PRASAD V POTLURI SIDDHARTHA INSTITUTE OF TECHNOLOGY
(Autonomous)

Academic Regulations for Two Year M. Tech Programme
(PVP 17)
(w.e.f. the Academic Year 2017-18)

MACHINE DESIGN

DEPARTMENT OF MECHANICAL ENGINEERING

PRASAD V. POTLURI SIDDHARTHA INSTITUTE OF TECHNOLOGY
(Autonomous)
AICTE approved, NBA & NAAC Accredited, An ISO 9001:2015 certified Institution
Permanently Affiliated to Jawaharlal Nehru Technological University
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w.e.f. A.Y 2017-2018

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MECHANICAL ENGINEERING

ACADEMIC REGULATIONS AND DETAILED SYLLABUS

MACHINE DESIGN (PVP17)

M.TECH TWO YEAR DEGREE PROGRAMME

Sponsored by
Siddhartha Academy of General & Technical Education
Vijayawada

ADMINISTRATION			
S.No.	Name	Designation	Phone Number
1	Dr.K.Sivaji Babu	Principal	9490958212
2	Dr.K.Ramesh	Head, Department of CE	9849045342
3	Dr. Suresh Chandra Satapathy	Head, Department of CSE	9000249712
4	Dr. P. Rajesh Kumar	Head, Department of ECE	9000264840
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6	Dr. B.V.Subba Rao	Head, Department of IT	9440109139
7	Dr. G.Vijaya Kumar	Head, Department of ME, Chairman ISTE	8897119811
8	Dr. P. Adi Lakshmi	Head, Department of MBA, Chairman, Women's Grievance Cell	9491348818
9	Dr. Ch. Padmanabha Raju	Head, Department of FE Chair man, Disciplinary & Anti Ragging Committee	9246400881
10	Dr. M.S.R. Niranjan Kumar	Controller of Examinations	9440491356
11	Sri R. Madhava Rao	Administrative Officer	9985882742
12	Sri A. Sudhakara Rao	Physical Director	9490958288
13	Sri G. Ramesh Babu	Training & Placement Officer	9640424777
14	Smt. T. Preethi Rangamani	Ladies Hostel Warden	9885029497
15	Sri S.Veerabhadra Rao	Gents Hostel Warden	9703549080
16	Dr. A. Sudheer Babu	Chairman, Anti Ragging Squad	9490686868
17	Smt. M.Rudrama Devi	Chairman, Literary & Cultural Committee	9490958256
18	Sri M.V. Sekhar	Assistant Librarian	9440356984
19	Dr. J.Rajendra Prasad	Alumni Association, Grievance Redressal Cell	9440463351
20	Sri B.V.R.V. Prasad	Management Representative, ISO	9948592702
21	Dr. K. Syam Sundar	NSS Co-ordinator	9963501295
22	Sri M. Dhadurya Naik	NCC Co-ordinator	9848280815

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Institute Vision

To provide rich ambience for Academic and Professional Excellence, Research, Employability skills, Entrepreneurship and Social responsibility.

Institute Mission

To empower the students with Technical knowledge, Awareness of up-to-date technical trends, Inclination for research in the areas of human needs, Capacity building for Employment/Entrepreneurship, Application of technology for societal needs.

Department Vision

To enhance the capabilities of students and mould them into innovative, employable, entrepreneurial, socially responsible graduates successful in advanced fields of research

Department Mission

To impart quality education, ethical values, social responsibility, employability, research and entrepreneurial skills.

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ACADEMIC REGULATIONS

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PRASAD V. POTLURI

SIDDHARTHA INSTITUTE OF TECHNOLOGY
(Autonomous)

Kanuru, Vijayawada – 520 007

Approved by AICTE, Accredited by NBA & NAAC, An ISO 9001:2008 Certified Institution
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Academic Regulations for Two Year M. Tech Programme (PVP 17)
(w.e.f. the Academic Year 2017-18)
(Common to all Programmes)

CONTENTS

1. INTRODUCTION

Academic Programmes of the Institute are governed by rules and regulations approved by the Academic Council, which is the highest Academic body of the Institute. These academic rules and regulations are effective from the academic year 2017-18 for students admitted into two years postgraduate Programme offered by the Institute leading to Master of Technology (M. Tech) in various specializations offered by respective departments as given in Table 1.

2. PROGRAMMES OFFERED

Currently, the Institute is offering M. Tech programmes in the following disciplines:

Table 1: List of Specializations

Sl. No.	Specialization	Offering Department
1	Computer Science and Engineering	Computer Science and Engineering
2	Microwave & Communication Engineering	Electronics and Communication Engineering
3	Power System Control & Automation	Electrical and Electronics Engineering
4	Machine Design	Mechanical Engineering

3. DURATION OF THE PROGRAMME

The duration of the programme is two academic years consisting of four semesters. A student is permitted to complete the M. Tech Programme in a stipulated time frame of 4 years from the date of admission. Otherwise they shall forfeit their seat in M. Tech Programme and their admission shall stand cancelled.

4. MINIMUM INSTRUCTION DAYS

Each semester normally consists of a minimum of 90 instruction days.

5. ELIGIBILITY CRITERIA FOR ADMISSION

The eligibility criteria for admission into M. Tech Programme shall be as per the guidelines of Andhra Pradesh State Council of Higher Education (APSCHE) & AICTE from time to time.

6. REGISTRATION

A student shall register for courses in each semester at the beginning of every semester according to the choice provided and courses offered by the concerned department.

7. MEDIUM OF INSTRUCTION

The medium of instruction and examination is English.

8. PROGRAMME STRUCTURE

Every specialization of M. Tech Programme shall have theory courses and practical courses along with Term Paper/ Mini project/ Seminar in the first and second semesters. Pedagogy training / Industrial training shall be for a period of 4 weeks at the beginning of third semester followed by a Dissertation in third and fourth semesters.

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8.1 Course Code and Course Numbering Scheme

Course Code consists of 9/10 characters which is specified by Regulation, department, programme, semester number, type of course, course number & elective code. The details are described in Tables 2, 3, 4 & Figure-1.

Table 2: Third and Fourth Characters description

Characters	Name of the Department
CS	Computer Science and Engineering
EC	Electronics & Communication Engineering
EE	Electrical & Electronics Engineering
ME	Mechanical Engineering

Table 3: Fifth and Sixth Characters description

Characters	Name of the Programme
CS	Computer Science and Engineering
MC	Microwave & Communication Engineering
PC	Power System Control & Automation
MD	Machine Design

Table 4: Course Type description

Course Type Character	Description
T	Theory course
L	Laboratory /Practice course
TR	Pedagogy training/ Industrial training
DS-A	Dissertation Part-A
DS-B	Dissertation Part-B

For example, the annotation of the course **17MEMD1T5A is** as given in Figure-1below.

1	7	M	E	M	D	1	T	5	A
Year of Framing the Regulations		Department Code		Specialization code		Semester number	Course type	(optional) Course number	(optional) Elective code

Figure-1: Course code description

8.2 Contact Hours and Credits

The Course Credits are broadly fixed based on the following norms.

- Theory – One Lecture period is assigned 1 credit
- Laboratory – Three periods are assigned 2 credits and two periods are assigned 1 credit
- Mini project /Term Paper/Seminar is assigned 2 credits
- Pedagogy training/Industrial training is conducted for four weeks and is assigned 2 credits
- Dissertation is assigned 16 credits
- However, some courses are prescribed with fixed number of credits depending on the complexity of the subject and relative importance.

8.3 Theory classes

Each course is prescribed with fixed number of lecture periods per week. During lecture periods, the course instructor shall deal with the concepts of the course.

8.4 Laboratory Courses

A minimum prescribed number of experiments/ programs have to be performed by the students, who shall complete these in all respects and get each experiment evaluated by course instructor concerned and certified by the Head of the Department concerned at the end of the semester.

8.5 Programme Credits

Each discipline of the M. Tech Programme is designed to have a total of 74 credits and the student shall have to register for all the courses prescribed in the curriculum and secure all 74 credits for award of the degree.

9. SYLLABUS

As approved by the BOS of concerned department and ratified by Academic Council.

10. ELIGIBILITY REQUIREMENT FOR APPEARING AT SEMESTER END EXAMINATION AND CONDONATION

10.1 A candidate shall be deemed to have eligibility to write his end semester examinations if he has put in at least 75% of attendance in that semester, which is computed by totaling the number of periods of lectures, practical courses and Dissertation (as the case may be), held in that semester with the total number of periods attended by the student in all the courses put together.

10.2 Condonation of shortage in attendance may be recommended by respective Heads of Departments on genuine medical grounds, provided the student puts in at least 65% attendance as calculated above and provided the Principal is satisfied with the genuineness of the reasons and the conduct of the student.

10.3 Students, having shortage of attendance percentage less than 75 and greater than or equal to 65, shall have to pay requisite fee towards condonation.

10.4 A student who gets less than 65% attendance in that semester shall not be permitted to take the end semester examinations. His registration for those courses in that semester will be cancelled. The student shall re register for that semester and repeat those courses of that semester as and when they are offered next.

10.5 The candidate should secure a minimum of 50% aggregate marks in internal examinations conducted for theory and laboratory courses in that semester, to be eligible to write semester end examinations.

10.6 A student, who does not satisfy the attendance and/or internal marks requirement, shall have to repeat that semester.

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11. EXAMINATIONS AND SCHEME OF EVALUATION

11.1 INTERNAL EXAMINATIONS:

11.1.1 Theory Courses

Each course is evaluated for 4**0** marks (a+b).

a) Two midterm examinations each for 30 marks will be conducted for 90 minutes' duration in every theory course in a semester. The First mid examination will be conducted in Units 1 & 2 of the syllabus, and the second mid examination will be conducted in Units 3 & 4 of the syllabus. The mid examination marks shall be awarded by calculating the average of the marks secured in the two midterm examinations.

   There shall be two questions from each unit of syllabus prescribed. Any one question from each unit has to be answered. Each question carries 15 marks.

b) Two home assignments each for 10 marks are to be conducted for each course after completion of First & Third units of Syllabus. The assignment marks shall be awarded by calculating the average of the marks secured in the two Assignments.

   Students shall be informed regarding the home assignment and they have to submit the completed assignment within the prescribed time period.

   NOTE: A student who is absent for any Mid Term Exam or non submission of assignment, for any reason whatsoever, shall be deemed to have scored zero marks in that Exam/ Assignment.

11.1.2 Laboratory Courses:

For Laboratory courses there shall be continuous evaluation during the semester for 25 internal marks. The distribution of internal marks is given below:

Criteria	Marks
Day to Day work	10
Record	05
Internal Examination	10

11.1.3 Term Paper/ Mini Project/ Seminar:

Two internal reviews are to be conducted for Term Paper/ Mini Project/ Seminar. The distribution of internal marks is given below:

Criteria	Marks
Review -1	10
Review -2 & Viva – Voce	15

11.2 SEMESTER END EXAMINATIONS

11.2.1 Theory Courses: 60 marks

- The Semester end examinations shall be conducted for 3 hours' duration at the end of the semester. The question paper shall be given in the following pattern:
  Each course shall consist of four units of syllabus. There shall be two questions from each unit of syllabus prescribed. Any one question from each unit has to be answered. Each question carries 15 marks.

11.2.2 Laboratory Courses: 50 marks

- 40 marks are allotted for experiments & 10 marks are allotted for viva-voce examination.
- Each Semester-end Laboratory Examination shall be evaluated by an External Examiner along with an Internal Examiner.

11.2.3 Term Paper/ Mini Project/ Seminar:

The distribution of Semester end examination marks is given below.

Criteria	Marks
Report	30
Seminar & Viva – Voce	20

11.2.4 Pedagogy training/ Industrial training:

- Pedagogy training shall be for a period of at least 4 weeks and evaluation shall be totally internal for 75 marks based on the performance during the training.
- Industrial training shall be for a period of at least 4 weeks and a report has to be submitted by the end of the third semester.
- The assessment shall be carried out for 75 marks during fourth semester by an internal evaluation committee comprising Head of the Department and two faculty of the department including the project supervisor.

11.2.5 MOOCS

- MOOCS Course can be chosen either from the listed electives III or IV as the case may be, or can be chosen by the student from other sources without having a conflict with the already offered courses of the programme.
- The course will be finalized by a committee constituted at the Department level.
- A mentor has to be identified in the department who would monitor the MOOCS course work from time to time and submit interim reports to the HOD duly signed by the mentor and the student.
- The duration of the course must be within 40-60 contact hours.
- Apart from the online certification the student would be evaluated for 40 marks for internals and 60 marks for external examination.
- The MOOCS course has to be completed as per the academic calendar for the concerned semester.

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11.2.6 Dissertation:

Dissertation shall be for a period of at least 40 weeks. There shall be two parts for evaluation:

Part-A: A Status report has to be submitted by the end of third semester which shall be evaluated for 50 marks by the Project Review Committee (PRC) based on the presentation made by student on the topic selected, literature survey and the progress of the work.

Part-B: The Project assessment shall be further carried out for 150 marks during fourth semester by an internal & external evaluation committee comprising Head of the Department, Project Supervisor and an External Examiner appointed by the Principal.

EVALUATION OF DISSERTATION WORK:

Every candidate shall be required to submit the dissertation after taking up a topic approved by the PRC.

a) The PRC shall be constituted with the Head of the Department as the Chairman and two senior faculty as Members along with the supervisor to oversee the proceedings of the dissertation work from allotment of topic to submission.

b) Registration of Dissertation Work: A candidate shall register for the Dissertation work in the beginning of the second year. The duration of the Dissertation work is for two semesters.

c) After satisfying point b, a candidate has to submit, in consultation with his supervisor, the title, objective and plan of action of his Dissertation to the PRC for its approval. Only after obtaining the approval of PRC the student can initiate the Dissertation work.

d) If a candidate wishes to change his supervisor or topic of the Dissertation work, he can do so with the approval of the PRC. If so, his date of registration for the Dissertation work shall start from the date of change of topic.

e) Evaluation of the Dissertation shall be done twice, one at the end of the third Semester and the other during the fourth Semester.

f) The evaluation at the end of third semester shall be carried out by PRC for 50 marks based on the presentation made by student on the topic selected, literature survey and the progress of the work. The student shall be permitted to proceed for the remaining work in fourth semester if he gets at least 25 marks. Otherwise, the student shall reappear before the PRC with improved work within four weeks.

g) The evaluation during fourth semester shall be carried out twice each for 25 marks by the PRC.

h) Dissertation is said to be completed only if the work done by the student leads to publication in Peer Reviewed international journal, national journal, international

conference and national conference (Preferably in IEEE, ASME, Elsevier, Springer etc proceedings) while evaluating the Dissertation.

i) The candidate shall make an oral presentation before the PRC for the approval to submit a draft copy of the Dissertation. A candidate shall be permitted to submit his Dissertation not earlier than 40 weeks from the date of registration of the Dissertation.

j) Three copies of the Dissertation certified by the supervisor shall be submitted to the Institute after approval by the PRC.

k) For the purpose of adjudication of the Dissertation, an external examiner shall be selected by the Principal from a panel of 5 examiners who are experienced in that field, proposed by the Head of the Department in consultation with the supervisor.

l) The final evaluation, i.e., viva-voce examination, for 100 marks, shall be conducted by a board consisting of the supervisor, Head of the Department and the external examiner.

m) A student is deemed to be failed, if he secures less than 50 marks in the external viva-voce examination and/or less than 100 marks from both internal and external viva-voce examination put together and shall be awarded Fail grade (F).

n) If any candidate fails or does not submit his dissertation due to ill health or any other reason permitted by the head of the institution, he will be given another chance to attend for the viva-voce examination conducted separately at a later date. The expenditure for conducting the viva-voce is completely borne by the candidate. If the candidate still fails to complete the dissertation, he should reregister into the second year and has to repeat the Dissertation.

12. CONDITIONS FOR PASS AND AWARD OF CREDITS FOR A COURSE

12.1 Conditions for Pass and award of Grades & Credits:

a) A candidate shall be declared to have passed in individual theory course if he secures a minimum of 50% aggregate marks (Internal & semester end examination marks put together), subject to a minimum of 40% marks in semester end examination.

b) A candidate shall be declared to have passed in individual laboratory/project course if he/she secures a minimum of 50% aggregate marks (Internal & semester end examination marks put together), subject to a minimum of 50% marks in semester end examination.

c) The student has to pass the failed course by appearing at the supplementary examination as per the requirement for the award of degree.

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

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

A letter grade and grade points will be awarded to a student in each course based on his/her performance as per the grading system shown in Table - 5.

Table - 5: Grading System for M. Tech Programme

Theory/Drawing	Laboratory/Project	Grade Points	Letter Grade
90% - 100%	90% - 100%	10	S
80% - 89%	80% - 89%	9	A+
70% - 79%	70% - 79%	8	A
60% - 69%	60% - 69%	7	B+
*50% - 59%	*50% - 59%	6	B
< 50%	< 50%	0	F (Fail)

* Pass mark

12.3 Calculation of Semester Grade Points Average (SGPA)

The performance of each student at the end of each semester is indicated in terms of SGPA. The SGPA is calculated as below:

$$\textbf{SGPA} = \frac{\sum(CR \times GP)}{\sum CR}$$

Where CR= Credits of a course

GP = Grade points awarded for a course

12.4 Calculation of Cumulative Grade Point Average (CGPA) and Award of Division for Entire Programme:

The CGPA is calculated as below:

$$\textbf{CGPA} = \frac{\sum(CR \times GP)}{\sum CR}$$ (for entire programme)

Where CR= Credits of a course
GP = Grade points awarded for a course

12.5 Award of Divisions

Award of divisions is as per the following criteria.

Table 6: Award of Divisions

CGPA	DIVISION
≥ 8.00	First class with distinction
≥ 6.00 - <8.00	First class
≥5.00 - <6.00	Second class
<5.00	Fail

13. SUPPLEMENTARY EXAMINATIONS

Supplementary examinations will be conducted along with regular semester end examinations.

14. READMISSION CRITERIA

A candidate, who is detained in a semester due to lack of attendance/marks/credits, has to obtain written permission from the Principal for readmission into the same semester after duly fulfilling all the required norms stipulated by the Institute in addition to paying an administrative fee of Rs. 1,000/-

15. RE-REGISTRATION

A candidate, who is unable to secure 50% marks in any course due to lack of internal marks, can re-register for that course(s) of that semester along with subsequent batches of admitted students for one attempt. However, he should attend the class work and appear for the internal & external examinations of that course(s) of the semester. Attendance in the re-registered courses(s) has to be calculated separately to become eligible to write the end examination in the re-registered course(s). In the event of taking another chance, the internal marks and end examination marks obtained in the previous attempt are nullified. The re-registration courses for a student at a time should not exceed one course during course work semester and two courses during Dissertation period. An administrative fee of Rs. 2000/- per each semester has to be paid.

16. BREAK IN STUDY

Student, who discontinues the studies for reasons what so ever, can get readmitted into appropriate semester of M. Tech Programme only with the prior permission of the Principal of the Institute. However, the academic regulations under which he was first admitted shall continue to be applicable to him. An administrative fee of Rs. 2000/- per each year of break in study in addition to the prescribed tuition and special fee has to be paid by the candidate to condone his break in study.

17. TRANSITORY REGULATIONS

A Candidate, who is detained or discontinued in the semester, on readmission will have to continue his studies in the same academic regulations under which he was first admitted.

18. ELIGIBILITY FOR AWARD OF M. TECH DEGREE

The M. Tech Degree shall be conferred on a candidate who has satisfied the following requirement.

- A Regular student (two year programme) should register himself for 74 Credits and has to secure all 74 academic credits.

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19. CONDUCT AND DISCIPLINE

- Students shall conduct themselves within and outside the premises of the Institute in a manner befitting the ethical code of the Institute.
- As per the order of Honourable Supreme Court of India and AICTE guidelines, ragging in any form is considered a criminal offence and is banned. Ragging within or outside any educational institution is prohibited. Ragging means doing an act, that causes or is likely to cause insult or annoyance or fear of apprehension or threat or intimidation or outrage of modesty or injury to a student. Any form of ragging will be severely dealt with as per AP Prohibition of Ragging Act-1997 section-4.

Table 7: Punishments for Ragging

Nature of ragging	Punishment
Teasing, embarrassing and humiliating	Imprisonment up to 6 months or fine up to Rs.1,000/- or both
Assaulting or using criminal force or criminal intimidation	Imprisonment up to 1 year or fine up to Rs.2,000/- or both
Wrongfully restraining or confining or causing hurt	Imprisonment up to 2 years or fine up to Rs.5,000/- or both
Causing grievous hurt kidnapping or raping or committing unnatural offence	Imprisonment up to 5 years and fine up to Rs.10,000/-
Causing death or abetting suicide	Imprisonment up to 10 years and fine up to Rs.50,000/-

- A student convicted of an offence under this act and punished with imprisonment for a term of more than six months shall not be admitted in any other educational institution.
- Whenever any student complains of ragging to the head or manager of an educational institution, such head or manager should inquire into the complaint and if the complaint in prima-facie found true, should suspend the student or students complained against.
- If the head or manager of an educational institution fails or neglects to take action in the manner specified in the Act, the person shall be deemed to have abetted the offence and shall be punished for the offence.
- If a student commits suicide due to or in consequence of ragging, the person who commits such ragging shall be deemed to have abetted such suicide.

The following acts of omission and/or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures.

i. Lack of courtesy and decorum; indecent behavior anywhere within or outside the campus.
ii. Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.

The following activities are not allowed within the campus:

- Mutilation or unauthorized possession of library books.
- Noisy and unruly behavior, disturbing studies of fellow students.
- Hacking 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.)
- Use of mobile phones in the campus.
- Plagiarism of any nature.
- Any other act of gross indiscipline as decided by the Institute from time to time.
- Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute / hostel, debarment from an examination, disallowing the use of certain facilities of the Institute, rustication for a specified period or even outright expulsion from the Institute, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.
- For an offence committed in (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.
- Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Principal for taking appropriate action.
- Unauthorized collection of money in any form is strictly prohibited.
- Detained and break-in-study candidates are allowed into the campus for academic purposes only with permission from authorities.
- Misconduct committed by a student outside the Institute campus but having the effect of damaging, undermining & tarnishing the image & reputation of the institution will make the student concerned liable for disciplinary action commensurate with the nature and gravity of such misconduct.
- The disciplinary action committee constituted by the Principal, 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.
- Grievance redressal committee, constituted by the Principal, shall deal with all grievances pertaining to the academic / administrative and disciplinary matters.
- All the students must abide by the code and conduct rules of the Institute.

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20. MALPRACTICES

The Principal shall refer the cases of malpractice by students in internal assessment tests and end semester examinations, to a malpractice enquiry committee constituted for the purpose. The committee shall follow the approved scales of punishment.

The committee consists of:

1. Heads of Department (Three)
2. Controller of Examinations
3. Deputy Controller of Examinations

Table 11: Disciplinary action for malpractices/improper conduct in examinations

	Nature of Malpractices/Improper conduct	Punishment
1 (a)	If the candidate possesses or keeps accessible, any paper, note book, programmable calculators, mobile phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in the examination hall but has not made use of (material shall include any marks on the student's body that can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	If the candidate gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through mobile phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	If the candidate has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and Dissertation. He shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the candidate is to be cancelled.
3	If the candidate impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and Dissertation) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The

		candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	If the candidate smuggles in an answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and Dissertation and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all other examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	If the candidate uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6	If the candidate refuses to obey the orders of the Chief Superintendent/Assistant -Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which results in damage to or destruction of property in the examination hall or any part of the Institute campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the Institute, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case will be registered against them.
7	If the candidate leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has

	inside or outside the examination hall.	already appeared including practical examinations and Dissertation and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all other examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	If the candidate possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and Dissertation and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the Institute, who is not a candidate for the particular examination or any person not connected with the Institute indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the Institute: Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and Dissertation. He shall not be permitted for the remaining examinations of the subjects of that semester/ year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the Institute: Will be handed over to police and a police case will be registered against them.
10	If the candidate comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and Dissertation. He shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and Dissertation of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11, shall be awarded suitable punishment.	

Note: Special squads may be formed to oversee the proper conduct of examinations.

21. WITHHOLDING OF RESULTS

- If the candidate has not paid any dues to the Institute or if any case of indiscipline is pending against him, the result of the candidate shall be withheld and he will not be allowed into the next higher semester. The recommendation for the issue of the degree shall be liable to be withheld in all such cases.

22. OTHER MATTERS

22.1 The physically challenged students who have availed additional examination time and a scribe during their Intermediate/ EAMCET (AP) examinations will be given similar concessions on production of relevant proof/documents.

22.2 Students who are suffering from contagious diseases are not allowed to appear for internal or end semester examinations.

22.3 The students who have participated in coaching/tournaments held at State/ National/ International levels through University/ Indian Olympic Association during end semester external examination period will be promoted to subsequent semesters till the entire course is completed as per the guidelines of University Grants Commission Letter No. F.1-5/ 88(SPE/PES), dated 18-08-1994.

22.4 The Principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the Heads of the Departments in an appropriate manner and subsequently such actions shall be placed before the Academic Council for ratification. Any emergency modification of regulation, approved in the meetings of the Heads of the Departments, shall be reported to the Academic Council of the Institute for ratification.

23. GENERAL

- The Academic Council may, from time to time, revise, amend or change the regulations, schemes of examination and/or syllabus and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute.
- Wherever the words “he”, “him”, “his”, occur in the regulations, they may include “she”, “her”, “hers” also.
- The academic regulations should be read as a whole for the purpose of any interpretation.
- In case of any doubt or ambiguity in the interpretation of above rules, the decision of the principal is final.

24. INSTITUTE RULES AND REGULATIONS

- Use of Mobile phones is strictly prohibited inside the Institute academic area.
- Students should come to Institute in proper dress.

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- All students should wear identity cards in the Institute campus.
- Students should be present in their respective classrooms by start time of class sharply.
- Students should not leave the Institute campus without prior permission of their respective Heads during Institute hours.
- Students should maintain silence in the class rooms during working periods.
- Sitting / wandering of the students at the stair cases, corridors, cycle stands or the areas within the Institute premises is strictly prohibited.
- Vehicle horn inside the campus is prohibited.

PROGRAMME STRUCTURE

&

DETAILED SYLLABUS

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Prasad V. Potluri Siddhartha Institute of Technology, Vijayawada
M.Tech (Machine Design)

PROGRAMME STRUCTURE

Course Code	Course Name	Periods/Week		Internal Marks	End Exam Marks	Total	Credits
		L	P				
Semester-I							
17MEMD1T1	Advanced Mechanics of Solids	4	---	40	60	100	4
17MEMD1T2	Mechanical Behaviour of Materials	4	---	40	60	100	4
17MEMD1T3	Mechanical Vibrations	4	---	40	60	100	4
17MEMD1T4	Geometric Modeling	4	---	40	60	100	4
	Elective I	4	---	40	60	100	4
	Elective II	4	---	40	60	100	4
17MEMD1L1	Machine Dynamics Lab	---	3	25	50	75	2
17MEMD1L2	Computer Aided Modeling Lab	---	3	25	50	75	2
	Total	**24**	**6**	**290**	**460**	**750**	**28**
Semester-II							
17MEMD2T1	Mechanism design and Synthesis	4	---	40	60	100	4
17MEMD2T2	Advanced Optimization Techniques	4	---	40	60	100	4
17MEMD2T3	Finite Element Methods In Engineering	4	---	40	60	100	4
17MEMD2T4	Advanced Robotics	4	---	40	60	100	4
	Elective III	4	---	40	60	100	4
	Elective IV/MOOCS	4	---	40	60	100	4
17MEMD2L1	Analysis Lab	---	3	25	50	75	2
17MEMD2L2	Mini Project/ Term Paper	---	3	25	50	75	2
	Total	**24**	**6**	**290**	**460**	**750**	**28**
Semester-III							
17MEMD3TR	Pedagogy Training / Industrial Training	---	---	75	---	75	2
17MEMD3DSA	Dissertation-Part-A	---	---	50	---	50	6
	Total	----	----	**125**	---	**125**	**8**
Semester-IV							
17MEMD4DSB	Dissertation -Part-B	----	----	50	100	150	**10**
	Total Credits (I+II+III+IV)						**74**

Electives	Course Code	Course Name
Elective-I	17MEMD1T5A	Computational Methods
	17MEMD1T5B	Continuum Mechanics& Tensor analysis
	17MEMD1T5C	Rapid Prototyping
	17MEMD1T5D	Computational Fluid Dynamics
Elective-II	17MEMD1T6A	Theory of Elasticity and Plasticity
	17MEMD1T6B	Mechanics of Composite Materials
	17MEMD1T6C	Design For Manufacturing
	17MEMD1T6D	Tribology
Elective-III	17MEMD2T5A	Fracture Mechanics
	17MEMD2T5B	Theory of Plates And Shells
	17MEMD2T5C	Condition Monitoring
	17MEMD2T5D	Nano Technology
Elective IV	17MEMD2T6A	Non-Destructive Testing
	17MEMD2T6B	Mechatronics
	17MEMD2T6C	Concurrent Engineering
	17MEMD2T6D	Product Design

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I YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD1T1 ADVANCED MECHANICS OF SOLIDS Credits 4

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- Understand the theory of elasticity including strain/displacement and Hooke's law relationships and apply various failure criteria for general state of stress a point.
- Compute the shear centre for various sections and calculate the bending stresses and deflections of beams under unsymmetrical loading
- Determine the bending stresses in curved beams and stresses in axisymmetric rotating members
- Solve the shear stresses in various cross sections under torsional loading and analyze solid mechanics problems using classical methods and energy methods

COURSE OUTCOMES:

Upon successful completion of this course, the student should be able to

1. Understand the concepts of three-dimensional stress and strain at a point as well as the stress-strain relationships and apply failure theories.
2. Locate the shear centre in beams and compute the stresses and deflections of beams under unsymmetrical loading
3. Analyze the curved beams and Calculate the stresses and strains in rotating disks
4. Solve torsion problems in bars with non circular cross sections and Apply energy methods for the determination of the deflections

Pre-Requisites: Mechanics of Solids

UNIT-I

THREE DIMENSIONAL STRESS AND STRAIN:

Definition of stress at a point, stress notation, stress in arbitrary plane, stress transformation, principal stresses, strain notation, strain displacement relation, strain compatibility relations, principal strains

YIELD CRITERIA:

General concepts, maximum Principal Stress Criterion, Maximum Principal Strain Criterion, Strain Energy Density Criterion, Maximum Shear Stress Criterion, Distortion Energy Density Criterion

UNIT-II

SHEAR CENTER:

Bending axis and shear center-shear center for axi-symmetric and unsymmetrical sections

UNSYMMETRICAL BENDING:

Bending stresses in Beams subjected to Nonsymmetrical bending, Deflection of straight beams due to nonsymmetrical bending.

UNIT-III

CURVED BEAM THEORY:

Winkler Bach formula for circumferential stress – Limitations – Location of Neutral axis of cross section–stresses in crane hooks – closed ring subjected to concentrated load-stresses in chain links.

AXI-SYMMETRIC PROBLEMS:

Rotating Discs- Flat discs, Discs of uniform thickness, Discs of uniform strength

UNIT-IV

TORSION

Torsion of a cylindrical bar of Circular cross Section, Saint-Venant's semi-inverse method, Linear elastic solution, Prandtl elastic membrane (Soap-Film) Analogy, Narrow rectangular cross Section, Hollow thin wall torsion members, Multiply connected Cross Section, Thin wall torsion members with restrained ends.

APPLICATION OF ENERGY METHODS

Elastic deflections and statically indeterminate members and structures: Principle of stationary potential energy, Castigliano's theorem on deflections, Castigliano's theorem on deflections for linear load deflection relations, deflections of statically determinate structures.

Learning Resources

Textbooks:

1. Advanced Mechanics of Materials, (6^{th} Edition) by Arthur P. Boresi and Richard J. Schmidt, Wiley India (P.) Ltd, New Delhi, 2012.

References:

1. Advanced strength of materials by Den Hortog J.P., Dover Publications, 1988
2. Advanced Mechanics of Solids by L.S Srinath, Mcgraw Hill Education, 2010.
3. Mechanics of Materials (10^{th} Edition) by B.C Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, 2015.
4. Strength of Materials (Revised Edition) by R. K. Rajput, S Chand & Pvt. Ltd., 2014.
5. Strength of Materials, (11^{th} Edition) by Dr. Sadhu Singh, Khanna Publishers, New Delhi, 2007.

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I Year M.Tech (MACHINE DESIGN) FIRST SEMESTER

17MEMD1T2 MECHANICAL BEHAVIOR OF MATERIALS Credits 4

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- To familiarize with different advanced materials and their properties.
- To know the mechanical behavior of materials under different loading and temperature conditions.

COURSE OUTCOMES:

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

1. Establish basic concepts in Mechanical behavior of different materials.
2. Understand the basic concept of Strain hardening, Fatigue, and Creep mechanisms.
3. Understand the basic principle of Microscopy and SEM, TEM for material characterization.
4. Understand the fracture behavior of ductile and brittle materials.

UNIT-I

INTRODUCTION: Overview of the course, examination and evaluation patterns, history and Introduction to Mechanical behaviour of Materials.

FUNDAMENTAL CONCEPTS: Mechanical properties of materials, stress and strain, Mohr's strain circle, Elasticity, plasticity, Tensile Testing, stress-strain curve for ductile, brittle and polymer materials, Bridgman correction, Other tests of plastic behavior.

UNIT-II

STRAIN HARDENING: Strain hardening of metals, Strain rate and Temperature dependence, Hardening mechanisms in metals- strain hardening, solid solution strengthening, dynamic strain ageing.

FATIGUE, AND CREEP MECHANISMS: S-N curves, Statistical nature of fatigue, Structural features of fatigue, fatigue crack propagation, effect of mean stress, stress concentration, design estimates, cyclic stress strain behavior, slip system, Creep mechanisms, temperature dependence of creep, Structural changes during creep, Mechanism of creep deformation, Creep under combined stresses, Creep fatigue interaction.

UNIT-III

MECHANICAL BEHAVIOUR OF OTHER MATERIALS: Mechanical behavior of ceramics, glasses, polymers and Composites: FRP and MMC, Material characterization using optical microscopy, Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM).

UNIT-IV

BRITTLE FRACTURE: Significance of transition, Temperature curve, Metallurgical factors affecting transition Temperature **,** Fracture Analysis diagram, Temper embrittlement, Environment Sensitive fracture-Hydrogen embrittlement, Stress-corrosion cracking, Liquid-metal embrittlement, Neutron embrittlement, Flow and fracture under very rapid rates of loading..

Learning Resources

Text Books:

1. Mechanical Metallurgy (2^{nd} Edition) by George E. Dieter, Mc Graw Hill, 2005.
2. Engineering Mechanics of Composite Materials (2^{nd} edition) by Isaak M. Daniel, Ori Ishai, Oxford university press, , 2006.

Reference Books:

1. Introduction to Fracture Mechanics by Hellan K, Mc Graw Hill, 2002.
2. Mechanical behaviour of materials at elevated temperatures by J.E.Dorn, , McGraw Hill, 2000.

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I YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD1T3 MECHANICALVIBRATIONS Credits 4

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- Derive the equation of motion of a single-degree-of-freedom system and solve for their free vibration response depending upon the type of damping.
- Find the responses of Undamped and viscously damped single-degree-of-freedom systems subjected to different types of harmonic force, including base excitation and rotating unbalance.
- Formulate the equations of motion of two-degree-of-freedom systems and Identify the mass, damping, and stiffness matrices from the equations of motion to compute the natural frequencies of vibration and the modal vectors.
- Formulate the equations of motion of multi degree-of-freedom systems using Newton's second law, influence coefficients, or Lagrange's equations to find the natural frequencies of vibration and the modal vectors by solving the Eigen value problem.

COURSE OUTCOMES:

After completed course, the students are expected to be able to:

1. Apply the knowledge of Mathematics and science to solve the free vibration problems of Single-Degree-of-Freedom Systems
2. Identify various types of forced vibration problems and develop the mathematical models, analyze, solve to find the response of Single-Degree-of-Freedom Systems subjected to a harmonic excitation
3. Identify and develop the mathematical models, analyze, solve to find the free/ forced vibration response of Two-Degrees-of-Freedom Systems
4. Develop the mathematical models, analyze, solve to find the free vibration response of Multi-Degrees-of-Freedom Systems

UNIT-I

FREE VIBRATION OF SINGLE-DEGREE-OF-FREEDOM SYSTEMS:

Importance of the Study of Vibration, Elementary Parts of Vibrating Systems, Number of Degrees of Freedom, Discrete and Continuous Systems, Classification of Vibration, Vibration Analysis Procedure, Harmonic Motion, Harmonic Analysis, Free Vibration of an Undamped Translational and Torsional Systems, Rayleigh's Energy Method, Free Vibration with Viscous Damping and Coulomb Damping**.**

UNIT-II

HARMONICALLY EXCITED VIBRATION:

Equation of Motion, an Undamped System Under Harmonic Force, Damped System Under Harmonic Force, Damped System Under the Harmonic Motion of the Base, Damped System

Under Rotating Unbalance, Transfer-Function Approach, Solutions using Laplace Transform, Frequency Transfer Functions, Representation of Frequency-Response Characteristics

UNIT-III

VIBRATION UNDER GENERAL FORCING CONDITIONS:

Response to impulse excitation, Step Input, Ramp Input, Rectangular Pulse

Two-Degree-of-Freedom Systems: Free Vibration Analysis of an Undamped System, Coordinate Coupling and Principal Coordinates, Forced-Vibration Analysis, Semidefinite Systems, dynamic vibration absorber,

UNIT- IV

MULTIDEGREE-OF-FREEDOM SYSTEMS: Influence Coefficients, Potential and Kinetic Energy Expressions, Generalized Coordinates and Generalized Forces, Using Lagrange's Equations to Derive Equations of Motion, free vibration of Multidegree-of-Freedom Systems.

Continuous Systems: Transverse Vibration of a String or Cable, Longitudinal Vibration of a Bar or Rod, Torsional Vibration of a Shaft or Rod, Lateral Vibration of Beams

Learning Resources

Text book:

1. Mechanical Vibrations (5^{th} edition) by Singiresu S. Rao, Pearson Education

References:

1. Elements of Vibration Analysis (2^{nd} edition) by Leonard Meirovitch, McGraw-Hill
2. Mechanical Vibrations : theory and applications by (1^{st} edition) S Graham Kelly, Cengage Learning
3. Vibrations (2^{nd} edition) by Balakumar Balachandran and Edward B. Magrab, Cengage Learning

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I YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD1T4 GEOMETRIC MODELING Credits 4

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

Make the student enable to

- Various representation schemes used for geometric entities used in geometric modeling, and various entity manipulation techniques.
- Algebraic, geometric form of cubic, Bezier, and B-spline curves and their properties, derivatives.
- Parametric representation of analytic and synthetic surfaces
- Basic solid model representation schemes, algebraic, geometric form of a tri-cubic solid.

COURSE OUTCOMES:

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

1. Express types of manipulation techniques, mathematical representation schemes for various entities used in geometric modeling.
2. Formulate algebraic and geometric form of a cubic spline, Bezier, and B-Spline curves and their derivatives.
3. Develop parametric representation of analytic and synthetic surfaces.
4. Distinguish various schemes used for construction of solid models and express a tri-cubic solid algebraically and geometrically.

UNIT-I

Transformations– 2D & 3D Transformations- Scaling, Rotation, Shearing, Zooming, Viewing Transformations, Reflection, rotation about an axis, concatenation.

CUBIC SPLINES-

Definition, Explicit and implicit equations, parametric equations. Algebraic and geometric form of cubic spline, tangent vectors, parametric space of a curve, blending functions, four point form, reparametrization, truncating and subdividing of curves.

UNIT-II

BEZIER CURVES: Bezier curve definition, matrix representation of Bezier curves, Bernstein basis, equations of Bezier curves, properties, derivatives, increasing the flexibility of Bezier curves, degree elevation.

B-SPLINE CURVES: B-Spline curve definition, properties, convex hull properties of B-spline, knot vectors, B-spline basis function, B-spline curve control, open, periodic, non uniform B-spline curves, matrix formulation of B-spline curve, end conditions of periodic B-spline curve, equations, and derivatives.

UNIT-III

INTRODUCTION: Surface Models, Surface Representation. Parametric Representation of Analytic Surfaces - Plane Surface, Ruled Surface, Surface of Revolution, Tabulated Cylinder. Parametric Representation of Synthetic Surfaces - Hermit Bi-cubic Surface, Bezier Surface, B-Spline Surface, Coons Surface, Gaussian curvature.

UNIT-VII

SOLID MODELING CONCEPTS: Boundary representation, half space modeling, spatial cell, cell decomposition.

SOLIDS: Tri-cubic solid, Algebraic and geometric form.

Learning Resources

Text Books:

1. Geometric Modeling (1st edition) by Micheal. E. Mortenson, McGraw Hill Publishers First edition
2. Elements of Computer Graphics (1st edition) by Roger & Adams Tata McGraw Hill. First edition

Reference:

1. An Introduction to Nurbs with Historical perspective (1st edition) by David F Rogers. First edition

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I YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD1T5A COMPUTATIONAL METHODS Credits 4

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- Able to find the solution of linear and non linear equations.
- To get good exposure to numerical integration, boundary value and characteristic value problems, finite difference solution of parabolic, elliptic and hyperbolic partial differential equations
- To find the curve of best fit for the given data by method of least squares.

COURSE OUTCOMES:

Upon completion of this course the student will be able to

1. Solve the linear and non linear system of equations using numerical methods and understand the concept of numerical integration.
2. Solve the boundary value and characteristic value problems and using regression analysis fit an approximation of functions.
3. Find the temperature distribution in a rectangular plates using finite difference method.
4. Find the temperature distribution in a rod and solve the wave equation by finite difference method.

UNIT-I

INTRODUCTION TO NUMERICAL METHODS APPLIED TO ENGINEERING PROBLEMS:

Examples, solving Sets of equations – Matrix notation – Determinants and inversion – Iterative methods –Relaxation methods – System of non-linear equations.

NUMERICAL INTEGRATION: Newton-Cotes integration formulas – Simpson's rules, Gaussian quadrature. Adaptive integration.

UNIT-II

BOUNDRY VALUE PROBLEMS AND CHARACTERISTIC VALUE PROBLEMS:

Shooting method – Solution through a set of equations – Derivative boundary conditions – Rayleigh – Ritz method –Characteristic value problems.

CURVE FITTING AND APPROXIMATION OF FUNCTIONS: Least square approximation fitting of non- linear curves by least squares –regression analysis- multiple linear regression, non linear regression.

UNIT-III

NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS:

Laplace's equations – Representations as a difference equation – Iterative methods for Laplace's equations – poisson equation – Examples – Derivative boundary conditions – Irregular and non – rectangular grids – Matrix patterns, sparseness – ADI method – Finite element method.

UNIT-IV

PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS:

Explicit method- Crank-Nickelson method – Derivative boundary condition, Stability and convergence criteria– Finite element for heat flow.

HYPERBOLIC PARTIAL DIFFERENTIAL EQUATIONS:

Solving wave equation by finite differences- stability of numerical method –method of characteristics-wave equation in two space dimensions.

Learning Resources

Text Books:

1. Numerical Methods for Engineers by Steven C.Chapra, Raymond P.Canale, Tata Mc- Graw hill.
2. Applied numerical analysis by Curtis F.Gerald, partick.O.Wheatly, Addison-wesley, 1989.
3. Numerical methods (2^{nd} edition) by Douglas J..Faires,Riched Burden, Brooks/cole publishing , 1998.

References:

1. Numerical mathematics and computing (4^{th} edition) by Ward cheney & David Kincaid, Brooks/cole publishing 1999.
2. Mathematical Methods for Physics and Engineering by Riley K.F.M.P.Hobson &Bence S.J, Cambridge University press, 1999.

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I YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD1T5B CONTINUUM MECHANICS & TENSOR ANALYSIS Credits 4

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- Demonstrate knowledge of the physical meanings, principles and mathematics of continuous media represented as solids, liquids and gases.
- Formulate and solve simplified problems using the language and methods of Continuum mechanics.
- Set up and discuss solvability of complicated continuum boundary value problems
- Articulated basic principles and equations applicable to all constitutive models.

COURSE OUT COMES:

At the end of the course student can be able to

1. Understand the stress tensor and derive it for ideal, Newtonian and viscous fluids
2. Explain the models of linear elasticity and, linear viscoelasticity
3. Explain central terms as material volume, particle and deformation tensor
4. Distinguish Eulerian and Lagrangian definition of the equations of motion
5. Derive conservation laws for mass, momentum and energy on local and global form

UNIT-I

TENSOR ANALYSIS - I:

Multi linear forms, Definition of Tensor over including vector spaces, Alternating tensors, determinants, orientation, tensor products.

UNIT-II

TENSOR ANALYSIS – II:

Rotation of tensors, calculations of tensors, internal calculations of tensors and Integral identities,

TENSOR CALCULUS: Tensor calculus.

UNIT-III

CONTINUUM MECHANICS

Eulerian and Lagrangian description of a continuous, discrete systems, continua, physical quantities and their derivatives. Rigid body motion, Relation between continuum models and real materials

CONSERVATION LAWS IN A CONTINUUM:

Mass conservation in Lagrangian and Eulerian frames, Conservation of momentum in Lagrangian and Eulerian frames.

UNIT-IV

CONSERVATION LAWS OF ENERGY:

Conservation in angular momentum in Lagrangian form. Conservation of energy in Lagrangian and Eulerian frames. Strain and decomposition. Finite deformation, infinitesimal displacements

CONSTITUTIVE RELATIONS - I:

Material frame indifference, Elastic Materials

CONSTITUTIVE RELATIONS - II:

Viscous fluids, linear viscoelasticity

Learning Resources

Text Book

1. Continuous mechanics by George Backus, Samizdat Press, 1997

References:

1. Mechanics of Continua by A.C. Eringan, 1962
2. Continuous Physics by A.C. Eringan Vol. 1, Academic press 17, 1967,
3. Introduction to Continuous Mechanics by B.L.N. Kennett
4. Quick introduction to Tensor analysis by R.Sharipov, 2004, Samizdat Press.
5. Non-linear continuum mech-win, SEACAS theory manuals part II by T.A. Laursen, S.W.Attaway and R.I.Zadoks

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I YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD1T5C **RAPID PROTOTYPING** **Credits 4**

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- To explore the automatic fabrication of 3D physical parts using additive manufacturing technology.
- To describe the principles embedded into the basis of Rapid Prototyping (RP).
- To acquaint students with the basic kinds of RP-systems.
- To show the progress in RP-technology in the context of shortening lead-time for new production.
- To consider the concept of Rapid Tooling (RT), to show its current and prospective application.
- To discuss the concept of Rapid Manufacturing in terms of its potential applicability, practicability, and expedience.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to

1. To understand the Rapid Prototyping principles and apply appropriate tools and techniques in Rapid Prototyping
2. Get acquainted with the basic kinds of RP-systems understand the progress in RP-technology in the context of shortening lead-time for new production.
3. Appreciate the concept of Rapid Manufacturing in terms of its potential applicability, practicability, and expedience.
4. Identify, characterize and select the ideal materials for a given Rapid Prototyping system.

UNIT-I

INTRODUCTION:

Prototype fundamentals – Definition, types of prototype, roles of prototype; historical development, development of RP in the primary areas – input, method, materials and applications; advantages of rapid prototyping, categorization of rapid prototyping systems liquid based, solid based, powder based. **Rapid Prototyping Process Chain-** Fundamental Automated Processes - process chain, 3D modeling, data conversion and transmission, checking and preparing, building, post processing.

UNIT-II

LIQUID-BASED RAPID PROTOTYPING:

3Dsystems Stereo Lithography Apparatus (SLA) - products, process, principle - photo polymers, photo polymerization, layering technology, laser and laser scanning; strength and weaknesses of the SLA, Applications. Example: INCS Prototyping and Manufacturing

Services Make Japan a Model for the World Market. Cubital's Solid Ground Curing (SGC)- , products, Advantages and disadvantages, Process, Principle, Applications. Rapid Freeze Prototyping, Micro Fabrication,

UNIT-III
SOLID-BASED RAPID PROTOTYPING:
Stratays's Fusion Deposition Modeling (FDM) Products: FDM MC Machines, Dimension Series, Process, Principle, Strengths and Weaknesses, Applications, Example- Toyota Uses FDM for Design and Testing. Cubic Technologies Laminated Object Manufacturing (LOM) Products, Process: Pre Processing, Building, Post-Processing, System Structure, Materials; Principle, Strengths and Weaknesses, Applications. Example: National Aeronautical and Space Administration (NASA) and Boeing Rocket dyne Use of LOM to Create Hot Gas Manifold for Space Shuttle Main Engine. 3D Systems Multi-jet Modeling System (MJM)- , products, process, principles, Advantages and disadvantages, Applications. The shape deposition Manufacturing Process, Introduction, process, Advantages and disadvantages

UNIT-IV
POWDER-BASED RAPID PROTOTYPING:
3D Systems Selective Laser Sintering (SLS) - Products, Process - The SLS Process, materials, Principle - Sinter Bonding, Strengths and Weaknesses, Applications. Example: Los-Angeles-Based TEST A Architecture/Design Utilizes SLS for Large-Scale Models of Carbon Tower Prototype OPTOMEC's Laser Engineered Net Shaping (LENS)- , products, Principle, Advantages and disadvantages, Applications and examples.

Learning Resources

Text books

1. Rapid Prototyping Principles and Applications (3rd Edition) by Chee Kai Chua, Kah Fai Leong, World Scientific Publishing Co. Pt. Ltd.
2. Rapid Manufacturing An Industrial Revolution for the Digital Age by N. Hopkinson, R.J.M. Hague and P.M. Dickens Lough borough University, UK

References:

1. Rapid Manufacturing by Pham, D.T, Dimov, S.S, , Springer, 2001.
2. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing by Ian Gibsn., David W Rosen., Brent Stucker, Springer, 2010

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I YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD1T5D COMPUTATIONAL FLUID DYNAMICS Credits 4

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- Demonstrate the governing flow equations for a fluid dynamics problem.
- Outline the Partial Differential Equations (PDEs) and various discretization techniques.
- Apply the basic knowledge of Computational Fluid Dynamics (CFD) to Nozzle flow problems and Incompressible flow problems.
- Apply the basic knowledge of CFD to Heat Transfer problems.

COURSE OUTCOMES:
After completion of the course, student should be able to

1. Describe governing flow equations for a fluid dynamics problem.
2. Classify the Partial Differential Equations (PDEs) and various Discretization techniques.
3. Apply the basic knowledge of Computational Fluid Dynamics (CFD) to Nozzle flow problems and Incompressible flow problems.
4. Apply the basic knowledge of CFD to Heat Transfer problems.

UNIT-I
INTRODUCTION
Computational Fluid Dynamics as a Research and Design Tool, Applications of Computational Fluid Dynamics,
GOVERNING EQUATIONS OF FLUID DYNAMICS:
Introduction, Models of the Flow, Substantial Derivative, Divergence of Velocity, Continuity Equation, Momentum Equation and Energy Equation, Conservation and Non-conservation forms of Governing Flow Equations.

UNIT-II
PARTIAL DIFFERENTIAL EQUATIONS – ITS MATHEMATICAL BEHAVIOR
Introduction, Classification of Quasi-Linear Partial Differential Equations, Eigen Value Method, Hyperbolic Equations, Parabolic Equations, Elliptic Equations.
DISCRETIZATION
Introduction, Finite Differences, Difference Equations, Explicit and Implicit Approaches, Errors and Stability Analysis, Grid Generation.
TRANSFORMATION OF GRIDS
Transformation of Equations, Metrics and Jacobians, Transformed version of Governing Flow Equations.

UNIT-III
CFD TECHNIQUES
Introduction, The Lax Wendroff Technique, MacCormack's Technique, The Alternation-Direction Implicit (ADI) Technique, Pressure Correction Technique.
CFD Application to Nozzle Flow Solution to Subsonic-Supersonic Isentropic flow using MacCormack's Technique
CFD Application to Incompressible Couette Flow Solution by using Pressure Correction method.

UNIT-IV
NUMERICAL METHODS IN HEAT CONDUCTION
One-Dimensional Steady Heat Conduction in a plane wall and boundary conditions; Two-Dimensional Steady Heat Conduction and boundary conditions; Transient Heat Conduction in a plane wall; Two-Dimensional Transient Heat Conduction in a rectangular coordinates.

Learning Resources

Text Books
1. John. D. Anderson, Computational fluid dynamics - Basics with applications, McGraw Hill
2. D. A. Anderson, J. C. Tannehill, and R. H. Pletcher. Computational Fluid Mechanics and Heat Transfer. NewYork: Hemisphere, 1984.

REFERENCES
1. Suhas V. Patankar, Numerical heat transfer and fluid flow, Butter-worth Publishers.
2. T. K Sengupta, Fundamentals of Computational Fluid Dynamics, University Press

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I YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD1T6A THEORY OF ELASTICITY AND PLASTICITY Credits 4

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- To impart knowledge of Principal stresses and strains
- To develop analytical skills of solving problems using plain stress and plain strain.
- To impart knowledge of engineering application of plasticity.

COURSE OUTCOMES:
After completion of the course, student should be able to

1. Demonstrate the application of plane stress and plane strain in a given situation.
2. Understand the two dimensional problems in polar coordinate system.
3. Apply stress-strain relations for linearly elastic solids, and Torsion
4. Demonstrate the ability to analyze the structure using plasticity.

UNIT-I
ELASTICITY
Introduction: Elasticity – notation for forces and stresses – components of stresses – components of strain – stress strain relationship – Generalized Hooke's law. Plane stress and plane strain analysis – plane stress – plane strain – differential equations of equilibrium – boundary conditions – compatibility equations – stress function – boundary condition.

UNIT-II
Two dimensional problems in rectangular coordinates – solution by polynomials – Saint Venant's principle – determination of displacements – bending of simple beams – application of corier eries or two dimensional problems – gravity loading. Two dimensional problems in polar coordinates – stress distribution symmetrical about an axis – pure bending of curved bars – strain components in polar coordinates – displacements for symmetrical stress distributions – simple symmetric and symmetric problems – general solution of two – dimensional problem in polar coordinates – application of general solution in polar coordinates.

UNIT-III
Torsion of Prismatic Bars-torsion of prismatic – bars with elliptical cross sections – other elementary solution – membrane analogy – torsion of rectangular bars – solution of torsion problems by energy method – use of soap films in solving torsion problems – hydro dynamical analogies – torsion of shafts, tubes , bars etc.

Bending of Prismatic Bars: Stress function – bending of cantilever – circular cross section – elliptical cross section – rectangular cross section – bending problems by soap film method – displacements.

UNIT-IV
PLASTICITY
Physical Assumptions – Yield criteria – Failure theories – Applications of thick cylinder – Plastic stress strain relationship. Elasto – plastic problems in bending and torsion.

Learning Resources

Text Books
1. Theory of Elasticity (third edition) by Timeshanko, McGrawhill Publications, 2010.
2. Theory of Plasticity (third edition) by J.Chakarbarthy, McGrawhill Publications, 2006.
Reference Books
3. Theory of Elasticity by Y.C.Fung.
4. Theory of Elasticity by Gurucharan Singh
5. Theory of Elasticity by Sadhu Singh, Khanna Publishers, New Delhi

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I YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD1T6B MECHANICS OF COMPOSITE MATERIALS Credits 4

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVE:

- Familiarization with the basic expressions and methods used in the mechanics of composite structures.
- To identify the behavior of fiber and matrix materials used in composites, as well as some common manufacturing techniques
- To predict the elastic behavior of composites with micromechanics and macro mechanics approaches
- To understand the failure behavior of the composite materials to evaluate their life

COURSE OUTCOMES:

After completion of the course, student should be able to

1. Understanding of types, manufacturing processes, and applications of composite Materials
2. Analyze problems on macro mechanical behavior of lamina
3. Analyze problems on micromechanical behavior of lamina
4. Analyze problems on macro mechanical behavior of laminate
5. Apply failure criteria and critically evaluate their behavior

UNIT-I

BASIC CONCEPTS AND CHARACTERISTICS:

Geometric and Physical definitions, natural and man-made composites, applications, types and classification of composites. Reinforcements: Fibers – Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibers. Particulate composites, Thermoplastics, Thermosetts, Metal matrix and ceramic matrix composites. Manufacturing Methods for Composite Materials, Autoclave Molding, Filament Winding, Resin Transfer Molding.

UNIT-II

ELASTIC BEHAVIOR OF UNIDIRECTIONAL LAMINA:

Stress-Strain Relations-General Anisotropic Material, Specially Orthotropic Material, Transversely Isotropic Material, Orthotropic Material Under Plane Stress, Isotropic Material, Relations Between Mathematical and Engineering Constants, Stress-Strain Relations for a Thin Lamina (Two-Dimensional), Transformation of Stress and Strain (Two-Dimensional), Transformation of Elastic Parameters (Two-Dimensional), Transformation of Stress-Strain

Relations in Terms of Engineering Constants (Two-Dimensional), Transformation Relations for Engineering Constants (Two-Dimensional), Micromechanical predictions of elastic constants

STRENGTH OF UNIDIRCETIONAL LAMINA

Longitudinal Tension-Failure Mechanisms and Strength, Longitudinal Compression, Transverse Tension, Transverse Compression, In-Plane Shear, Out-of-Plane Loading, General Micromechanics Approach. Macro-mechanical strength parameters, macro-mechanical failure theories, maximum stress theory, maximum strain theory, Tsai- hill, Tsai-Wu theory.

UNIT-III

ELASTIC BEHAVIOR OF MULTIDIRECTIONAL LAMINATES:

Laminates, Basic assumptions, Strain-Displacement Relations, Stress-Strain Relations of a Layer Within a Laminate, Force and Moment Resultants, General Load-Deformation Relations: Laminate Stiffness, Inversion of Load-Deformation Relations: Laminate Compliances. Symmetric Laminates: Symmetric Laminates with Isotropic Layers, Symmetric Laminates with Specially Orthotropic Layers (Symmetric Cross-ply Symmetric Angle-Ply Laminates Anti symmetric Laminates, Anti symmetric Cross-ply Laminates, Anti symmetric Angle-Ply Laminates, Balanced Laminates,

UNIT-IV

FAILURES AND LIFE PREDICTIONS:

Possible modes of failure, stress analysis of first ply failure, ultimate laminate failure or analysis of last ply failure: Total- ply failure method and partial-ply failure method, inter laminar stress.

FAILURE MODES: Matrix cracking, Delamination, Tensile fiber failure, Micro buckling, global instability, Common Features of Life Prediction Methodology, Damage Characterization.

Learning Resources

Text Books:

1. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press, 1994.
2. Mechanics of Composite Materials by R. M. Jones, Mc Graw Hill , New York, 1975.
3. Mechanics of composite materials by Madhujit Mukhopadhyay, Universities press.

References:

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

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I YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD1T6C DESIGN FOR MANUFACTURING Credits 4

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

Make the student enable to

- Various Design philosophies and material selection for various machine components, and process selection.
- Various machining processes, tolerances and their selection for various applications.
- Factors considered for designing of casting and weld joints appraisal of various process parameters.
- Design factor to be considered Forging and extrusion.

COURSE OUTCOMES:

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

1. Express design principles of design for economic production and material selection, and process selection.
2. State design rules for machining, dimensional tolerance and specify design recommendation for machine parts
3. Illustrate various factors to be considered in design of casting and welding.
4. List out design guide lines for forging and extrusion process.

UNIT-I

INTRODUCTION

Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production

MATERIALS: Selection of materials for design-developments in material technology-criteria for material selection-material selection interrelationship with process selection-process selection charts.

UNIT-II

MACHINING PROCESSES:

Overview of various machining processes-general design rules for machining-dimensional tolerance and surface roughness-Design for machining – ease –redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT-III

METAL CASTING: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design product design rules for sand casting.

METAL JOINING: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints.

UNIT-IV

FORGING: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

EXTRUSION & SHEET METAL WORK: Design guide lines extruded sections-design principles for punching, blanking, bending, and deep drawing-Keeler Goodman forging line diagram – component design for blanking.

Learning Resources

Text Books:

1. Design for Manufacture by Geoffrey Boothroyd.
2. Design for manufacture, John cobert, Adisson Wesley. 1995

References:

1. Product Design for Manufacturing and Assembly by Geoffrey Boothroyd, Peter Dewhurst, Winston Knight. Marcel Dekker,Inc
2. ASM Hand book Vol.20

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I YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD1T6D **TRIBOLOGY** **Credits 4**

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- Illustrate nature of surfaces and know the selection of lubricating system for different types of bearings in various environmental conditions
- Understand the principles of design of Hydrostatic and Hydro Dynamic bearings and Classify the mechanical seals
- Assess and monitor rolling element bearings and analysis of failure of tribological components

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

1. Monitor the nature of surfaces and select proper lubrication system to reduce friction
2. Analyze and design hydro dynamic bearings
3. Analyze and design hydro static bearings and plan proper sealing
4. Select the rolling element bearing for the given conditions and analyze failure of tribological components

Pre Requisites: Design of machine Members

UNIT-I
INTRODUCTION:
Nature of surfaces and contact-Surface topography-friction and wear mechanisms and effect of lubricants- methods of fluid film formation.
LUBRICATION:
Choice of lubricants, types of oil, Grease and solid lubricants- additives- lubrication systems and their selection – selection of pump, filters, piping design- oil changing and oil conservation.

UNIT-II
HYDRODYNAMIC BEARINGS:
Fundamentals of fluid formation – Reynold's equation; Hydrodynamic journal bearings – Sommerfield number- performance parameters – optimum bearing with maximum load

capacity – Friction – Heat generated and Heat dissipated. Hydrodynamic thrust bearings; Raimondi and Boyd solution for hydrodynamic thrust bearings- fixed tilting pads, single and multiple pad bearings-optimum condition with largest minimum film thickness.

UNIT-III

HYDROSTATIC BEARINGS:

Thrust bearings – pad coefficients- restriction- optimum film thickness journal bearings – design procedure –Aerostatic bearings; Thrust bearings and Journal bearings – design procedure.

SEALS:

Different type-mechanical seals, lip seals, packed glands, soft piston seals, Mechanical piston rod packing, labyrinth seals and throttling bushes, oil flinger rings and drain grooves – selection of mechanical seals.

UNIT-IV

SELECTION OF ROLLING ELEMENT BEARINGS:

Nominal life, static and dynamic capacity-Equivalent load, probabilities of survival- cubic mean load- bearing mounting details, pre loading of bearings, conditioning monitoring using shock pulse method.

FAILURE OF TRIBOLOGICAL COMPONENTS:

Failure analysis of plain bearings, rolling bearings, gears and seals, adhesive wear, abrasive wear, corrosion wear, surface fatigue, wear analysis using soap and Ferrography.

Learning Resources

Text books:

1. Hydrostatic and Hybrid bearing design by Rowe W.W.& O. Dionoghue, Butterworths & Co. Publishers Ltd, 1983.
2. Mechanical Fault diagnosis and condition monitoring by Collacott R.A, Chapman and Hall, London 1977.
3. Fundamentals of fluid film lubricant by Bernard J. Hamrock, Mc Graw-Hill Co, 1994.

References:

1. Tribology hand Book by Neale MJ Neumann Butter worths, 1975.
2. Standard hand book of lubrication engineers by Connor and Boyd JJO, ASLE, Mc Graw Hill Book & Co.,1968
3. Design of Machine Elements, (3ed Edition) by V.B. Bhandari, Tata McGraw Hill Publishers, New Delhi, 2010.

Data Book to be allowed in Examination:

1. Design data hand book (4th Edition), by K Mahadevan & K Balaveera Reddy, CBS Publishers, 2013.
2. Design Data Hand Book by (1st Edition) by S. Md. Jalaluddin, , Anuradha Publications, Chennai, 2009.

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I YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD1L1 **MACHINE DYNAMICS LAB** **Credits 2**

Lecture: 3 periods/week **Internal assessment: 25 marks**

Tutorial: - - **Semester end examination: 50 marks**

COURSE OBJECTIVES:

- Determine the vibration parameters of a vibrating system
- Predict the radius of gyration and moment of inertia of vibrating system
- Verify the static and dynamic balancing
- Study the effect of gyroscopic couple and operations of robotic arm

COURSE OUTCOMES:

Upon the completion of this course the student will be able to:

1. Evaluate the natural frequencies in different vibrating systems and effect of gyroscopic couple
2. Compute the radius of gyration & Moment of Inertia of oscillating part in vibration system
3. Measure the amplitude of vibration in damped and un damped vibrating system
4. Verify the static balancing and dynamic balancing
5. Implement the operations to manipulate the robot arm in industries
6. Determine the critical speed using whirling of shaft.
7. Determination of vibrations using FFT analyzer

List of Experiments:

Any 12 experiments from the following

1. Determination of the magnitude of gyroscopic couple, angular velocity of precession, and representation of vectors.
2. Checking of Static balancing using steel balls.
3. Determination of the magnitude and orientation of the balancing mass in dynamic balancing.
4. Determination of steady state amplitude of a forced vibratory system without damping.

5. Determination of steady state amplitude of a forced vibratory system with damping.
6. Determination of Natural frequency of un damped torsional single rotor system.
7. To determine damping coefficient of torsional single rotor system.
8. Determination of critical speed with Rotors /whirling of shafts.
9. Determination of radius of gyration and moment of inertia – trifilar suspension method.
10. Determination of vibrations in machines using FFT analyzer.
11. Determination of misalignment in given machine using FFT analyzer
12. Diagnosis of unbalance in a machine using FFT analyzer.
13. Direct kinematic analysis of a robot.
14. Inverse kinematic analysis of a robot.
15. Trajectory planning of a robot in joint space scheme.
16. Palletizing operation using Robot programming.

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I YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD1L2 COMPUTER AIDED MODELLING LAB Credits 2

Lecture: 3 periods/week **Internal assessment: 25 marks**

Tutorial: - - **Semester end examination: 50 marks**

COURSE OBJECTIVES:

- Students will learn theory and practice related to solid modeling, assembly modeling, drafting and parametric modeling.
- Use basic and advanced features of current modeling software
- Understand how CAD technology can be leveraged in the design process

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

1. Model a part or assembly of parts using Computer-Aided Design software.
2. Use parametric modeling techniques to reflect engineering requirements.
3. Use motion and interference checking to ensure that parts will not interfere throughout their complete range of motion.
4. Communicate effectively the geometry and intent of design features.

LIST OF EXPERIMENTS

1. Introduction of 3D Modeling software

2. Part modeling of following models
   a) Screw Jack
   b) Universal Joint
   c) Plummer Block

3. Creation of 3D assembly model of following machine elements using 3D modeling software
   a) Screw Jack
   b) Universal Joint
   c) Plummer Block

4. Creation of drawing views of assembly models using 3D modeling software

   a) Screw Jack
   b) Universal Joint
   c) Plummer Block

I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2T1 MECHANISM DESIGN AND SYNTHESIS Credits 4

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- Discriminate mobility (number of degrees-of-freedom) of the member and enumeration of rigid links and types of joints within mechanisms.
- Distinguish a mechanism for displacement, velocity and acceleration at any point in a moving link.
- Understand types of kinematic synthesis, Precision points, Two position motion generation by analytical synthesis
- To develop student understanding of Velocity and Acceleration Analysis of Fourbar pin jointed linkage the Fourbar slider-crank, Coriolis acceleration.

COURSE OUTCOMES:

Upon completion of this course the student will be able to:

1. Build up critical thinking and problem solving capacity of various mechanical engineering problems related to kinematics of mechanisms
2. Analyze design related problems of function, path, motion generation, dimensional synthesis, Coordinate transformation of the kinematic members.
3. Asses various concepts of two position motion, three position motion by analytical synthesis, precision point methods
4. Velocity and acceleration analysis of Four bar pin jointed linkage, Coriolis acceleration, working principles of cams

UNIT- I

KINEMATICS OF MECHANISMS: Introduction – kinematics and kinetics - Mechanisms and machines-applications of kinematics- identification of need, background research, Detailed design prototyping and testing, production.

Kinematics fundamentals: Introduction, Degrees of Freedom (DOF), types of motion, links, joints and kinematic chains, Determining Degree of Freedom in Planar Mechanisms and Spatial Mechanisms. Mechanisms and structures.

UNIT -II

GRAPHICAL LINKAGE SYNTHESIS: Introduction synthesis, Function, path, and motion generation, Dimensional synthesis, two position synthesis, three position synthesis with specified moving pivots. Quick return mechanisms, Fourbar quick return, Straight line mechanisms designing optimum straight line Fourbar linkages.

POSITION ANALYSIS: Introduction co-ordinate systems position and displacement, Co-ordinate transformation. Translation, and rotation, Graphical position Analysis of linkages,

The Four bar slider crank position solution, Position of any point on a linkage, Transmission angles, extreme values of the transmission angle.

UNIT -III

ANALYTICAL LINKAGE SYNTHESIS: Introduction, types of kinematic synthesis, Precision points, Two position motion generation by analytical synthesis, Three position motion generation by analytical synthesis, Synthesis for a specified fixed pivot location, Center point and circle point circles, Four and five position analytical synthesis, Analytical synthesis of a path generator with prescribed timing analytical synthesis of Fourbar function generator, Precision point methods, Coupler curve equation methods, Optimization methods.

UNIT -IV

VELOCITY ANALYSIS: Introduction-definition of velocity, Graphical velocity analysis, instant centers of velocity, velocity analysis with instant centers, angular velocity ratio, Mechanical Advantage, using instant centers in linkage Design, The Fourbar inverted slider crank.

ACCELERATION ANALYSIS: Introduction definition of Acceleration Graphical Acceleration analysis, Analytical solutions for acceleration analysis, and the Fourbar pin jointed linkage the Fourbar slider-crank, Coriolis acceleration. The Fourbar inverted slider crank.

CAM DESIGN: Introduction cam terminology, type of follower motion, type of follower, type of cam, type of motion constraints, SVAJ Diagrams. The fundamental law of cam design, Simple Harmonic Motion (SHM), Cycloidal displacement.

Learning Resources

Text books:

1. Kinematics and Dynamics of Machinery by RL. Norton, Tata McGraw Hill, 2009
2. Machine Design an Integrated Approach by RL. Norton, Pearson, 2004

References

1. Mechanical Engineering Design by Shigley et al., Tata McGraw Hill, 2011
2. Mechanism Design by Arthur g Erdman Prentice hall of India, 1988
3. Theory of Mechanisms& Machines by Amitabh Ghosh E.W.P. Publishers.

I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2T2 ADVANCED OPTIMIZATION TECHNIQUES Credits 4

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:
To enable the student to

- Enumerate the fundamental knowledge of Linear Programming and Dynamic Programming problems.
- Learn classical optimization techniques and numerical methods of optimization.
- Know the basics of different evolutionary algorithms.
- Explain Integer programming techniques and apply different optimization techniques to solve various models arising from engineering areas.

COURSE OUTCOMES:
Upon completion of the subject, students will be able to:

1. Explain the fundamental knowledge of Linear Programming and Dynamic Programming problems.
2. Use classical optimization techniques and numerical methods of optimization.
3. Describe the basics of different evolutionary algorithms.
4. Enumerate fundamentals of Integer programming technique and apply different techniques to solve various optimization problems arising from engineering areas.

UNIT- I
LINER PROGRAMMING (L.P):
Revised Simplex Method, Duel simplex Method, Sensitivity Analysis
DYNAMIC PROGRAMMING (D.P):
Multistage decision processes. Concepts of sub optimization, Recursive Relation-calculus method, tabular method, LP as a case of D.P.

UNIT-II
CLASSICAL OPTIMIZATION TECHNIQUES:
Single variable optimization without constraints,
Multi variable optimization without constraints, multivariable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions.
NUMERICAL METHODS FOR OPTIMIZATION:
Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method.

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UNIT-III

MODERN METHODS OF OPTIMIZATION:

GENETIC ALGORITHM (GA):

Differences and similarities between conventional and evolutionary algorithms, working principle, Genetic Operators- reproduction, crossover, mutation

GENETIC PROGRAMMING (GP):

Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, Random population generation.

Fuzzy Systems: Fuzzy set Theory, Optimization of Fuzzy systems

UNIT-IV

INTEGER PROGRAMMING:

Graphical Representation, Gomory's Cutting Plane Method, Balas' Algorithm for Zero–One Programming, Branch-and-Bound Method.

APPLICATIONS OF OPTIMIZATION IN DESIGN AND MANUFACTURING SYSTEMS:

Formulation of model- optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

Learning Resources

Text books:

1. Engineering Optimization (4^{th} Edition) by S.S.Rao, New Age International,

References:

1. Optimization for Engineering Design by Kalyanmoy Deb, PHI Publishers
2. Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers
3. Operations Research by Hillar and Liberman, TMH Publishers
4. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers

I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2T3 FINITE ELEMENT METHODS IN ENGINEERING **Credits 4**

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVE:

- To introduce the concepts of finite element method to solve engineering problems.

COURSE OUTCOMES:

Student will be able to

1. Apply variational and weighted residual methods to solve differential equations.
2. Analyze 1-D bar, Truss, beam and Frame problems using finite element method.
3. Develop finite element formulations and solve 2-D structural problems using triangular and quadrilateral elements.
4. Analyze vibration problems for frequencies and mode shapes.

UNIT-I

FORMULATION TECHNIQUES:

Methodology, engineering problems and governing differential equations, variational methods-potential energy method, Raleigh Ritz method, strong and weak forms, weighted residual methods.

FINITE ELEMENT METHOD: Concepts of discretization, types of elements, interpolation function, node numbering scheme, assembly and boundary conditions.

UNIT-II

ANALYSIS OF BARS:

Element shape functions, stiffness matrix, load vectors, determination of displacements, reaction, stresses, temperature effects.

ANALYSIS OF TRUSSES: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses, temperature effects.

ANALYSIS OF BEAMS AND FRAMES: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses.

UNIT-III

TWO DIMENSIONAL PROBLEMS: Analysis of 2-D problems using constant strain triangle element, axi-symmetric formulations.

ISOPARAMETRIC FORMULATIONS: Sub, iso and super parametric elements, four noded quadrilateral element, numerical integration – Gaussian Quadrature approach.

UNIT-IV

FINITE ELEMENTS IN STRUCTURAL DYNAMICS: Dynamic equations, eigen value problems, and their solution methods, simple problems.

CONVERGENCE: Requirements for convergence, h-refinement and p-refinement, complete and incomplete interpolation functions, Pascal's triangle.

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Learning Resources

Text Books:

1. Introduction to Finite Elements in Engineering by Tirupathi R. Chandraputla, Ashok D. Belegundu, Prentice Hall,2011
2. The Finite Element Methods in Engineering (4th Edition) by SS Rao, Pergamon.

Reference Books:

1. An introduction to Finite Element Method (3ed Edition) by JN Reddy, McGraw-Hill,.
2. Finite Element Analysis -Theory and Programming (2nd Edition) by C. S. Krishnamurthy, Tata Mc Graw Hill,
3. A first course in finite element method by Daryl L Logan, Cengage Learning.
4. Finite element procedures by K. J. Bathe, Prentice-Hall, 1996

I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2T4 **ADVANCED ROBOTICS** **Credits 4**

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- Learns the fundamentals of robotics and homogeneous transformations
- Formulate the direct and inverse kinematic equations and solve the equations for position and orientation of a joint and joint variables.
- Understands about the dynamic analysis of a robots and principles involved in trajectory planning
- Learns about the motion control system algebra and working principles of various sensors and actuators.

COURSE OUTCOMES:

After completed course, the students are expected to be able to:

1. Apply the knowledge of Mathematics and science to carry out the position and orientation analysis of robot using homogeneous transformations
2. Develop the mathematical models, analyze, solve forward and inverse kinematics equations of a robot
3. Develop the mathematical models for dynamic analysis and trajectory planning of a robot
4. Understand the principles of Block diagram algebra in motion control systems and working principles of various types of sensors and actuators.

UNIT-I

FUNDAMENTALS:

Introduction, definition of robot, classification of robots, robot components, degree of freedom, robot joints, robot coordinates, reference frames, robot characteristics, robot work space, advantages, disadvantages and applications of robots. matrix representation of a point in a space, representation of a vector in space, representation of a frame at the origin of a reference frame, representation of a frame in a reference frame, representation of a rigid body. representation of a pure translation, pure rotation about an axis, representation of combined transformations, transformations relative to the rotating frame, inverse of transformation matrices.

UNIT-II

ROBOT KINEMATICS:

Forward and inverse kinematics of robots-forward and inverse kinematic equations for position, forward and inverse kinematic equations for orientation, forward and inverse kinematic equations for position and orientation, Denavit-Hartenberg (D-H) representation of forward kinematic equations of robots, The inverse kinematic solution of robots Degeneracy and Dexterity, problems with D-H representation.

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DIFFERENTIAL MOTIONS AND VELOCITIES:
Introduction, differential relationship, Jacobian, differential motions of a frame-translations, rotation, rotating about a general axis, differential transformations of a frame. Differential changes between frames, differential motions of a robot and its hand frame, calculation of Jacobian, relation between Jacobian and the differential operator, Inverse Jacobian.

UNIT-III
DYNAMIC ANALYSIS AND FORCES:
Introduction, Lagrangian mechanics, Effective moments of inertia, dynamic equations for multi-degree of freedom robots-kinetic energy, potential energy, the Lagrangian, robot's equations of motion, static force analysis of robots.
TRAJECTORY PLANNING:
Introduction, basics of trajectory planning, joint space trajectory planning-third order polynomial trajectory planning, fifth order polynomial trajectory planning, linear segments with Parabolic blends, linear segments with parabolic blends via points Higher order trajectories

UNIT-IV
MOTION CONTROL SYSTEMS:
Basic components and terminology, Block Diagrams, Laplace Transform, Transfer function, Block diagram algebra, first and second order transfer functions, Pole/Zero Mapping, Steady state error, Root Locus Method, Proportional controls Proportional Plus Integral controllers, proportional plus derivative controllers, PID Controller
ROBOT ACTUATORS: characteristics of Actuating systems, comparison of actuating systems, hydraulic devices, pneumatic devices, Electric motors, servomotors, stepper motors, Advantages, Disadvantages & applications of Robot Actuators.
ROBOT SENSORS: Sensor characteristics, Position, Velocity and Acceleration sensors, force and pressure sensors, proximity sensors, sniff sensors, advantages, disadvantages and applications of sensors.

Learning Resources

Text Books:

1. Introduction to Robotics – Analysis, System, Applications, (2nd edition) by Saeed B. Niku, Wiley India Pvt. Ltd.

References:

1. Introduction to Robotics: Mechanics and Control, (3rd edition) by John J. Craig, , Pearson Education India
2. Robotics: Fundamental Concepts and Analysis, (1st edition) by Ashitava Ghosal, Oxford University Press.

I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2T5A **FRACUTRE MECHANICS** **Credits 4**

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- Fracture phenomena in metals and nonmetals will be discussed
- To characterize brittle and ductile fractures from the macroscopic and microscopic point of view
- Describe basic conditions for crack initiation for the brittle and ductile failure mode.
- To understand the concept of fatigue in the design of engineering structures

COURSE OUTCOMES:

On completion of the course the student should be able to:

1. Understand basic conditions for crack initiation for the brittle and ductile failure mode.
2. Predict material failure for any combination of applied stresses.
3. Distinguish the behavior of materials under Elastic/Plastic zones
4. Determine the stress intensity factor for simple components of simple geometry
5. Predict the likelihood of failure of a structure containing a defect
6. Understand the variation in the material behavior under fatigue loading

UNIT-I

INTRODUCTION:

Fracture behavior of metals and alloys, Definitions of types of fracture and failure, Introduction to stress intensity factor and strain energy release rate, Equivalence of energy approach and stress intensity approach. Brittle and Ductile Fracture, Modes of Fracture Failure, Damage Tolerance

UNIT-II

STRESS INTENSITY FACTOR AND ITS USE IN FRACTURE MECHANICS: Early concepts of stress concentrators and flaws, Ingles solution to stress round an elliptical hole-implications of results. Stress intensity factor for a crack. Westergaard's solution for crack tip stresses. Stresses and displacement in Cartesian and polar coordinates, Linear Elastic Fracture Mechanics. Different modes of crack opening.

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UNIT-III

ELASTIC/PLASTIC FRACTURE MECHANICS:

Elastic/plastic fracture mechanics: The crack opening displacement and J-integral approaches, R-curve analysis Testing procedures, Measurement of these parameters, Fail safe and safe life design approaches,

UNIT-IV

FATIGUE:

Importance of fatigue in engineering, Low cycle fatigue, Coffin-Manson law, Cyclic work hardening and softening. Micro structural models of crack initiation. Stage I, II and III crack growth. Analysis of Fatigue: The empirical laws of fatigue failure. High cycle-low strain fatigue, Basquin's law, Goodman, Soderberg and Gerber mean stress corrections, Miner's law of damage summation.

Learning Resources

Text books

1. Elements of Fracture Mechanics by Prashant Kumar, McGraw Hill Education Private Limited, New Delhi, India.
2. Mechanical Metallurgy by Dieter, McGraw Hill.

References:

1. Fracture Mechanics: Fundamental and Applications by Anderson T.L & Boca Raton, CRC Press, Florida, 1998.

I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2T5B **THEORY OF PLATES AND SHELLS** **Credits 4**

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- To impart Knowledge on the analysis of different types of plates and shells under different boundary conditions.
- To impart knowledge on the behavior of plates and shell elements, their places of utility and of course the design procedure of such elements in practical applications.
- To provide a knowledge of the fundamentals of theory of shells and folded plates

COURSE OUTCOME:

On completion of this course, students are able to

1. Understand the Simple bending of Plates and Different Boundary Conditions for plates.
2. Analyze circular plates subjected to different kinds of loads.
3. Understand the concept of Material Orthotropy, Structural Orthotropy and Plates on elastic foundation
4. Design various types of shells structures and folded pipes.

UNIT-I

Simple bending of Plates, Assumptions in thin plate theory, Different relationships, Different Boundary Conditions for plates, Plates subjected to lateral loads, Navier's method for simply supported plates, Levy's method for general plates, Example problems with different types of loading.

UNIT-II

Circular plates subjected to Axi-symmetrical loads, concentrated load, uniformly distributed load and varying load, Annular circular plate with end moments, Rayleigh-Ritz method, Application to different problems, Finite difference method, Finite element methodology for plates.

UNIT-III

Orthotropic Plates, Bending of anisotropic plates with emphasis on orthotropic plates, Material Orthotropy, Structural Orthotropy, Plates on elastic foundation.

UNIT-IV

Shells- Classification of shells - Membrane and bending theory for singly curved and doubly curved shells - Various approximations -Analysis of folded plates.

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Learning Resources

Text book:

1. Theory and Analysis of Plates by Rudolph Szilard, Prentice Hall, New Jercy 1986.
2. Theory of Plates and Shells by Timoshenko S.P and Woinowsky Krieger, McGraw Hill, 1984.
3. Design and Construction of Concrete Shell Roofs by G. S. Ramaswamy, CBS Publishers. 2005.

References:

1. Theory and Analysis of Elastic Plates and Shells by J N Reddy, CRC Press, 2007.
2. Theory of Plates by K Chandra Shekhara, University Press, Hyderabad, 2001.

I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2T5C **CONDITION MONITORING** **Credits 4**

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVE:

- Provide an overview of the fundamental principles of maintenance and condition monitoring techniques
- Acquire knowledge of data acquisition and signal processing techniques
- Explain about diagnosis of machinery faults and methods to correct faults
- Describe oil analysis and other NDT techniques

COURSE OUTCOMES:

At the end of the course student can be able to

1. Apply maintenance and condition monitoring techniques to machineries and industries
2. Implement data acquisition and signal processing techniques to all mechanical components and plants
3. Diagnose Machinery faults and apply methods to correct faults
4. Predict machinery faults and using oil analysis and other NDT techniques

UNIT-I

PREDICTIVE MAINTENANCE TECHNIQUES:

Basics, maintenance philosophies, Bath tub curve, Classification of maintenance, advantages and disadvantages of maintenance, plant machinery classifications and recommendations.

CONDITION MONITORING TECHNIQUES:

Introduction to Condition monitoring, definition, Types of condition monitoring, advantages and limitations of different condition monitoring techniques like wear derbies monitoring, oil monitoring, performance monitoring, vibration monitoring, thermography, corrosion monitoring.

UNIT-II

DATA ACQUISITION:

Introduction, collection of vibration signal, vibration transducers, characteristics and mountings, conversion of vibrations to electrical signal.

SIGNAL PROCESSING, APPLICATIONS AND REPRESENTATIONS:

The Fast Fourier Transform (FFT) analysis, Time waveform analysis, Phase signal analysis, special signal processes.

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UNIT-III

MACHINERY FAULT DIAGNOSIS USING VIBRATION ANALYSIS:

Unbalance, bent shaft, Eccentricity, Misalignment, looseness, Belt drive problems, gear defects, bearing defects, Electrical faults, Cavitation Shaft cracks, Rotor rubs, Resonance, Hydraulic and aerodynamic forces.

CORRECTING FAULTS THAT CAUSE VIBRATION:

Introduction, Balancing Alignment, Resonance vibration control with dynamic absorbers.

UNIT-IV

OIL AND PRACTICAL ANALYSIS:

Introduction, oil fundamentals, oil analysis sampling methods, lubricant properties, contaminants in lubricants, practical analysis techniques.

OTHER PREDICTIVE MAINTENANCE TECHNIQUES:

Ultrasound, Infrared thermography applications of IR thermography, ISO 2372 standards for vibrations.

Learning Resources

Text books

1. Machinery vibration Analysis & Predictive Maintenance by Paresh Girdhar, Elsevier publishers.
2. Mechanical Fault diagnosis and condition monitoring by R. A .Collacott.

References

1. Vibration monitoring and diagnosis by R. A. Collacott.
2. First course on condition monitoring in the process industries, by M.J.Neale, Nov 1979, Manchester.
3. Management of Industrial Maintenance by Newman-Butterworth, March 1978.
4. Condition Monitoring Manual by National Productivity council, New Delhi

I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2T5D **NANO TECHNOLOGY** **Credits 4**

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:
To enable the students to

- Study the material property changes that changes with size, scale and dimensions
- Demonstrate different nano particle fabrication methods
- Recognize different imaging, scanning and probing techniques.
- Illustrate different synthesis methods of metal and semiconductor Nano particles
- Acquire knowledge and applications of carbon nano tubes

COURSE OUT COMES:
Upon completion of course student be able to

1. Recognize importance of nano materials
2. Characterize nano materials by SEM, STM, AFM etc
3. Describe different nano particle fabrication methods
4. Identify different synthesis methods for semi conductor and metal nano particles
5. List the applications of carbon nano tubes

UNIT-I
INTRODUCTION:
Size and shape dependence of material properties at the nanoscale, Nanoscale elements in conventional technologies.
NANO FABRICATION:
Top-down and bottom-up nanofabrication lithography, etching, ion implantation, thin film deposition, Electron beam lithography, Soft lithography: nano imprinting and micro contact printing, Solution/plasma-phase nanofabrication, sol-gel methods, template techniques.

UNIT-II
SELF ASSEMBLY AND SELF-ORGANIZATION:
Functional coatings with self assembled monolayers of molecules and nanoparticles Langmuir-Blodgett films, layer-by-layer growth.
IMAGING/CHARACTERIZATION OF NANOSTRUCTURES:
General considerations for imaging, Scanning probe techniques: SEM, STM, AFM, NSOM.

UNIT-III
METAL AND SEMICONDUCTOR NANOPARTICLES:
Synthesis, stability, control of size, Optical and electronic properties, Ultra-sensitive imaging and detection with nano particles, bioengineering applications, Catalysis.
SEMICONDUCTOR AND METAL NANOWIRES:
Vapor/liquid/solid growth and other synthesis techniques, Nano wire transistors and sensors.

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UNIT-IV

CARBON NANOTUBES:

Structure and synthesis, Electronic, vibrational, and mechanical properties, enabling faster computers using carbon nano tubes, brighter TV screens and stronger mechanical reinforcement,

Mechanics at nanoscale Enhancement of mechanical properties with decreasing size, Nano electromechanical systems, Nano machines, Nano fluidics, filtration, sorting, Molecular motors.

Learning Resources

Text Books:

1. Nanoscale Science and Technology by Kelsall, Hamley, and Geoghegan, Wiley (2005)
2. Introduction to Nanoscale Science and Technology by Di Ventra, Evoy, and Heflin, Kluwer Academic Publishers (2004).

References:

1. Introduction to Nanotechnology by Poole and Owens, Wiley (2003).
2. Nanochemistry: A Chemical Approach to Nanomaterials by Ozin and Arsenault, RSC Publishing

I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2T6A **NON-DESTRUCTIVE TESTING** **Credits 4**

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- Familiarize with the fundamentals of non-destructive testing and Liquid Penetration testing.
- Describe Magnetic Particle Testing and Ultrasonic testing methods.
- Gain knowledge about Acoustic Emission Testing, Thermography, and Codes, Standards, Specification and Procedures used for NDT.
- Acquire knowledge to detect different flaws in composite materials

COURSE OUTCOMES:

Upon completion of this course the student will be able to:

1. Explain the fundamentals of non-destructive testing and Liquid Penetration testing.
2. Demonstrate Magnetic Particle Testing and Ultrasonic testing methods.
3. Describe Acoustic Emission Testing, Thermography, and Codes, Standards, Specification and Procedures used for NDT.
4. Enumerate the procedures to detect different flaws in composite materials

UNIT-I

INTRODUCTION:

Various methods, advantages, disadvantages and applications. Visual Examination: Basic principle, the eye- defects which can be detected by unaided, visual inspection, optical aids used for visual inspection- microscope, bore scope, endoscope, telescope, holography; applications.

LIQUID PENETRANT TESTING: Physical principles, Procedure for Penetrant testing-cleaning, penetrant application, removal of excess penetrant, application of developer, inspection and evaluation; Penetrant testing materials: penetrants, cleaners and emulsifiers, developers, special requirements, test blocks; penetrant testing methods: water washable method, post-emulsifiable method, solvent removal method; sensitivity, applications & limitations.

UNIT-II

MAGNETIC PARTICLE TESTING:

Principle of MPT, Magnetizing techniques- magnetization using a magnet, magnetization using an electro magnet, constant current flow method. Procedure used for testing a component: Equipment used for MPT-simple equipment, large portable equipment, stationary magnetizing equipment; sensitivity, limitations.

ULTRASONIC TESTING: Basic properties of sound beam- sound waves, velocity of ultrasonic waves, acoustic impedance, behaviour of ultrasonic waves. Inspection methods:

Normal incident pulse-echo inspection, normal incident through-transmission testing, angle beam pulse-echo testing, criteria for probe selection, flaw sensitivity, beam divergence, penetration and resolution.

UNIT-III

ACOUSTIC EMISSION TESTING:

Principle of AET, technique, instrumentation, sensitivity, applications.

THERMOGRAPHY: Basic principles, detectors and equipment, techniques, applications.

CODES, STANDARDS, SPECIFICATION AND PROCEDURES:

Code, standards- international and national standards, industry standards, government and military standards, industry practices, standards; specification, procedures, Indian National standards for NDT, International standards for NDT- ISO standards for quality systems.

UNIT-IV

LIQUID CRYSTALS FOR FLAW DETECTION IN COMPOSITES:

Equipment, specimen preparation procedure, results, passive tests, discussion and conclusions.

DETECTION OF DAMAGE IN COMPOSITE MATERIALS BY VIBROTHERMOGRAPHY:

Experimental technique, results and discussion.

APPLICATION OF X-RAY TOMOGRAPHY TO THE NON-DESTRUCTIVE TESTING OF HIGH PERFORMANCE POLYMER COMPOSITES:

Introduction, presentation of basic method on the medical scanner, absorption of x-rays, x-ray tomography, terminology, results achieved with the CGR – ND 8000 Scanner, conclusions.

Learning Resources

Text Books:

1. Practical Non-Destructive Testing, (2nd Edition) by Baldev Raj, T. Jayakumar, M. Thavasimuthu, Wood head Publishing Limited.
2. Non-Destructive Testing of Fibre-Reinforced Plastics Composites by J. Summer-scales, Springer.
3. Damage Detection in Composite Materials by Masters JE, ASTM STP 1128.
4. Non-destructive evaluation and flaw criticality for composite materials by R. Byron Pipes, ASTM International, 1979

I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2T6B **MECHATRONICS** **Credits 4**

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- Appraise the applications of mechatronics systems.
- Select appropriate types of sensors and actuators for the given application.
- Acquire knowledge on digital electronics, signal conditioning and controller applications.
- Familiarize with PLC Programming and system modeling and analysis.

COURSE OUTCOMES:

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

1. Understand the fundamentals of mechatronics systems in a synergistic framework
2. Select appropriate sensors and transducers to devise an instrumentation system for collecting information
3. Design a control system for effective functioning of Mechatronics systems using digital electronics, microprocessors, microcontrollers and Programmable logic controllers
4. Determine the performance of a Mechatronics system

UNIT- I

OVERVIEW OF MECHATRONICS:

History of Mechatronics, Scope and Significance of Mechatronics systems, elements of mechatronics systems, needs and benefits of mechatronics in manufacturing.

CASE STUDIES:

Design of pick and place robot, Barcode, Washing machine, Car engine management system, automated manufacturing system, Automatic camera, Automatic parking system, Safety devices and systems.

UNIT-II

SENSORS:

Classification of sensors basic working principles, Displacement Sensor -Linear and rotary potentiometers, LVDT and RVDT, incremental and absolute encoders. Strain gauges. Force/Torque –Load cells. Temperature –Thermocouple, Bimetallic Strips, Thermistor, RTD, Accelerometers, Velocity sensors –Tachometers, Proximity and Range sensors –Eddy current sensor, ultrasonic sensor, laser interferometer transducer, Hall Effect sensor, inductive proximity switch. Light sensors –Photodiodes, phototransistors, Flow sensors –Ultrasonic sensor, laser Doppler anemometer tactile sensors –PVDF tactile sensor, micro-switch and reed switch Piezoelectric sensors, vision sensor.

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ACTUATORS:
Electrical Actuators: Solenoids, relays, diodes, Thyristors, Triacs, BJT, FET, DC motor, Servo motor, BLDC Motor, AC Motor, stepper motors. Hydraulic & Pneumatic devices – Power supplies, valves, cylinder sequencing. Design of Hydraulic & Pneumatic circuits. Piezoelectric actuators, Shape memory alloys.

UNIT-III
DIGITAL ELECTRONICS:
Number systems, BCD codes and arithmetic, Gray codes, self-complimenting codes, Error detection and correction principles. Boolean functions using Karnaugh map, Design of combinational circuits, Design of arithmetic circuits. Design of Code converters, Encoders and decoders.
SIGNAL CONDITIONING:
Operational amplifiers, inverting amplifier, differential amplifier, Protection, comparator, filters, Multiplexer, Pulse width Modulation Counters, decoders. Data acquisition – Quantizing theory, Analog to digital conversion, digital to analog conversion.
CONTROLLERS:
Classification of control systems, Feedback, closed loop and open loop systems, Continuous and discrete processes, control modes, Two step Proportional, Derivative, Integral, PID controllers.

UNIT-IV
PLC PROGRAMMING:
PLC Principles of operation PLC sizes PLC hardware components I/O section Analog I/O section Analog I/O modules, digital I/O modules CPU Processor memory module Programming. Ladder Programming, ladder diagrams, timers, internal relays and counters, data handling, analogue input and output. Application on real time industrial automation systems
BASIC SYSTEM MODELS & ANALYSIS:
Modelling of one and two degrees of freedom Mechanical, Electrical, Fluid and thermal systems, Block diagram representations for these systems. Dynamic Responses of System: Transfer function, Modelling Dynamic systems, first order systems, second order systems.

Learning Resources:

Text books
1. Mechatronics, (5^{th} edition) by W. Bolton, Addison, Wesley Longman Ltd, 2010
2. Introduction to Mechatronics and Measurement systems (4^{th}edition) by Alciatore David G & Histand Michael B, Tata McGraw Hill, 2006

References.
1. Introduction to Robotics Analysis, Systems (2^{nd} edition), Applications by Saeed B Niku, Pearson Education India, PHI, 2003.
2. Mechatronics System Design (3^{rd}edition) by Devdas Shetty& Richard Kolk, PWS Publishing, 2009.

VIDEO REFERENCES:
1.http://video_demos.colostate.edu/mechatronics
2.http:// mechatronics.me.wisc.edu

I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2T6C **CONCURRENT ENGINEERING** **Credits 4**

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- Acquire knowledge about entire product life cycle, from design to disposal, in an integrated design process.
- To introduce Concurrent Engineering Principles applied to manufacturing Sectors.
- State various techniques and concepts of achieving manufacturing excellence through Concurrent Engineering.
- Acquire knowledge regarding manufacturing competitiveness, life cycle management, product process, and organization.

COURSE OUTCOMES:

After completion of the course, student should be able to

1. Understand the need for adopting CE methodology to organizations.
2. Understand the importance of such factors as the right corporate culture, multi-disciplinary teams and their empowerment for successful implementation of CE
3. Undertake an evaluation of the company's present communication infrastructure and recommend suitable changes to support the CE environment
4. Become familiar with a range of computer based tools for modeling engineering processes and information
5. Understand various factors and techniques required to optimize the product development process

UNIT-I

INTEGRATED PRODUCT DEVELOPMENT:

Idealized model for Integrated Product Development, Integration between project and management, Integration with other development activities, understanding the IPD model, Validity of the IPD model. Introduction: Extensive definition of CE-CE design Methodologies - Organizing for CE, CE tool box collaborative product development.

UNIT-II

DESIGN STAGE:

Life-cycle design of products - opportunity for manufacturing enterprises -modality of Concurrent Engineering Design, Automated analysis idealization control - Concurrent engineering in optimal structural design - Real time constraints checking the design process

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UNIT–III

CONCEPTUAL DESIGN MECHANISM:

Qualitative physical approach, an intelligent design for manufacturing system Modeling and reasoning for computer based assembly planning.

UNIT-IV

DESIGN FOR ECONOMICS:

Evaluation of design for manufacturing cost, Concurrent mechanical design - decomposition in concurrent design -negotiation in concurrent engineering design studies

Learning Resources

Textbooks:

1. Integrated Product Development by Anderson MM and Hein, L. Berlin, Springer Verlog, 1987

2. Design for Concurrent Engineering by Cleetus, J, Concurrent Engg. Research Centre, Morgantown, WV, 1992

References:

1. Concurrent Engineering: Automation Tools and Technology by Andrew Kusaik, John Wiley and Sons Inc., 1992

2. Concurrent Engineering Fundamentals: Integrated Product Development by Prasad, Prentice Hall, 1996

3. Successful Implementation of Concurrent Product and Process by Sammy G Sinha, John Wiley and Sons Inc, 1999

I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2T6D **PRODUCT DESIGN** **Credits 4**

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- To impart the process of product design;
- To expose the various factors influencing product design.

COURSE OUTCOMES:

After completion of the course, student should be able to

1. Apply various tools of problem solving to arrive at a fruitful design
2. Analyze the factors influencing the design.
3. Determine the risk and reliability aspects associated with product design.
4. Select appropriate manufacturing processes to realize the product design
5. Evaluate various modes of product testing.

UNIT-I

PRODUCT DESIGN PROCESS:

Design process steps, problem-solving process, creative problem solving, invention, brainstorming, morphological analysis, behavioral aspects of decision making, decision theory.

MODELING AND SIMULATION:

Triz, role of models in engineering design, mathematical modeling, similitude and scale models, geometric modeling on computer, finite-element analysis.

UNIT-II

MATERIAL SELECTION:

Material selection for new product design, role of processing in design, design for manufacture, design for assembly.

DESIGN FOR ENVIRONMENT:

Need of Design for Environment, techniques to reduce environment impact.

UNIT-III

RISK AND RELIABILITY:

Risk and society, Hazard analysis, fault tree analysis. failure analysis and quality: causes of failures, failure modes, failure mode and effect analysis, FMEA procedure, Product liability, Intellectual property.

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UNIT- IV

PRODUCT TESTING:

Thermal, vibration, electrical, and combined environments, temperature testing, vibration testing, test effectiveness, accelerated testing and data analysis, accelerated factors, Weibull probability plotting, testing with censored data.

Learning Resources

Text Books:

1 Engineering Design by George E. Dieter, Mc Graw-Hill.
2. Product Design by Kevin Otto, Pearson Education, 2014.

Reference Books:

1. The Product Management Handbook by Richard S. Handscombe, Mc Graw-Hill.
2. New Product Design and development by Ulrich Eppinger, TMH.
3. Engineering Design Principles by Ken Hurst, Elseviewer.
4. Product Integrity and Reliability in Design by John W. Evans and Jillian Y. Evans, Springer

I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2L1 **ANALYSIS LAB** **Credits 2**

Lecture: 3 periods/week **Internal assessment: 25 marks**

Tutorial: - - **Semester end examination: 50 marks**

COURSE OBJECTIVES:

- To provide the fundamental concepts of the theory of the finite element method
- To understand the use of the basic finite elements for structural applications using truss, beam, frame, and plane elements
- To understand the application and use of the FE method for heat transfer problems
- To develop proficiency in the application of the finite element method (modeling, analysis, and interpretation of results) to realistic engineering problems

COURSE OUTCOMES:

After completion of the course, student should be able to

1. Demonstrate the ability to create models for trusses, frames, plate structures, machine parts, and components using ANSYS general-purpose software
2. Use the ANSYS package to solve basic engineering analysis problems using FEA techniques
3. Model heat transfer, fracture, vibrational problems using ANSYS
4. Demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation purposes
5. Develop a basic understanding of the limitations of the FE method and understand the possible error sources in its use

Any 12 tasks on the following:

1. Analysis of a Truss Structure with multipoint constrains
2. Analysis of a Slit Ring
3. Analysis of a Plate with a Circular Hole
4. Analysis of a bi-material cylindrical pressure vessel under internal pressure (Plane strain approach)
5. Analysis of an Axisymmetric Shell with Internal Pressure
6. Analysis of a Layered Composite Plate
7. Linear Buckling Analysis
8. Thermo-Mechanical Analysis

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9. Fracture analysis of plate with center crack
10. Vibration of an Automobile Suspension
11. Harmonic Analysis of a Guitar String
12. Impact Loading on a Beam
13. Dynamic Analysis of a 4-bar Linkage
14. Transient Thermo-Mechanical Analysis of a Welded Joint
15. Large Deformation Analysis of a Plate
16. Plastic Deformation of an Aluminum Sphere
17. Contact Analysis of a Block Dropping on a Beam
18. Simulation of a Nano-Indentation Test

REFERENCES:

User manuals of ANSYS package

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I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2L2 MINI PROJECT/ TERM PAPER Credits 2

Lecture: 3 periods/week **Internal assessment: 25 marks**

Tutorial: - - **Semester end examination: 50 marks**

COURSE OBJECTIVES:

- The student is introduced to the concept of validating a simple idea through model
- preparation / Software package or solving a simple Industrial/ Theoretical problem.
- To develop problem solving, analysis, synthesis and evaluation skills.
- To encourage teamwork and improve student's presentation and communication skills.

COURSE OUTCOMES:

After completion of the course, student should be able to

1. Formulate a real world problem and identify its requirements
2. Express technical ideas, strategies and methodologies in oral and document form.
3. Self learn new software tools, methodologies and/or experimental techniques that contribute to the solution of the project.

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II YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD3TR PEDAGOGY TRAINING /INDUSTRIAL TRAINING Credits 2

Lecture: - - **Internal assessment: 75 marks**
Tutorial: - - **Semester end examination: --**

COURSE OBJECTIVES:

PEDAGOGY

- To developing intercultural communication competence.
- Able to design syllabus and plan lessons that align objectives, methods, and assessments

INDUSTRIAL TRAINING

- To expose the students to actual working environment and enhance their Knowledge and skill.
- To instill the good qualities of integrity, responsibility and self Confidence.

COURSE OUTCOMES:

After completion of the course, student should be able to

PEDAGOGY

1. Prepare lesson plans effectively
2. Understand different teaching methods
3. Deliver lectures

INDUSTRIAL TRAINING

1. Understand the real working environment
2. Apply technical knowledge to realistic situations
3. Express technical ideas, strategies and methodologies in oral and document form

PEDAGOGY TRAINING

First Week
Preparation of lesson plan
Second Week
Study of different teaching methods
Third Week
Demo Classes to be given for UG students
Fourth Week
Evaluation of teaching performance

INDUSTRIAL TRAINING

First Week
Identification of Industry for training
Second Week
Observation of the working strategies in the industries
Third Week
Identifying and demonstration of the effective methods to the existed methods
Fourth Week
Preparation of documentation

II YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD3DSA **DISSERTATION-PART-A** **Credits 6**

Lecture: - - **Internal assessment: 50 marks**

Tutorial: - - **Semester end examination: - -**

COURSE OBJECTIVES:

- Identification of an industrial / a theoretical problem of smaller scale in his/her field of interest, survey of existing literature and exposure to problem solving methodology.

COURSE OUTCOMES:

After completion of the course, student should be able to

1. Exposure to research and development procedures, latest developments in the selected research area.
2. Demonstrate technical ideas, strategies and methodologies to peer team

Week 1-10 (II Year- First Semester)

- Literature Survey, Defining Problem & Proposed methodology along with Status Report-1

Week 11-20 (II Year- First Semester)

- Analysis & Design along with Status Report-2

PVP17

II YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD4DSB **DISSERTATION -PART-B** **Credits 10**

Lecture: - - **Internal assessment: 50 marks**

Tutorial: - - **Semester end examination: 100 marks**

COURSE OBJECTIVES:

- Development of Prototype or experimental setup or development of Simulation techniques to solve the problem undertaken

COURSE OUTCOMES:

After completion of the project, student should be able to

1. Get the solution to industrial / theoretical problems
2. Publish research findings in National or International conference/ Journals.
3. Express technical ideas, strategies and methodologies in oral and document form

Week 21-30 (II Year-Second Semester)

- Development of methodology for considered problem with validation along with Status Report-3

Week 31-40 (II Year-Second Semester)

- Testing & Paper Publishing along with Status Report-4

OUR OTHER INSTITUTIONS :

1. Parvathaneni Brahmayya Siddhartha College of Arts & Science
2. Parvathaneni Brahmayya Siddhartha Junior College of Arts & Science
3. Veeramachaneni Paddayya Siddhartha Public School
4. Velagapudi Ramakrishna Siddhartha Engineering College
5. Sri Durga Malleswara Siddhartha Mahila Kalasala
6. Sri Durga Malleswara Siddhartha Junior Mahila Kalasala
7. Y.V. Rao Siddhartha College of Education
8. Sri Velagapudi Durgamba Siddhartha Law College
9. K.C.P. Siddhartha Adarsh Residential Public School
10. K. V. Sadasiva Rao Siddhartha College of Pharmaceutical Sciences
11. A.G. & S.G. Siddhartha Arts & Science College
12. A.G. & S.G. Siddhartha Arts & Science Junior College
13. Siddhartha Institute of Hotel Management & Catering Technology
14. Dr. Pinnamaneni Siddhartha Institute of Medical Sciences & Research Foundation
15. Siddhartha School of Nursing
16. Drs. Sudha & Nageswara Rao Siddhartha Institute of Dental Sciences
17. Dr. C. Sobhanadri Siddhartha College of Nursing