter boring, parting off with and without using Canned Cycles and sub programs on CNC Lathe

2. Manual Part Programming examples in drilling, pocket milling and profile milling with and without using Canned Cycles and sub programs on CNC Milling Machine.

3. Modelling, part program generation and tool path simulation using any one of the CAM software packages like Master CAM, Edge CAM, Ideas, Pro - E, CATIA etc.,

ME 452 Industrial/ Research Internship (2 Months)

IV Year B.Tech. (Mech) :: First Semester

Practicals :		*Sessional Marks*	*: 100*
University Exam :		*University Exam Marks*	*: 0*

ME 461 : PROJECT WORK

IV Year B.Tech. (Mech) :: Second Semester

Practicals	:	20 Periods / week	Sessional Marks	: 50
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*: 100*

The Project Report has to be submitted at the end of the semester and marks will be awarded based on the Viva-voce examination

ME 462 : SEMINAR

IV Year B.Tech. (Mech) :: Second Semester

Practicals	:	0 Periods / week	Sessional Marks	: 50
University Exam.	*:*	*3 hrs.*	*University Exam. Marks*	*: 0*

ME 463 ELECTIVE THROUGH MOOCS

IV Year B.Tech. (Mech) Second Semester

Lecturers/ Tutorials:	*Sessional Marks : 0*
University Exam:	*University Exam Marks : 100*