M.Tech - R25 – Academic Regulations

(Effective for the students admitted into I year from the Academic Year 2025-26 and onwards)

Sreenivasa Institute of Technology and Management Studies, Chittoor (SITAMS) offers **Two Years (Four Semesters)** full-time Master of Technology (M.Tech.) Degree programme, under Choice Based Credit System (CBCS) in different branches of Engineering and Technology with different specializations.

The institute shall confer M. Tech. degree on candidates who are admitted to the programme and fulfill all the requirements for the award of the degree.

1. **Award of the M.Tech. Degree**
   A student will be declared eligible for the award of the M.Tech. degree if he/she fulfils the following:
   - 1.1 Pursues a course of study for not less than two academic years and not more than four academic years.
   - 1.2 Registers for 75 credits and secures all 75 credits.

2. Students, who fail to fulfil all the academic requirements for the award of the degree within four academic years from the year of their admission, shall forfeit their seat in M.Tech. course and their admission stands cancelled.

3. **Programme of Study:**
   The following M.Tech. Specializations are offered at present in different branches of Engineering and Technology:

S.No.	Discipline	Name of the Specialization	Code
1	Electrical and Electronics Engineering	Power Electronics	43
2	Mechanical Engineering	Product Design	80
3	Electronics and Communication Engineering	VLSI System Design	57
4	Computer Science and Engineering	Computer Science & Engineering	58

4. Eligibility for Admissions:

4.1 Admission to the M. Tech Program shall be made subject to the eligibility, qualification and specialization prescribed by the A.P. State Government/University from time to time.

4.2 Admissions shall be made either on the basis of either the merit rank or Percentile obtained by the qualified student in the relevant qualifying GATE Examination/ the merit rank obtained by the qualified student in an entrance test conducted by A.P. State Government (APPGECET) for M.Tech. programmes an entrance test conducted by University/on the basis of any other exams approved by the University, subject to reservations as laid down by the Govt. from time to time.

4.3 As per the norms of Government of Andhra Pradesh, B-Category seats will be filled by the management.

5. Programme related terms:

5.1 Credit: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (Lecture/Tutorial) or two hours of practical work/field work per week.

Credit definition:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit

5.2 Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year.

5.3 Choice Based Credit System (CBCS): The CBCS provides choice for students to select from the prescribed courses.

6. Programme Pattern:

6.1 Total duration of the of M.Tech. programme is two academic years

6.2 Each academic year of study is divided into two semesters.

6.3 Each Semester shall be of 22 weeks duration (inclusive of Examinations), with a minimum of 90 instructional days per semester.

6.4 The student shall not take more than four academic years to fulfill all the academic requirements for the award of M.Tech. degree from the date of commencement of first year first semester, failing which the student shall forfeit the seat in M.Tech. programme.

6.5 The medium of instruction of the programme (including examinations and project reports) will be in English only.

6.6 All subjects/courses offered for the M.Tech. degree programme are broadly classified as follows:

6.7 The department shall take measures to implement Virtual Labs (https://www.vlab.co.in) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.

S.No.	Broad Course Classification	Course Category	Description
1.	Core Courses	Foundational & Professional Core Courses (PC)	Includes subjects related to the parent discipline / department / branch of Engineering
2.	Elective Courses	Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline/department/ branch of Engineering
		Open Elective Courses (OE)	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline which are of importance in the context of special skill development
3.	Mandatory Course	Quantum Technology and Application	To understand importance of latest technologies, research and process of creation of patents through research
		Research methodology & IPR	
4.	Skill Enhancement and Project Based Courses	Skill Enhancement courses (SE)	Interdisciplinary / job-oriented/domain courses which are relevant to the industry
		Comprehensive Viva	To test the overall domain knowledge
		Short Term Industry Internship	To provide real time exposure
		Dissertation	To provide application of domain knowledge to solve real problems
5.	Audit Courses	Mandatory noncredit courses	Covering subjects of developing desired attitude among the learners.

6.8 A faculty advisor/mentor shall be assigned to each specialization to advise students on the programme, its Course Structure and Curriculum, Choice of Courses, based on his competence, progress, pre-requisites and interest.

6.9 Preferably 25% course work for the theory courses in every semester shall be conducted in the blended mode of learning.

7. Attendance Requirements:

7.1 A student shall be eligible to appear for the semester end examinations if he/she acquires i) a minimum of 50% attendance in each course and ii) 75% of attendance in aggregate of all the courses.

7.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

7.3 Condonation of shortage of attendance shall be granted only on genuine and valid reasons on representation by the candidate with supporting evidence

7.4 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class.

7.5 A stipulated fee shall be payable towards condonation of shortage of attendance.

7.6 A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek re-admission into that semester when offered next.

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

7.8 If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

8. Evaluation – Distribution and Weightage of Marks:

The performance of a student in each semester shall be evaluated subject - wise (irrespective of credits assigned), for a maximum of 100 marks for theory and 100 marks for practical, based on Internal Evaluation and End Semester Examination.

8.1 There shall be five units in each of the theory subjects. For the theory subjects 60 marks will be for the End Examination and 40 marks will be for Internal Evaluation.

8.2 Two Internal Examinations shall be conducted for 30 marks each, one in the middle of the Semester and the other immediately after the completion of instruction period. The other 10 marks is awarded for continuous assessment in the form of assignments, quizzes, open book examination, presentation, etc. First mid examination shall be conducted for I & II units of the syllabus and second mid examination for III, IV & V units. Each mid exam shall be conducted for a total duration of 120 minutes with 3 questions (without choice) and each question carries 10 marks. Final Internal marks for a total of 40 marks shall be arrived at by considering the marks secured by the student in both the internal examinations with 80% weightage to the better internal exam and 20% to the other.

8.3 The following pattern shall be followed in the End Examination:

i. Five questions shall be set from each of the five units with either/or type for 12 marks each.
ii. All the questions have to be answered compulsorily.
iii. Each question may consist of one, two or more bits.

8.4 For practical subjects, 60 marks shall be for the End Semester Examinations and 40 marks will be for internal evaluation based on the day-to-day performance.

i. The internal evaluation based on the day-to-day work-10 marks, record- 10 marks and the remaining 20 marks to be awarded by conducting an internal laboratory examination.
ii. The end examination shall be conducted by the examiners, with a breakup mark of Procedure-10, Experimentation-25, Results-10, Viva- voce-15.

8.5 There shall be Mandatory Audit courses in I & II semesters for zero credits. There is no external examination for audit courses. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 50% or more in the internal examinations. In case, the student fails, a re- examination shall be conducted for failed candidates for 40 marks for every six months/semester satisfying the conditions mentioned in item 1 & 2 of the regulations.

8.6 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

8.7 In case the candidate does not secure the minimum academic requirement in any of the subjects he/she has to reappear for the Semester Examination either supplementary or regular in that subject or repeat the course when next offered or do any other specified subject as may be required.

8.8 The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.

9. Credit Transfer Policy

As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the Institute shall allow up to a maximum of 40% of the Professional and Open Electives in a semester through SWAYAM/SWAYAM Plus.

9.1 The Institute shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses through SWAYAM platform.

9.2 The online learning courses available on the SWAYAM platform will be considered for credit transfer. SWAYAM course credits are as specified in the platform

9.3 Student registration for the MOOCs shall be only through the institution, it is mandatory for the student to share necessary information with the institution

9.4 The institution shall select the courses to be permitted for credit transfer through SWAYAM. However, while selecting courses in the online platform institution would essentially avoid the courses offered through the curriculum in the offline mode.

9.5 The institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer in the forthcoming Semester.

9.6 Students may register for an 8-week (2 credits) or 12-week (3 credits) SWAYAM / SWAYAM plus course with the approval of the Head of the Department (HoD).

9.7 Examination fees, if applicable, shall be borne by the student. Pass marks and grading will be as per the academic regulations.

9.8 A student must get minimum 40% marks for assignments and quizzes on the SWAYAM/ SWAYAM plus platform to be eligible for the end-semester examination. The students who are unable to get minimum internal marks in SWAYAM/ SWAYAM plus platform, they have to re-register for the course in subsequent semester through SWAYAM/ SWAYAM plus platform.

9.9 The end-semester exam may be conducted by the National Testing Agency (NTA), the National Programme on Technology Enhanced Learning (NPTEL) or the Institute during the regular end-term exams. Evaluation shall comprise 60% weightage for the end-semester examination and 40% for assignments and quizzes conducted by the SWAYAM/ SWAYAM plus course coordinator. The student has to get 50% marks for internal and external with minimum of 40% marks in the external examination to declare them as pass.

9.10 The institution shall also ensure that the student has to complete the course and produce the course completion certificate as per the academic schedule given for the regular courses in that semester. However, the credits will be transferred to the students who got minimum 50% marks with 40% marks in the external examination

9.11 The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.

9.12 The Institute shall ensure no overlap of SWAYAM MOOC exams with that of the semester end examination schedule. In case of delay in SWAYAM results, the university will re-issue the marks sheet for such students.

9.13 Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the minimum 50% of marks and grades.

9.14 The department shall submit the following to the examination section of the institute:

i. List of students who have passed MOOC courses in the current semester along with the certificates of completion.
ii. Undertaking form filled by the students for credit transfer.

9.15 The Institute shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

10. Re-registration for Improvement of Internal Evaluation Marks:

A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and has failed in the end examination

10.1 The candidate should have completed the course work and obtained examinations results for I, II and III semesters.

10.2 The candidate should have passed all the subjects for which the Internal Evaluation marks secured are more than 50%.

10.3 Out of the subjects the candidate has failed in the examination due to Internal Evaluation marks secured being less than 50%, the candidate shall be given one chance for each Theory subject and for a maximum of three Theory subjects for Improvement of Internal evaluation marks.

10.4 The candidate has to re-register for the chosen subjects and fulfill the academic requirements.

10.5 For reregistration the candidates have to apply to the Exam Section through the department by paying the requisite fees and get approval from the Institute before the start of the semester in which re-registration is required

10.6 In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for the reregistered subjects stand cancelled.

11. Evaluation of Project/Dissertation Work:

The Project work shall be initiated at the beginning of the III Semester and the duration of the Project is of two semesters. Evaluation of Project work is for 300 marks with 200 marks for internal evaluation and 100 marks for external evaluation. Progress of the project work is monitored through three reviews:

i. Project review – I at the beginning of the III semester for zero marks
ii. Project review – II at the end of the third semester for 100 marks
iii. Project review – III before submission of the thesis i.e., end of the IV semesters for 100 marks

External evaluation of final Project work viva voce in IV semester shall be for 100 marks.

A Project Review Committee (PRC) shall be constituted with the Head of the Department as Chairperson, Project Supervisor and one faculty member of the department offering the M.Tech. programme.

11.1 A candidate is permitted to register for the Project Work in III Semester after satisfying the attendance requirement in all the subjects, both theory and laboratory (in I & II semesters).

11.2 A candidate is permitted to submit Project dissertation with the approval of PRC. The candidate has to pass all the theory, practical and other courses before submission of the Thesis.

11.3 Project work shall be carried out under the supervision of teacher in the parent department concerned.

11.4 A candidate shall be permitted to work on the project in an industry/research organization on the recommendation of the Head of the Department. In such cases, one of the teachers from the department concerned would be the internal guide and an expert from the industry/ research organization concerned shall act as co-supervisor/ external guide. It is mandatory for the candidate to make full disclosure of all data/results on which they wish to base their dissertation. They cannot claim confidentiality simply because it would come into conflict with the Industry"s or R&D laboratory"s own interests. A certificate from the external supervisor is to be included in the dissertation.

11.5 Continuous assessment of Project Work - I and Project Work – II in III & IV semesters respectively will be monitored by the PRC.

11.6 The candidate shall submit status report by giving seminars in three different phases (two in III semester and one in IV semester) during the project work period. These seminar reports must be approved by the PRC before submission of the Project Thesis.

11.7 After registration, a candidate must present in Project Review - I, in consultation with his Project Supervisor, the title, objective and plan of action of his Project work to the PRC for approval within four weeks from the commencement of III Semester. Only after obtaining the approval of the PRC can the student initiate the project work.

11.8 The Project Review - II in III semester carries internal marks of 100. Evaluation should be done by the PRC for 50 marks and the Supervisor will evaluate the work for the other 50 marks. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain and progress of the Project Work.

11.9 A candidate has to secure a minimum of 50% of marks to be declared successful in Project Review - II. Only after successful completion of Project Review – II, candidate shall be permitted for Project Work Review – III in IV Semester. The unsuccessful students in Project Review - II shall reappear after three months.

11.10 The Project Review - III in IV semester carries 100 internal marks. Evaluation should be done by the PRC for 50 marks and the Supervisor will evaluate it for the other 50 marks. The PRC will examine the overall progress of the Project Work and decide whether or not eligible for final submission. A candidate has to secure a minimum of 50% of marks to be declared successful in Project Review - III. If student fails to obtain the required minimum marks, he/she has to reappear for Project Review - III after a month.

11.11 For the approval of PRC the candidate shall submit the draft copy of dissertation to the Head of the Department and make an oral presentation before the PRC.

11.12 After approval from the PRC, the student is permitted to submit a report. The dissertation report will be accepted only when the plagiarism is within 30% checked through Turnitin software (repository mode). The plagiarism report shall be submitted along with the dissertation report.

11.13 Research paper related to the Project Work shall be published in an SCI/ESCI/Scopus/UGC Care listed journal, or in conference proceedings with ISBN number organized by professional societies such as IEEE, IEI, etc.

11.14 After successful plagiarism check and publication of research paper, three copies of the dissertation certified by the supervisor and HOD shall be submitted to the College.

11.15 The dissertation shall be adjudicated by an external examiner selected by the Chief Superintendent. For this, the Head of the Department shall submit a panel of three examiners for each student. However, the dissertation will be adjudicated by one examiner nominated by the Chief Superintendent.

11.16 If the report of the examiner is not satisfactory, the candidate shall revise and resubmit the dissertation, in the time frame as decided by the PRC. If report of the examiner is unfavorable again, the thesis shall be summarily rejected. The candidate has to reregister for the project and complete the project within the stipulated time after taking the approval from the Chief Superintendent.

11.17 If the report of the examiner is satisfactory, the Head of the Department shall coordinate and make arrangements for the conduct of Project Viva voce exam.

11.18 The Project Viva voce examinations shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who has adjudicated the dissertation. For Dissertation Evaluation (Viva voce) in IV Sem. there are external marks of 100 and it is evaluated by external examiner. The candidate has to secure a minimum of 50% marks in Viva voce exam.

11.19 If he fails to fulfill the requirements as specified, he will reappear for the Project Viva voce examination only after three months. In the reappeared examination also, if he fails to fulfill the requirements, he will not be eligible for the award of the degree.

12. Industry Internships:

12.1 Industry internship either onsite or virtual with a minimum of 06-08 weeks“ duration, done at the end of Ist year second semester. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Power projects, software MNCs or any industries in the areas of concerned specialization of the PG program.

12.2 The student shall register for the internship as per course structure after commencement of academic year.

12.3 Evaluation of the summer internships shall be through the departmental committee.

12.4 A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, Mentor/Supervisor of the internship and a

12.5 Senior faculty member of the department. A certificate of successful completion from industry shall be included in the report. Internship will be evaluated for 100 marks with 50 marks for the report evaluated by the mentor and 50 marks for oral presentation.

12.6 A student should secure minimum 50% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the Institute.

13. Comprehensive Viva

13.1 A Comprehensive Viva shall be conducted after the II Semester examinations for 100 marks by a committee consisting of the Head of the Department, one senior faculty member of the same specialization, and an external subject expert appointed by the Chief Superintendent.

13.2 The student must secure a minimum of 50% marks to be declared as passed

14. Credits for Co-curricular Activities

14.1 A Student should earn 01 credit under the head of co-curricular activities, viz., attending Conference, Scientific Presentations and Other Scholarly Activities.

14.2 Following are the guidelines for awarding Credits for Co-curricular Activities

Name of the Activity	Maximum Credits / Activity
Participation in National Level Seminar / Conference / Workshop / Training programs (related to the specialization of the student)	0.5
Participation in International Level Seminar / Conference / workshop / Training programs held outside India (related to the specialization of the student)	1
Academic Award / Research Award from State Level / National Agencies	0.5
Academic Award/Research Award from International Agencies	1
Research / Review Publication in National Journals (Indexed in Scopus / Web of Science)	0.5
Research / Review Publication in International Journals with Editorial board outside India (Indexed in Scopus / Web of Science)	1

14.3 Note:

i. Credit shall be awarded only for the first author. Certificate of attendance and participation in a Conference/Seminar is to be submitted for awarding credit. A
ii. Minimum participation of five days is required to earn the necessary credits. Alternatively, the student may attend five different one day programs to meet this requirement.
iii. Certificate of attendance and participation in workshops and training programs (Internal or External) is to be submitted for awarding credit. The total duration should be at least one week.
iv. Participation in any activity shall be permitted only once for acquiring required credits under co-curricular activities

15. Grading:

15.1 As a measure of the student"s performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed:

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

15.3 Structure of Grading of Academic Performance

Range in which the marks in the subject fail	**Grade**	**Grade points Assigned**
≥ 90	S (Superior)	10
≥ 80 < 90	A (Excellent)	9
≥ 70 < 80	B (Very Good)	8
≥ 60 < 70	C (Good)	7
≥ 50 < 60	D (Pass)	6
< 50	F (Fail)	0
Absent	Ab (Absent)	0

15.4 A student obtaining Grade „F" or Grade „Ab" in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

15.5 For noncredit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

15.6 Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

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

v. SGPA = Σ (Ci × Gi)/Σ Ci

vi. where, Ci is the number of credits of the ith subject and Gi is the grade point scored by the student in the ith course.

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

CGPA = Σ (Ci × Si)/ Σ Ci

where "Si" is the SGPA of the ith semester and Ci is the total number of credits up to that semester.

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

ix. While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

15.7 Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters S, A, B, C, D and F.

16. Award of Class:

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

Class Awarded	CGPA to be secured
First Class with Distinction	≥7.5%
First Class	< 7,5≥ 6.5
Pass Class	< 6.5

17. Exit Policy:

17.1 The student shall be permitted to exit with a PG Diploma based on his/her request to the Institute at the end of first year subject to passing all the courses in first year.

17.2 The Institute shall resolve any issues that may arise in the implementation of this policy from time to time and shall review the policy in the light of periodic changes brought by UGC, AICTE and State government.

18. Withholding of Results:

18.1 If the candidate has any case of in-discipline pending against him/her, the result of the candidate shall be withheld, and he/she will not be allowed / promoted into the next higher semester. The issue of degree is liable to be withheld in such cases.

19. Transitory Regulations

19.1 Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfillment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

20. General:

20.1 The academic regulations should be read as a whole for purpose of any interpretation.

20.2 Disciplinary action for Malpractice/improper conduct in examinations is appended.

20.3 Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

20.4 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

20.5 The Institute may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the Institute.

****

RULES FOR

DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
	If the candidate:	
1.(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four 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. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for four consecutive semesters from class work and all University examinations if his involvement is established. Otherwise, the candidate is debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles in the 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 project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject only.
6.	Refuses to obey the orders of the Chief Superintendent /Assistant - Superintendent /any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. If the candidate physically assaults the invigilator/ officer-in-charge of the Examinations, then the candidate is also debarred and forfeits his/her seat. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person

		(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject only or in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester / year examinations, depending on the recommendation of the committee.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

Note:

Whenever the performance of a student is cancelled in any subject/subjects due to Malpractice, he has to register for End Examinations in that subject/subjects consequently and has to fulfil all the norms required for the award of Degree.

****

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES
(Autonomous)

DEPARTMENT OF MECHANICAL ENGINEERING

PG Specialization: PRODUCT DESIGN

JNTUA - M.Tech R25 - COURSE STRUCTURE AND SYLLABI

Semester I (First Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	25MTESC11T	**Research Methodology and IPR**	2	0	0	2	40	60	100
2	25MTPDD11T	Creativity in Product Design	3	0	0	3	40	60	100
3	25MTPDD12T	Computer Applications in Product Design	3	0	0	3	40	60	100
4	25MTPDD13	**Professional Elective – I**	3	0	0	3	40	60	100
5	25MTPDD14	**Professional Elective – II**	3	0	0	3	40	60	100
6	25MTPDD15T	Artificial Intelligence and Machine Learning (Skill Enhancement Course)	2	0	0	2	40	60	100
7	25MTPDD16L	Product Design and Modeling Lab	0	0	4	2	40	60	100
8	25MTPDD17L	Simulation and Analysis Laboratory	0	0	4	2	40	60	100
9	25MTMAC11	**Audit Course – I**	2	0	0	0	-	-	P
Total credits						20	-	-	-
Total Marks							320	480	800

Semester II (First Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	25MTESC21T	**Quantum Technologies And Applications**	2	0	0	2	40	60	100
2	25MTPDD21T	Integrated Product Design and Development	3	0	0	3	40	60	100
3	25MTPDD22T	Additive Manufacturing Processes	3	0	0	3	40	60	100
4	25MTPDD23	**Professional Elective – III**	3	0	0	3	40	60	100
5	25MTPDD24	**Professional Elective – IV**	3	0	0	3	40	60	100
6	25MTPDD25P	**Comprehensive Viva-Voce**	0	0	0	2	40	60	100
7	25MTPDD26L	Product Design and Development Lab	0	0	4	2	40	60	100
8	25MTPDD27L	Product Testing and Multibody Body Dynamics Lab	0	0	4	2	40	60	100
9	25MTMAC21	**Audit Course – II**	0	0	0	0	-	-	P
Total credits						20	-	-	-
Total Marks							320	480	800

Semester III (Second Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	OE-MOOC	**Open Elective – I**	3	0	0	3	40	60	100
2	25MTPDD31	**Professional Core Theory - V**	3	0	0	3	40	60	100
3	25MTPDD32P	Dissertation Phase – I	-	-	-	10	40	60	100
4	25MTPDD33P	Industry Internship	-	-	-	2	40	60	100
5	25MTPDD34L	Co-curricular Activities	-	-	-	1	-	-	100
Total credits						19	-	-	-
Total Marks							160	240	500

Semester IV (Second Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	25MTPDD41P	Dissertation Phase – II	-	-	-	3	40	60	100
Total credits						16	-	-	-
Total Marks							40	60	100

Audit Course – I - Semester I (First Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	25MTMAC11A	Disaster Management	2	-	-	-	40	-	-
2	25MTMAC11B	English for Research Paper Writing	2	-	-	-	40	-	-
3	25MTMAC11C	Essence of Indian Traditional Knowledge	2	-	-	-	40	-	-

Professional Elective – I - Semester I (First Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	25MTPDD13A	Material Selection for Product Development	3	-	-	3	40	60	100
2	25MTPDD13B	Design for Manufacture, Assembly and Environments	3	-	-	3	40	60	100
3	25MTPDD13C	Optimization Techniques in Design	3	-	-	3	40	60	100

Professional Elective – II - Semester I (First Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	25MTPDD14A	Quality Concepts in Product Design	3	-	-	3	40	60	100
2	25MTPDD14B	Advance Finite Element Methods	3	-	-	3	40	60	100
3	25MTPDD14C	Mechanics of Composite Materials	3	-	-	3	40	60	100

Professional Elective – III - Semester II (First Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	25MTPDD23A	Industrial Design and Ergonomics	3	-	-	3	40	60	100
2	25MTPDD23B	Marketing Research for New Product	3	-	-	3	40	60	100
3	25MTPDD23C	Design of Hydraulic and Pneumatic Systems	3	-	-	3	40	60	100

Professional Elective – IV - Semester II (First Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	25MTPDD24A	Product Innovation and Management	3	-	-	3	40	60	100
2	25MTPDD24B	Advanced Mechanisms in Design	3	-	-	3	40	60	100
3	25MTPDD24C	Integrated Design and Manufacturing	3	-	-	3	40	60	100

Professional Elective – V - Semester III (Second Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	25MTPDD31A	Design of Hybrid and Electric Vehicles	3	-	-	3	40	60	100
2	25MTPDD31B	Industrial Robotics and Expert Systems	3	-	-	3	40	60	100
3	25MTPDD31C	Mechatronics System Design	3	-	-	3	40	60	100

S.No	Subject Area	Semester Wise Credit Mapping				Total Credits
		I	II	III	IV	
1	PCT	6	6	--	--	12
2	PE	6	6	3	--	15
3	PCL	4	4	--	--	08
4	SEC	2	--	--	--	02
5	OEC	--	--	3	--	03
6	PWC	--	--	10	16	26
7	AC	0	0	--	--	0
8	Other Theory	2	2	--	--	04
9	CVV	--	2	--	--	02
10	Internship	--	--	2	--	02
11	Co-curricular	--	--	1	--	01
TOTAL		20	20	19	16	75

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

Course Code	RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
25MTVSD11T		2	0	0	2

Course Objectives:

1. To understand the research design process and data collection methods.
2. To develop skills in data analysis and reporting.
3. To familiarize students with intellectual property rights (IPR) and patents.
4. To apply research skills in real-world contexts.

UNIT - I FUNDAMENTALS OF RESEARCH METHODOLOGY

Overview of research process and design - Types of Research - Approaches to Research (Qualitative vs Quantitative) - Observation studies, Experiments and Surveys - Use of Secondary and exploratory data to answer the research question - Importance of Reasoning in Research and Research ethics - Documentation Styles (APA/IEEE etc.) - Plagiarism and its consequences

Learning Outcomes

- Recall key concepts of the research process, including different types and approaches to research, and the importance of ethics.
- Differentiate between qualitative and quantitative research approaches and the various uses of secondary data.
- Identify the core principles of research design and ethics, including plagiarism and documentation styles.
- Explain the significance of reasoning and ethical conduct in all stages of the research process.
- Apply knowledge of different documentation styles, such as APA and IEEE, to properly cite sources and avoid plagiarism.

UNIT - II DATA COLLECTION AND SOURCES

Importance of Data Collection - Types of Data - Data Collection Methods - Data Sources - primary, secondary and Big Data sources - Data Quality & Ethics - Tools and Technology for Data Collection

Learning Outcomes

- Identify different types of data and the various methods for collecting both primary and secondary data.
- Explain the importance of data quality and ethical considerations in data collection.
- Differentiate between primary, secondary, and Big Data sources.
- Describe the various tools and technologies used for effective data collection.
- Analyze the ethical implications of data collection and ensure data quality in a research study.

UNIT - III DATA ANALYSIS AND REPORTING

Overview of Multivariate analysis - Experimental research, cause-effect relationship, and development of hypotheses- Measurement systems analysis, error propagation, and validity of experiments - Guidelines for writing abstracts, introductions, methodologies, results, and discussions - Writing Research Papers & proposals

Learning Outcomes

- Apply knowledge of multivariate analysis and experimental research to develop hypotheses and analyze data.
- Explain the process of measurement systems analysis and error propagation in experimental design.
- Formulate clear and concise abstracts, introductions, and methodologies for research papers.
- Write effective results and discussion sections based on data analysis.
- Develop comprehensive research papers and proposals based on proper data analysis and reporting guidelines.

UNIT - IV UNDERSTANDING INTELLECTUAL PROPERTY RIGHTS

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

Learning Outcomes

- Recall the fundamental concepts of Intellectual Property (IP) and its evolution.
- Describe the roles of organizations like WIPO and WTO in the establishment of IPR.
- Differentiate between various types of IPR, including trade secrets and trademarks.
- Explain the common rules and features of IPR agreements and the role of UNESCO.
- Analyze the relationship between IPR and biodiversity, and its broader impact.

UNIT – V PATENTS

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification - Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licenses, Licensing of related patents, patent agents, Registration of patent agents

Learning Outcomes

- Explain the objectives, benefits, and key features of a patent, including the concept of an inventive step.
- Differentiate between the various types of patent applications and the e-filing process.
- Describe the process of patent examination, grant, and revocation.
- Identify the roles of patent agents and the process for their registration.
- Analyze the concepts of equitable assignments, licenses, and licensing of related patents.

Text books:

1. Stuart Melville and Wayne Goddard, Research Methodology: An introduction for Science & Engineering students, Juta and Company Ltd, 2004
2. Catherine J. Holland, Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets, Entrepreneur Press, 2007.

Reference books:

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education 11e (2012).
2. Ranjit Kumar , Research Methodology: A Step-by-Step Guide for Beginners. . David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
3. Deborah E. Bouchoux , Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 6th Edition, Cengage 2024.
4. Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, The Craft of Research, 5th Edition, University of Chicago Press, 2024
5. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.
6. Peter Elbow, Writing With Power, Oxford University Press, 1998.

Online Resources (Free & Authentic)

- Coursera / edX – Research Methodology and Data Analysis courses
- Springer Link & ScienceDirect – Latest journals on research design and statistics
- Google Scholar – Free access to research papers
- NCBI Bookshelf – Open-access research methodology resources
- Khan Academy (Statistics & Probability) – For fundamentals of hypothesis testing, regression, and ANOVA.

Course Outcomes (CO):

CO1	Recall key concepts and terminology related to research design, data collection, and intellectual property rights.
CO2	Explain the importance of research design and data analysis in research studies, and describe the concept of intellectual property rights.
CO3	Design a research study, including data collection and analysis methods, and apply intellectual property rights principles to protect research findings.
CO4	Analyze research studies to identify strengths and limitations, and evaluate the effectiveness of data collection and analysis methods.
CO5	Assess the impact of intellectual property rights on research and innovation, and evaluate the effectiveness of research designs and methods.
CO6	Develop a comprehensive research plan, including a detailed research design, data collection and analysis methods, and a plan for protecting intellectual property.

CO	B.T	PO1	PO2	PO3	P04	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L1	3	2	-	-	-	-	-	-	1	-	-	-
CO2	L2	3	3	-	2	2	-	1	-	2	–	-	1
CO3	L3	3	3	1	2	3	2	-	2	3	2	3	2
CO4	L4	2	3	1	2	2	2	-	-	3	2	2	3
CO5	L5	2	3	1	1	3	2	-	3	2	2	2	3
CO6	L6	3	3	2	3	3	3	-	3	3	3	3	3

I M.Tech I Semester

L	T	P	C
3	0	0	3

25MTPDD11T **CREATIVITY IN PRODUCT DESIGN**

Course Educational Objectives:

1. To understand complex interaction, stages of action and behavioral theory as well in design thinking.
2. To apply creativity principles and templates in ICEDIP phases and theoretical framework in product design
3. Imagining and designing using the principles of creativity in futuristic portfolio for new product development
4. Applying various innovation principles and practices in new products in business
5. Using the principles of innovation management in problem solving and TRIZ concept.

UNIT – 1: DESIGN THINKING (9)

Design for Everyday Things: Complexity of modern devices – Principles of interaction, system image, paradox of technology, execution and evaluation – Seven stages of action – Human thought, cognition and emotion – Levels of processing – Storytellers – Wrong things and falsely blaming – Precise behavior, structure of memory and models – Memory in multiple heads and devices – Natural mapping, culture and design – Kinds of constraints, affordances, signifiers, constraints and conventions – Faucet, sound as signifiers, understanding the error and violations, types of errors, social and institutional pressures – Detecting error – Designing for error – Resilience engineering – Paradox of automation – Design principles for error. **Design Thinking:** Solving the problem – Double-diamond model – Human-centered design, design challenge, complexity and confusion – Standardization, developing technology, competitive forces and new technologies force change – New product timeline – Forms of innovation and moral obligations.

UNIT – 2: CREATIVITY (9)

Creativity: Definition – Understanding creativity – Creative process – Logical thinking. **ICEDIP Phases:** Inspiration – Clarification – Listening – Clarification – Distillation – Perspiration – Evaluation – Incubation. **Theoretical Framework:** Codes of product evolution – Revisiting the view of creativity – Creativity- enhancement methods. **Creativity Templates:** Attribute dependency template – Forecasting matrix – Replacement, displacement and component control template – Templates in advertising – Template theory – Validation of the templates theory – Creativity templates – Templates in success and failure of products.

UNIT – 3: IMAGINATION TO CREATIVITY (9)

Imagination to creativity – Innovation – Road to innovation – Thinking outside of the box – Existing demand Vs non-existing demand – Imagination to work – Drive to innovate – Diffusion of the innovation – Principles of developing a new product strategy – Futuristic portfolio – Future full of innovations.

UNIT – 4: INNOVATION (9)

Emotional design – Three levels of design – Innovator's solution – Growth imperative – Process to beat most powerful competitors – Type of products to develop – Customers for best products – Scope of the business right – Process to avoid commoditization – Disruptive growth – Managing the strategy development process – Good money and bad money – Role of senior executives in leading new growth.

UNIT – 5: TRIZ METHODOLOGY OF INVENTIVE PROBLEM SOLVING (9)

Problem-Solving Aids: Routine and inventive problems – Psychological inertia – Trial-and-error method – Methods of creativity – Decision aids – Problem solving information and requirements – TRIZ overview. **TRIZ Concepts:** Technique and attributes – Design Scenario – Contradictions – Ideality – Substance-Field resources – Evolution of technique – Inventions and effects. **Problem Solving:** Information, constraints, and presumptions – Inventiveness – TRIZ multi-screen approach – Fantasy – YES-NO trials – Su-Fields. Function-Oriented Search (FOS) - S-Curve Analysis (Technology Evolution Trends)

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the interaction, action and behavioral theory and in design thinking.	**PO1,PO2,PO3,PO6**
CO2	Apply creativity principles and templates in ICEDIP phases and theoretical framework in product design	**PO1,PO2,PO3,PO5**
CO3	Imagine and design using the principles of creativity in futuristic portfolio for new product development.	**PO1,PO2,PO3**
CO4	Apply various innovation principles and practices in new products in business	**PO1,PO2,PO3**
CO5	Utilize the principles of innovation management in problem solving and TRIZ concept.	**PO1,PO2,PO3,PO5**

Text Books:

1. The Design of Everyday Things - Revised Edition, Don Norman, 2013, Perseus Books Group.
2. Creativity in Product Innovation, Jacob Goldenberg and David Mazursky, 2002, Cambridge University Press

Reference books:

1. How to Be Better At - Creativity, Geoff Petty, 2/e, 2017, Kogan Page in Association, The Industrial Society.
2. From Imagination to Innovation - New Product Development for Quality of Life, A. Coskun Samli,2011, Springer New York Dordrecht Heidelberg London
3. Emotional Design, Donald A. Norman, 2004, Perseus Books Group New York.
4. The Innovator's Solution: Creating and Sustaining Successful Growth, Clayton M. Christensen and Michael E.Raynor, 2003, Harvard Business School Publishing.
5. Engineering of Creativity TRIZ, Semyon D. Savransky, 2001, CRC Press LLC.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	3	-	-	-	-	-	-
CO2	3	3	3	-	2	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-
CO5	3	3	3	-	2	-	-	-	-	-	-	-
CO*	3	3	3	-	2	**3**	**-**	**-**	**-**	**-**	**-**	**-**

I M.Tech I Semester

L	T	P	C
3	0	0	3

25MTPDD12T COMPUTER APPLICATIONS IN PRODUCT DESIGN

Course Educational Objectives:

1. To understand fundamental concepts of computer graphics and its tools in a generic framework.
2. To impart the parametric fundamentals to create and manipulate geometric models using curves, surfaces and solids.
3. To impart the parametric fundamentals to create and manipulate geometric models using NURBS and solids
4. To provide clear understanding of tolerances, visual realism, assembly modeling and product data exchange.
5. To create strong skills of finite element modeling and prepare the student to be an effective user of CAD

UNIT – 1: PRINCIPLE OF COMPUTER GRAPHICS (9)

Computer Graphics: Analog and digital flat panel displays – Raster displays and specifications – Formulation – Translation – Rotation – Scaling – Reflection – Homogeneous, concatenated and inverse transformation – Mapping geometric models and projections – Two dimensional clipping.

UNIT – 2: CURVES AND SURFACES MODELLING (9)

Curves: Curve entities and representation – Analytic curves – Line, circle, ellipse, parabola, hyperbola and conics – Synthetic and Hermite cubic spline – Bezier and B-spline curve – Curve manipulations. **Surfaces Modeling:** Surface entities and representation – Surface analysis – Analytic surfaces – Plane and ruled surface – Surface revolution – Tabulated cylinder – Synthetic and Hermite bicubic surface – Bezier and B- spline surface – Coons, blending and offset surface – Triangular patches – Surface manipulators.

UNIT – 3: NURBS AND SOLID MODELLING (9)

NURBS: Basics – Curves – Lines – Arcs – Circles – Bilinear and ruled surface. **Solid Modeling:** Geometry and topology – Solid entities and representation – Fundamentals of solid modeling – Half spaces – Boundary representations (B-rep) – Constructive Solid Geometry (CSG) – Sweeps – Solid manipulators. **Features:** Feature entities and representation – Three dimensional sketching – Parametrics and relations – Constraints –Feature manipulations.

UNIT – 4: VISUAL REALISM, ASSEMBLY MODELLING & PRODUCT DATA EXCHANGE (9)

Engineering Tolerances: Conventional and geometric tolerances – Fits and limits – Tolerance accumulation and cost relationship – Surface quality – Datum's – Tolerances practices in drafting and manufacturing – Tolerance modelling and representation – Tolerance analysis by Monte Carlo simulation. **Assembly Modelling:** Assembly tree and planning – Mating conditions – Bottom up and top down assembly – Testing Matting – Assembly load options – Managing assemblies and sub assemblies – Inference of position and orientation. **Visualization:** Model clean-up – Hidden line, surface and solid removal – Shading and colors. **Computer Animation:** Engineering animation – Types of animation – Animation techniques – Key frame technique.**Product Data Exchange:** Translators – IGES – STEP – ACIS and DXF – Processors.

UNIT – 5: FINITE ELEMENT MODELING (9)

Finite Element Modeling: Methods of engineering analysis – General steps of finite element analysis – Integral function using Rayleigh Ritz method – Finite elements and modelling – Mesh generation. Mesh Optimization and Adaptive Mesh Refinement - Explicit Dynamics and Crash Simulation **One Dimensional Element:** Shape function – Stiffness matrix – Element stresses – Support reactions. **Two Dimensional Elements:** CST element – Shape function – Plane stress – Plane strain– Strain displacement matrix – Stress-strain relationship – Stiffness matrix – Element stresses – Element strains.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to Cos
CO1	Understand fundamental concepts of computer graphics and its tools in a generic framework.	PO1,PO2,PO3, PO4,PO5
CO2	Impart the parametric fundamentals to create and manipulate geometric models using curves, surfaces and solids.	PO1,PO2,PO3, PO4,PO5
CO3	Impart the parametric fundamentals to create and manipulate geometric models using NURBS and solids.	PO1,PO2,PO3, PO4,PO5
CO4	Provide clear understanding of engineering tolerances, visual realism, assembly modelling and product data exchange.	PO1,PO2,PO3, PO4,PO5
CO5	Create strong skills of finite element modeling and prepare the student to be an effective user of CAD system	PO1,PO2,PO3, PO4,PO5

Text Books:

1. Mastering CAD/CAM, R Ibrahim Zeid, 2018, McGraw Hill Education, India.
2. Computer Graphics with Virtual Reality System, Rajesh K. Maurya, 3/e, 2018, Wiley India Pvt. Ltd.,

Reference books:

1. Computer Graphics, Donald Hearn and M. Pauline Baker, 2/e, 1992, Prentice Hall, Inc
2. Geometric Modeling, Michael E. Mortenson, 3/e, 2006, Industrial Press, Inc.
3. CAD/CAM-Principles and Applications, P.N. Rao, 3/e, 2010, Tata McGraw-Hill Education Pvt. Ltd.,Noida.
4. Basics of Computer Aided Geometric Design: An Algorithmic Approach, M.Ganesh, 3/e, DreamtechPress, Wiley India.
5. Introduction to Finite Elements in Engineering, Tirupathi R. Chandrupatla and Ashok D.Belegundu, 4/e,2015, Pearson Education, India.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	-	-	-	-	-
CO2	3	2	2	2	2	-	-	-	-	-	-	-
CO3	3	2	2	2	2	-	-	-	-	-	-	-
CO4	3	2	2	2	2	-	-	-	-	-	-	-
CO5	3	2	2	2	2	-	-	-	-	-	-	-
CO*	**3**	**2**	2	2	2	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Professional Elective – I

I M.Tech I Semester

L	T	P	C
3	0	0	3

25MTPDD13A MATERIALS SELECTION FOR PRODUCT DEVELOPMENT

Course Educational Objectives:

1. To analyze the different material behavior and selection of various engineering materials
2. To select materials based on crucial design aspects commensurate with single and multipleconstraints in product design
3. To know material selection aspects for shape and designing hybrid materials in product design
4. To expose to the material selection for processes and environment in industrial product design
5. To familiarize with material characterization and emerging materials

UNIT – 1: MATERIAL BEHAVIOR AND SELECTION OF ENGINEERING MATERIALS (9)

Material Behavior: Elastic and plastic deformation – Property variability and design – Dislocations – Mechanisms of strengthening in metals – Recovery, recrystallization, and grain growth – Fracture, fatigue and creep. **Selection of Engineering Materials:** Motivation – Cost basis for selection – Service requirements and failure analysis – Selection for mechanical properties on static strength, toughness, stiffness, fatigue, creep and temperature resistance – Selection for surface durability on corrosion resistance and materials for resistance to wear – Relationship between materials selection and materials processing.

UNIT – 2: MATERIALS SELECTION FOR SINGLE AND MULTIPLE CONSTRAINTS (9)

Materials in Design: Evolution of engineering materials and products – Design tools and materials data – Function, material, shape, and process – Engineering materials families – Materials information for design and units – Exploring material properties – Material property charts. **Single Constraints:** Selection strategy and procedure – Material indices and structural index – Case studies on oars, telescopes, table legs, flywheels, springs, hinges and couplings, brittle polymers, seals, pressure vessels, shaker tables, passive solar heating, thermal distortion in precision devices and heat exchangers. **Multiple Constraints:** Selection – Conflicting objectives – Case studies on light pressure vessels, connecting rod and disk-brake caliper.

UNIT – 3: SELECTION OF MATERIAL FOR SHAPE & DESIGNING HYBRID MATERIALS (9)

Selection of Material for Shape: Shape factors and efficiency – Exploring material-shape combinations – Material indices – Graphical co-selecting – Microscopic shape – Case studies on spars for human-powered planes, racing bicycle, increasing the stiffness of steel sheet, ultra-efficient springs. **Designing Hybrid Materials:** Holes in material-property space – Composites – Sandwich structures – Cellular and segmented structures – Case studies on designing metal matrix composites, extreme combinations of thermal and electrical conduction, refrigerator walls, heat-spreading surfaces, mechanical efficiency of natural materials.

UNIT – 4: MATERIALS FOR THE PROCESS SELECTION AND ENVIRONMENT (9)

Processes Selection: Classification – Shaping, joining and finishing – Processing for properties – Process selection, ranking and process cost – Case studies on casting an connecting rod, fan, spark plug insulators, manifold jacket, radiator, ball-bearing.

Materials and Environment: Material life-cycle and energy- consuming – Eco-attributes and selection of materials – Case studies on drinking containers and crash barriers. **Materials and Industrial Design:** Requirements pyramid – Product character and personality.

UNIT – 5: MATERIAL CHARACTERIZATION AND EMERGING MATERIALS (9)

Material Characterization: Principles and applications in material characterization using X-Ray Scattering, Dynamic light scattering, Scanning Electron Microscopy (SEM), Transmission Electron Microscope (TEM) and Scanning Tunneling Microscopy (STM). **Emerging Materials:** Properties and applications of smart materials, shape memory alloys, functionally graded materials, dual steels, Transformation Induced Plasticity (TRIP) Steel, Ni and Ti Aluminides, metallic glass quasi crystal and Nano crystalline materials Bio-Inspired and Bio-Compatible Materials - Metamaterials and Meta-surfaces - Green and Sustainable Materials - Nanomaterials and Quantum Dots - High-Entropy Alloys (HEAs).

.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand and analyze the engineering material behavior and selection based on product requirements	PO1,PO2
CO2	Select materials based on crucial design aspects like function, material, shape and process, under single and multiple constraints in product design	PO1,PO2,PO3, PO4
CO3	Know material selection aspects for shape and designing hybrid materials in product design	PO1,PO2, PO3,PO4
CO4	develop the novel material through understanding the properties of the existing metallic materials based on process, environment and industry	PO1, PO2, PO3,PO7
CO5	Familiarize with material characterization and emerging materials Analyze, characterize different modern materials used in the engineering applications	PO1,PO2,PO3,PO5

Text Books:

1. Selection and Use of Engineering Materials, J. A. Charles, F. A. A. Crane & J. A. G. Furness, 3/e, 2006, Butterworth-Heinemann, A division of Reed Educational and Professional Publishing Ltd.
2. Materials Selection in Mechanical Design, Michael F. Ashby, 4/e, 2011, Butterworth-Heinemann, Elsevier Ltd.

Reference books:

1. Materials Science and Engineering - An Introduction, William D. Callister and David G. Rethwisch, 9/e, 2014, Wiley India Pvt. Ltd
2. Handbook of Materials Characterization, Surender Kumar Sharma, 2018, Springer Nature Switzerland.
3. Manufacturing Engineering and Technology, Serope Kalpakjian and Steven R. Schmid, 6/e, 2009, Pearson Education SI Units.
4. Essentials of Materials Science & Engineering, SI Edition, Wendelin Wright and Donald Askeland, 3/e, 2013, Cengage Learning, India.
5. Microstructural Characterization of Materials, David Brandon and Wayne D. Kaplan, 2/e, 2008, John Sons Ltd.,

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	2	2	2	1	-	-	-	-	-	-	-	-
CO3	3	2	2	1	-	-	-	-	-	-	-	-
CO4	2	2	2	-	-	-	2	-	-	-	-	-
CO5	3	3	2	-	2	-	-	-	-	-	-	-
CO*	**2.6**	**2.4**	**2**	**1**	2	**-**	**2**	**-**	**-**	**-**	**-**	**-**

I M.Tech I Semester

L	T	P	C
3	0	0	3

DESIGN FOR MANUFACTURE, ASSEMBLY AND ENVIRONMENTS

25MTPDD13B

Course Educational Objectives:

1. Selecting the relevant process; applying the general design principles for manufacturability.
2. Applying the design considerations while designing the cast and welded components.
3. Applying the design considerations while designing the machined components.
4. Apply design considerations for manual, automatic and robot assembly system.
5. Apply design considerations for environmental and sustainability issues.

UNIT – 1: ECONOMIC USE OF METALS AND DESIGN FOR FORMED METALS (9)

Economics of process selection – Design principles for manufacturability – Managing DFM – Evaluating design proposals. **Economical use of Materials Selection:** Hot rolled, cold-finished and stainless steel – Aluminum, copper, brass, magnesium and other nonferrous metals – Zinc, lead, tin, nickel, cobalt, titanium, refractory metals, precious metals and their alloys – Plastics, elastomers, and other organic materials – Ceramics and glasses – Rubber parts. **Formed-Metal Components:** Metal extrusions, stampings, fine- blanked, four-slide, spun-metal, cold-headed, cold-extruded, rotary-swaged and specialized forming methods
– Design for hot forging – Forgings and electroformed parts – Powder metallurgy parts– Springs and wire forms – Tube and section bends – Roll-formed sections– Welded plastic assemblies – Design for sheet metal.

UNIT – 2: DESIGN FOR CASTING AND WELDING (9)

Design for Casting: Design for injection molding – Metal injection-molding – Sand molds – Design for sand casting, permanent-mold castings, centrifugal castings, plaster-mold castings, ceramic-mold castings, investment castings and die castings – Thermoset-molding processes – Injection-molded thermoplastics – Structural-foam, rotationally and blow-molded plastic parts – Plastic profile extrusions – Thermoformed plastics. **Design for Welding:** Design considerations for arc, resistance, spot, seam and projection welding.

UNIT – 3: DESIGN FOR MACHINING COMPONENTS (9)

Parts cut to length, screw-machine and other turned parts – Machined round holes – Parts produced on milling, planning, shaping, and slotting – Screw threads, broached and contour-sawed parts – Flame-cut parts
– Internally and cylindrically ground parts – Flat-ground surfaces – Honed, lapped, and super finished parts – Roller-burnished parts – Parts produced by electrical-discharge, electrochemically machined, chemically machined and other advanced machining processes – Design of gears components and economical deburring.

UNIT – 4: PRODUCT DESIGN FOR MANUAL, AUTOMATIC AND ROBOT ASSEMBLY (9)

Manual Assembly: Design guidelines, systematic design and assembly efficiency – Effect of part symmetry on handling time, part thickness and weight – Manipulation, combinations of factors, symmetry parts, chamfer design, estimation of insertion, avoiding jams, reducing disc-assembly, access of threaded fasteners on pop-riveting and holding down – Assembly database and data sheets – Application of the DFA – Large assemblies – Effect of layout and quality of assembly – Learning curves to the DFA. **Automatic Assembly:** Design of parts for high-speed feeding and orienting – Feeding difficulties, automatic insertion and analysis of an assembly – Product design for automation and high-speed automatic and robot assembly.

UNIT – 5: DESIGN FOR ENVIRONMENT AND SUSTAINABILITY (9)

Environmental objectives – Motivating forces – Global, regional and local issues – Business value drivers – Managing environmental innovation – Principles of design for environment – Performance indicators and metrics – Design rules and guidelines of DFE – Analysis methods for design decisions – Product life-cycle management – Sustainability and resilience – The real-world practice of design for environment on materials production industries and energy production industries.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Selecting the relevant process; applying the general design principles for manufacturability.	**PO1,PO2,PO3**
CO2	Applying the design considerations while designing the cast and welded components.	**PO1,PO2,PO3, PO4**
CO3	Applying the design considerations while designing the machined components.	**PO1,PO2, PO3,PO4**
CO4	Apply design considerations for manual, automatic and robot assembly system.	**PO1, PO2, PO3,PO4**
CO5	Apply design considerations for environmental and sustainability issues.	**PO1,PO2,PO3, PO12**

Text Books:

1. Design for Manufacturability Handbook, James G. Bralla, 2/e, 1998, McGraw-Hill International Edition.
2. Product Design for Manufacture and Assembly, Geoffrey Boothroyd, Peter Dewhurst and Winston Knight, 3/e, 2011, CRC Press, Taylor and Francis Group, LLC.

Reference Books:

1. Design for Environment - A Guide to Sustainable Product Development, Joseph Fiksel, 2/e, 2009, McGraw-Hill International Edition.
2. Design for Manufacturability - How to Use Concurrent Engineering to Rapidly Develop Low-Cost, High-Quality Products for Lean Production, David M. Anderson, 2014, CRC Press, Taylor and Francis Group, LLC.
3. Mechanical Assemblies - Their Design, Manufacture, and Role in Product Development, Daniel E. Whitney, 2004, Oxford University Press, Inc.
4. Process Selection - From Design to Manufacture, 2003, K. G. Swift and J. D. Booker, Butterworth-Heinemann, An imprint of Elsevier.
5. Design for Sustainability: A Practical Approach, Tracy Bhamra and Vicky Lofthouse, 1/e, 2016, Routledge Press.

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	3	3	-	-	-	-	-	-	-	-	3
CO.2	2	3	3	2	-	-	-	-	-	-	-	-
CO.3	2	3	3	2	-	-	-	-	-	-	-	-
CO.4	2	3	3	2	-	-	-	-	-	-	-	-
CO.5	2	3	3	-	-	-	-	-	-	-	-	3
CO*	**2**	**3**	**3**	**2**	-	**-**	**-**	**-**	**-**	**-**	**-**	**3**

I M.Tech I Semester

L	T	P	C
0	0	0	3

25MTPDD13C BEARING DESIGN AND ROTOR DYNAMICS

Course Educational Objectives:

1. Apply and develop mathematical model of a system
2. Applying the design and suggest bearings for specific applications
3. Applying a fatigue life calculations for various types of bearings
4. Apply and analyze bearing behaviour
5. Study the dynamics of rotors mounted on Hydrodynamic Bearings

UNIT – 1: CLASSIFICATION AND SELECTION OF BEARINGS (9)

Surface Engineering: Surface modifications, properties, transformation hardening and surface fusion – Hydrophobic – Super hydrophobic – Hydrophilic – Surface coating Techniques – PVD – CVD – Physical CVD – Ion implantation – Thermo chemical processes – Plating and anodizing – Fusion processes. **Materials for Bearings:** Materials for rolling element bearings – Materials for fluid film bearings – Materials for marginally lubricated and dry bearings – Biomaterials – Bio Tribology – Nano tribology. **Selection of Bearings:** Selection criteria – Dry and boundary lubrication bearings – Hydrodynamic and hydrostatic bearings –Electro magnetic bearings – Dry bearings – Rolling element bearings – Bearings for precision – Applications of bearings – Foil bearings – Special bearings – Selection of plain bearing materials

– Metallic and non metallic bearings – Materials for rolling bearings.

UNIT – 2: DESIGN OF FLUID FILM BEARINGS (9)

Lubricants: Types and properties of lubricants – Testing methods – Hydrodynamic lubrication – Boundary lubrication – Solid lubrication – Hydrostatic lubrication. **Fluid Film Bearings:** Design and performance analysis of thrust and journal bearings – Full, partial, fixed and pivoted journal bearings design procedure – Minimum film thickness – Lubricant flow and delivery – Power loss, heat and temperature distribution calculations – Design based on charts and tables – Design of hydrostatic, thrust and journal bearings – Stiffness consideration – Flow regulators and pump design in hydrostatic bearings – Foil and air bearings.

UNIT – 3: ROLLING CONTACTS SELECTION OF ROLLING BEARINGS (9)

Film Lubrication Theory: Fluid film in simple shear – Viscous flow between very close parallel plates –Shear stress variation Reynolds equation for film lubrication – High speed unloaded journal bearings – Loaded journal bearings – Reaction torque on the bearings – Virtual co-efficient of friction – The Sommerfield diagram. **Selection of Rolling Bearings:** Contact stresses in rolling bearings – Centrifugal stresses – Elasto hydrodynamic lubrication – Fatigue life calculations – Bearing operating temperature –Lubrication – Selection of lubricants – Internal clearance – shaft and housing fit – Mounting arrangements Manufacturing methods – Ceramic bearings – Rolling bearing cages – Bearing seals selection.

UNIT – 4: ROTOR DYNAMICS (9)

Motion of the shaft in the bearing – Rotor supported on rigid and flexible supports – Campbell diagram, rotor dynamic analyses – Undamped critical speed – Unbalance response – Damped eigen value analysis – Bearing stiffness and damping coefficients – Mechanics of hydro dynamic instability – Half frequency whirl and resonance whip – Bearing instability and oil whirl technologies to improve the stability of rotor – Bearing systems – Design configurations of stable journal bearings.

UNIT – 5: DYNAMICS OF ROTORSMOUNTED ON HYDRODYNAMIC BEARINGS (9)

Hydrodynamic lubrication equation for dynamic loadings – Squeeze film effects in journal bearings andthrust bearings – Rotating loads, alternating and impulse loads in journal bearings – Journal centre trajectory-Analysis of short bearings under dynamic conditions – Finite difference solution for dynamic conditions.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand application of various types of bearings and their operating principles	**PO1,PO2,PO3,PO4**
CO2	Design and suggest bearings for specific applications	**PO1,PO2,PO3,PO4**
CO3	Perform fatigue life calculations for various types of bearings	**PO1,PO2,PO3,PO4**
CO4	Understand and analyze bearing behavior	**PO1,PO2,PO3,PO4**
CO5	Study the dynamics of rotors mounted on Hydrodynamic Bearings	**PO1,PO2,PO3,PO4**

Text Books:

1. Industrial Tribology, R.B.Patil, 1/e, 2012, Tech-Max Publications, Pune.
2. Applied Tribology: Bearing Design and Lubrication, Michael M. Khonsari and E. Richard Booser, 3/e,2017, John Wiley & Sons Ltd.

Reference Books:

1. Bearing Design in Machinery, Harnoy, Avraham Harnoy, 1/e, 2002, Marcel Dekker Publishers, NewYork.
2. Engineering Tribology, Gwidon W. Stachowiak and Andrew W. Batchelor, 3/e, 2005, ElsevierButterworth-Heinemann.
3. Modern Tribology Handbook: Principles of Tribology - Volume I, Bharat Bhushan, CRC Press LLC.
4. Principles and Applications of Tribology, Bharat Bhushan, 2/e, 2013, John Wiley & Sons, Ltd.
5. Tribology in Machine Design, T. A. Stolarski, 2000, Butterworth-Heinemann.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	1	-	-	-	-	-	-	-	-
CO.2	3	2	2	1	-	-	-	-	-	-	-	-
CO.3	3	2	2	1	-	-	-	-	-	-	-	-
CO.4	3	2	2	1	-	-	-	-	-	-	-	-
CO.5	3	2	2	1	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	**1**	-	-	-	-	-	-	-	-

Professional Elective – II

I M.Tech I Semester

L	T	P	C
3	0	0	3

25MTPDD14A ADVANCED FINITE ELEMENT METHODS

Course Objectives:

- You learn modern analysis techniques used widely in engineeringpractice and the sciences, and you use these techniques in a general finite element program.
- You learn how to establish computational models of problems of solids and fluids, solvethem on your laptop, and assess the accuracy of the results.
- You capitalize on your knowledge of mechanics, reinforce your knowledge, and solve problems that can only be tackled numerically on the computer. Great knowledge in yourtool box whatever your goals.

Course Outcomes (CO): Student will be able to

- Students will learn the mathematical formulation of the finite element method and how to apply it to basic (linear) ordinary and partial differential equations.
- Solve 1- D problems. & 2- D Structural & Heat Transfer Problems using FEA
- Solve Trusses & Beams Problems using FEA
- Formulate & solve structural & dynamics problems

UNIT - I Lecture Hrs: 09

Formulation Techniques: Methodology, Engineering problems and governing differential equations, finite elements., Variational methods-potential energy method, Raleigh Ritz method, strong and weak forms, Galerkin and weighted residual methods, calculus of variations, Essential and natural boundary conditions.

UNIT - II Lecture Hrs: 09

One-dimensional finite element methods: Bar elements, temperature effects. Element matrices, assembling of global stiffness matrix, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Quadratic Element, Heat transfer problems: One-dimensional, conduction and convection problems. Examples: - one dimensional fin,

UNIT - III Lecture Hrs: 09

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

Beams and Frames: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses.

UNIT - IV Lecture Hrs: 09

Two dimensional problems: CST, LST, four noded and eight nodded rectangular elements, Lagrange basis for triangles and rectangles, serendipity interpolation functions. Axisymmetric Problems: Axisymmetric formulations, Element matrices, boundary conditions. Heat Transfer problems: Conduction and convection, examples: - two-dimensional fin.

Isoparametric formulation: Concepts, sub parametric, super parametric elements, numerical integration.

UNIT - V Lecture Hrs: 09

Textbooks:

1. Introduction to Finite element methods by Chandraputla & Ashok D.Belagondu by Pearson 2012A
2. Concepts and Applications of Finite Element Analysis By Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt

Reference Books:

1. Finite element method in Heat transfer and fluid dynamics, J.N.Reddy, CRC press,1994
2. Finite Element Method, Zienckiwicz O.C. & R. L. Taylor,McGraw-Hill,1983.
3. Finite Element of Nonlinear continua, . J. N. Oden, McGraw-Hill, New York, 1971.
4. Finite element procedures, K. J. Bathe, Prentice-Hall, 1996.

Online Learning Resources:

- https://nptel.ac.in/courses/112/104/112104193/
- https://nptel.ac.in/courses/112/104/112104205/
- https://nptel.ac.in/courses/105/105/105105041/
- https://nptel.ac.in/courses/112/106/112106130/
- https://nptel.ac.in/courses/112/103/112103295/

I M.Tech I Semester

L	T	P	C
3	0	0	3

25MTPDD14B MECHANICS OF COMPOSITE MATERIALS

Course Educational Objectives:

1. Study of different composite materials and finding its mechanical strength.
2. Fabrication of FRP and other composites by different manufacturing methods
3. Stress analysis of fiber reinforced Laminates for different combinations of plies with different orientations of the fiber.
4. Calculation of stresses in the lamina of the laminate using different failure theories.
5. Calculation of residual stresses in different types of laminates under thermo-mechanical load using the Classical Laminate Theory.

UNIT – 1: INTRODUCTION TO COMPOSITE MATERIALS (9)

Matrix materials **–** Polymers, metals and ceramics. **Reinforcements:** Particles, whiskers, inorganic fibers, metal filaments – Ceramic fibers – Fiber fabrication – Natural composite wood, Jute – Advantages and drawbacks of composites over monolithic materials – Mechanical properties and applications of composites-Particulate-Reinforced composite Materials – Dispersion-strengthened composite – Fiber-reinforced composites – Rule of mixtures – Characteristics of fiber-reinforced composites – Manufacturing fiber and composites.

UNIT – 2: MANUFACTURING OF COMPOSITES (9)

Manufacturing of Polymer Matrix Composites (PMCs) – Handlay-up, spray technique and filament winding– Pultrusion – Resin Transfer Moulding (RTM) – Bag moulding and injection moulding – Sandwich Mould Composites (SMC) – Manufacturing of Metal Matrix Composites (MMCs) – Solid state, liquid state and vapour state processing – Manufacturing of Ceramic Matrix Composites (CMCs) – Hot pressing – Reaction bonding process – Infiltration technique – Direct oxidation – Interfaces.

UNIT – 3: LAMINA CONSTITUTIVE EQUATIONS (9)

Lamina Constitutive Equations: Lamina Assumptions – Macroscopic viewpoint – Generalized Hooke's Law – Reduction to homogeneous orthotropic lamina – Isotropic limit case – Orthotropic stiffness matrix – Definition of stress and moment resultants – Strain displacement relations – Basic assumptions of laminated anisotropic plates – Laminate constitutive equations – Coupling Interactions – Balanced laminates, symmetric laminates, angle ply laminates and cross ply laminates – Laminate structural moduli – Evaluation of lamina properties from laminate tests – Quasi-isotropic laminates – Determination of lamina stresses within laminates.

UNIT – 4: LAMINA STRENGTH ANALYSIS (9)

Maximum stress and strain criteria – Von-Misses yield criterion for isotropic materials – Generalized Hill's criterion for anisotropic materials – Tsai-Hill's failure criterion for composites – Tensor polynomial failure criterion – Prediction of laminate – Failure equilibrium equations of motion – Energy formulations – Static bending analysis – Buckling analysis – Free vibrations – Natural frequencies.

UNIT – 5: THERMO-STRUCURAL ANALYSIS (9)

Fabrication stresses/Residual stresses in FRP laminated composites – Co-efficient of thermal expansion – Modification of Hooke's law – Modification of laminate constitutive equations – Orthotropic lamina C.T.E's-Stress and moment resultants due cooling of the laminates during fabrication – Calculations for thermo- mechanical stresses in FRP laminates. **Case Studies:** Implementation of CLT for evaluating residual stresses in the components made with different isotropic layers.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to Cos
CO1	Calculate for mechanical strength of the composite material.	**PO1,PO2,PO3, PO4**
CO2	Fabricate the FRP and other composites by different manufacturing methods.	**PO1,PO2,PO3, PO4**
CO3	Analyze fiber reinforced Laminates for different combinations of plies with different orientations of the fiber.	**PO1,PO2,PO3, PO4**
CO4	Evaluate the stresses in the lamina of the laminate using different failure theories.	**PO1,PO2,PO3, PO4**
CO5	Analyze thermo-mechanical behavior and evaluate residual stresses in different types of laminates using the Classical Laminate Theory.	**PO1,PO2,PO3, PO4**

Text Books:

1. Principles of Composite Material Mechanics, Gibson, R.F., 4/e, 2016, CRC Press, Taylor & Francis Group.
2. Advanced Mechanics of Composite Materials, Valery V. Vasiliev and Evgeny V. Morozov, 4/e, 2018, Elsevier Ltd.

Reference Books:

1. Composite Structures: Design, Mechanics, Analysis, Manufacturing, and Testing, Manoj Kumar Buragohain, 2017, CRC Press, Taylor & Francis Group.
2. Engineering Mechanics of Composite Materials, Issac M. Daniel and Ori Ishai, 2/e, 2013, Oxford University Press, Inc.
3. Micromechanics of Composite Materials, 2013, Jacob Aboudi, Steven M Arnold & Brett A. Bednarcyk, Butterworth-Heinemann is an imprint of Elsevier
4. Mechanics of Laminated Composite Plates and Shells: Theory and Analysis, J.N.Reddy, 2/e, 2003, CRC Press, Taylor & Francis Group.
5. Composite Materials: Science and Applications, Chung D.L. Deborah., 2/e, 2010, Springer Ltd..

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	3	2	-	-	-	-	-	-	-	-
CO.2	2	2	3	2	-	-	-	-	-	-	-	-
CO.3	3	2	3	2	-	-	-	-	-	-	-	-
CO.4	3	2	3	2	-	-	-	-	-	-	-	-
CO.5	3	2	3	2	-	-	-	-	-	-	-	-
CO*	**2.8**	**2**	**3**	**2**	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**

I M.Tech I Semester

L	T	P	C
3	0	0	3

25MTPDD14C QUALITY CONCEPTS IN PRODUCT DESIGN

Course Educational Objectives:

1. To enable the students with quality aspects, customer needs and quality improvemnt methods
2. To provide statistical process control knowledge, sampling and control charts with metrological aspects
3. To excel with quality in experimental design
4. knowledge in the field of reliability engineering
5. To educate students with fundamental and six sigma and DFSS

UNIT – 1: DESIGN FOR QUALITY (9)

Dimensions of quality – Quality assurance, quality circles, quality cost and teams – Customer needs and market share –Deming's, B.Crosby's and M.Juran's philosophy – Legal aspects of quality – Environmental management and quality standards – Service industries, characteristics and practices – Quality improvement tools – TQM frame work – Leadership – Employee involvement, supplier partnership and performance measures – Product liability – Benchmarking, QFD, FMEA, Just-in-Time, Poka-Yoke and DMAIC process.

UNIT – 2: PROCESS CONTROL AND DESIGN (9)

Basis of the control chart – Magnificent seven tools – Implementing SPC in a quality – Application of SPC – Control charts for x and R – Control charts for x and s – Applications of variables control charts – Control chart for fraction nonconforming – Control charts for nonconformities – Attributes and variables control charts – Guidelines for implementing control charts – Process capability analysis and ratios – Gauge and measurement system capability studies – Specification limits on discrete components – Estimating the natural tolerance limits – Acceptance-Sampling – Single, double, multiple, and sequential sampling.

UNIT – 3: QUALITY IN EXPERIMENTAL DESIGN (9)

Experimental Design Fundamentals – Factorial experiments – Taguchi method and philosophy – Loss functions – Signal-to-Noise ratio – Critique of S/N ratios – Experimental and parameter design in the Taguchi method – Critique of experimental design and the Taguchi method – Regression Analysis – Deterministic and probabilistic models – Model assumptions – Least squares method for parameter estimation – ANOVA and least squares to work – ANOVA for Blocked and nested designs – Model validation and remedial measures – Estimation and inferences from a regression model – Qualitative independent variables – Issues in multiple regression – Logistic regression.

UNIT – 4: DESIGN FOR RELIABILITY (9)

Life-cycle curve and probability distributions in reliability – System reliability – Operating curves – Hazard rate – Percentiles product life – Moments of time to failure – Product requirements and constraints – Product life cycle conditions – Reliability capability – Human factors and reliability – Deductive versus inductive – Failure modes, effects, and criticality analysis – Fault tree analysis – Physics of failure – LCP development – Estimating life-cycle loads – Reliability capability and practices – Probabilistic design for reliability and the factor of safety – Reliability estimation – Tests product life cycle – Product qualification and testing – No- fault-found – Reliability block diagram – Products with redundancy – Complex system reliability.

UNIT – 5: DESIGN FOR SIX SIGMA (9)

Basic unit, process capability and overview of six sigma – Lean operation principles – Process mapping, value stream mapping and process management – Six sigma goes upstream and product development process – Lean principles and product development approaches – Design for Six Sigma (DFSS) – DFSS phases, six sigma and DFSS – DFSS company, strategy, deployment and goals – Six sigma project and training – Sustain DFSS deployment – DFSS project algorithm – DFSS transfer function and score cards.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Enable quality aspects, customer needs and quality improvement methods	PO1,PO2,PO5,PO8
CO2	Acquire statistical process control knowledge, sampling and control charts with metrological aspects	PO1,PO2,PO3,PO4,PO5
CO3	Excel with quality in experimental design	PO1,PO2,PO3,PO4,PO5,PO7
CO4	knowledge in the field of reliability engineering	PO1,PO2,PO3,PO4,PO5
CO5	Familaiarise with fundamental and six sigma and DFSS	PO1,PO2,PO3,PO4,PO5

Text Books:

1. Fundamentals of Quality Control and Improvement, Amitava Mitra, 4/e, 2016, John Wiley & Sons, Inc.
2. Introduction to Statistical Quality Control, Douglas C. Montgomery, 7/e, 2013, John Wiley & Sons, Inc.

Reference books:

1. Reliability Engineering, Kailash C. Kapur and Michael Pecht, 2014, John Wiley & Sons, Inc.
2. Design for Six Sigma: A Roadmap for Product Development, Kai Yang and Basem S. El-Haik, 2/e,2009, McGraw-Hill Companies, Inc.
3. Reliability, Maintainability and Risk: Practical Methods for Engineers, 8/e, 2011, Butterworth-Heinemann, Elsevier Ltd.
4. Design and Analysis of Experiments, Douglas C. Montgomery, 8/e, 2013, John Wiley & Sons, Inc.
5. Total Quality Management, Besterfield Dale H, Besterfield Carol, Besterfield Glen H, Besterfield Mary,Urdhwareshe Hemant and Urdhwareshe Rashmi, 5/e, 2018, Pearson Education, New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	-	-	2	-	-	-	-
CO2	3	3	3	2	3	-	-	-	-	-	-	-
CO3	3	2	3	3	3	-	2	-	-	-	-	-
CO4	3	3	3	3	2	-	-	-	-	-	-	-
CO5	3	2	3	3	3	-	-	-	-	-	-	-
CO*	**3**	**2.4**	3	2.8	2.6	-	2	2	-	-	-	-

I M.Tech I Semester

L	T	P	C
3	0	0	3

25MTPDD15T ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course Outcomes (CO): Student will be able to

- Design intelligent agents, define problems using state-space models, and apply AI techniques.
- Implement and compare different search algorithms (both uniform and heuristic), apply and analyze appropriate strategies for solving AI problems.
- Solve CSPs using local search methods and implement adversarial search algorithms to make optimal decisions in competitive game scenarios.
- Utilize statistical and logical reasoning methods, to represent knowledge and perform forward and backward reasoning in AI applications.
- Understanding and apply various machine learning techniques, along with an introduction to neural networks and deep learning.

Lecture Hrs:09

UNIT – I

Introduction to Artificial Intelligence and Problem-Solving Agent: Problems of AI, AI technique, Tic – Tac – Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. Defining the problem as state space search, production system, problem characteristics, and issues in the design of search programs.

UNIT – II Lecture Hrs: 09

Search Techniques: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best - first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search.

UNIT – III Lecture Hrs: 09

Constraint Satisfaction Problems and Game Theory: Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

UNIT – IV Lecture Hrs: 09

Knowledge & Reasoning: Statistical Reasoning: Probability and Bays' Theorem, Certainty Factors and Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. AI for knowledge representation, rule-based knowledge representation, procedural and declarative knowledge, Logic programming, Forward and backward reasoning.

Lecture Hrs: 09

UNIT - V

Introduction to Machine Learning: Exploring sub-discipline of AI: Machine Learning, Supervised learning, Unsupervised learning, Reinforcement learning, Classification problems, Regression problems, Clustering problems, Introduction to neural networks and deep learning.

TOTAL: 45 HOURS

Textbooks:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2015.
2. Nils J. Nilsson, "Artificial Intelligence: A New Synthesis", 1st Edition, Morgan-Kaufmann, 1998.

Reference Books:

1 Elaine Rich, Kevin Knight, & Shivashankar B Nair, "Artificial Intelligence", McGraw Hill, 3rd ed.,2017.
2. Patterson, "Introduction to Artificial Intelligence & Expert Systems", Pearson, 1st ed. 2015.
3. Saroj Kaushik, "Logic & Prolog Programming", New Age International, Ist edition, 2002.
4. Joseph C. Giarratano,Gary D. Riley, "Expert Systems: Principles and Programming", 4th Edition, 2007.

I M.Tech I Semester

L	T	P	C
0	0	4	2

25MTPDD15L PRODUCT DESIGN AND MODELLING LAB

Course Educational Objectives:

1. To impart knowledge on preparation 3D surface/ solid modeling and prepare part and assembly drawings for various mechanical components using any commercially available 3D modeling softwares

List of Exercises:

1. CAD Introduction and Sketcher
2. Introduction of 3D Modelling software
3. Solid modeling – Extrude, Revolve, Sweep and Variational sweep, Loft
4. Surface modeling – Extrude, Sweep, Trim and Mesh of curves, Free form.
5. Feature manipulation – Copy, Edit, Pattern, Suppress, History operations etc.
6. Assembly – Constraints, Exploded Views, Interference check
7. Drafting – Layouts, Standard & Sectional Views, Detailing & Plotting.
8. Creation of 3D assembly model of following machine elements using 3D Modeling software (Flange Coupling, Plummer Block, Screw Jack, Lathe Tailstock, Universal Joint, Machine Vice, Stuffing box, Crosshead, Safety Valves, Non-return valves, Piston, Connecting rod and crank shaft etc.,)

Note:

a. Exercises in modeling, drafting assembly of mechanical components using parametric and feature based packages like CATIA / PRO-E / SOLID WORKS / CATIA / NX etc.,

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Create 3D part and assembly Models on any CAD software with high configuration.	**PO1**
CO2	Draw solid and surface modelling	**PO2**
CO3	Examine feature manipulation parts will not interfere.	**PO3**
CO4	Convert 3D solid models into 2D drawing and prepare different views, sections and dimensioning of part models.	**PO4**
CO5	Use the modern engineering tools necessary for drafting and modelling	**PO5**
CO6	Follow the ethical principles in conducting the experiments	**PO8**
CO7	Perform Experiments individually and also a team/individual to complete the work	**PO9**
CO8	Communicate in verbally or in written form their understanding about the exercises.	**PO10**
CO9	Continue updating their skill related to drafting and modeling of mechanical components during their life time.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-
CO7	-	-	-	-	-	-	-	-	3	-	-	-
CO8	-	-	-	-	-	-	-	-	-	3	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**3**	**3**	-	**-**	**3**	**3**	**3**	-	**3**

I M.Tech I Semester **L T P C**
0 0 4 2

25MTPDD16L SIMULATION AND ANALYSIS LABORATORY

Course Educational Objectives:

1. To provide exposure to software tools needed to simulate and analyze engineering problems.

List of Exercises:

1. Force and Stress analysis using link elements in Trusses.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and axi-symmetric components.
4. Thermal stress and heat transfer analysis of plates.
5. Thermal stress analysis of cylindrical shells.
6. Vibration analysis of spring-mass systems.
7. Modal analysis of Beams.
8. Harmonic, transient and spectrum analysis of simple systems.
9. Analysis of machine elements under dynamic loads.
10. Analysis of non-linear systems.

Note:

Exercises in analyzing of mechanical components using Finite Element Analysis packages

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Create exposure to software tools needed to analyze engineering problems.	**PO1**
CO2	Analyze the stresses and strains induced in trusses, brackets and beams and heattransfer problems.	**PO2**
CO3	Heat transfer analysis of plates and cylindrical shells	**PO3**
CO4	Calculate the natural frequency and mode shape analysis Harmonic, transient andspectrum analysis of simple systems	**PO4**
CO5	Use the modern engineering tools to necessary for engineering analysis , machineelements under dynamic loads and non-linear systems	**PO5**
CO6	Follow the ethical principles in conducting the exercises.	**PO8**
CO7	Perform Experiments individually and also a team/individual to complete the work	**PO9**
CO8	Communicate in verbally or in written form their understanding about the exercises.	**PO10**
CO9	Continue updating their skill related to simulation and analysis of mechanical components during their life time.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-
CO7	-	-	-	-	-	-	-	-	3	-	-	-
CO8	-	-	-	-	-	-	-	-	-	3	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**3**	**3**	-	**-**	**3**	**3**	**3**	-	**3**

Course Code	DISASTER MANAGEMENT (Audit Course-I)	L	T	P	C
25MTMAC11A		2	0	0	0
Semester		I			

Course Objectives:

1. **To enable the students to understand** the fundamental concepts of disasters, hazards, their factors, and significance with special reference to India.
2. **To prepare them to classify and analyze** different types of natural and man-made disasters, their causes, magnitude, and impacts.
3. **To foster them develop understanding** of disaster preparedness, monitoring systems, and the role of government, community, and media.
4. **To equip them in learning** risk assessment techniques, disaster risk reduction strategies, and the importance of global and national cooperation.
5. **To foster their ability to think critically and respond to disasters and design** effective mitigation measures (structural and non-structural) with a focus on emerging trends and Indian disaster management programs.

Course Outcomes:

On successful completion, students will be able to:

CO1 - Define and distinguish between hazards and disasters, and explain their types, nature, and impacts.
CO2 Identify and map disaster-prone areas in India and understand the epidemiological consequences of disasters.
CO3 Assess the economic, social, and ecological repercussions of major natural and man-made disasters.
CO4 Demonstrate knowledge of disaster preparedness tools such as remote sensing, meteorological data, risk evaluation, and community awareness.
CO5 Apply risk assessment methods and propose disaster risk reduction strategies at local, national, and global levels.
CO6: Formulate and evaluate structural and non-structural disaster mitigation strategies, with emphasis on Indian programs and emerging trends.

UNIT –I	Introduction	

Disaster - Definition, Factors and Significance - Difference Between Hazard and Disaster - Natural and Man-made Disasters - Difference, Nature, Types and Magnitude -

Disaster Prone Areas in India - Study of Seismic Zones - Areas Prone to Floods and Droughts, Landslides and Avalanches - Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami - Post-Disaster Diseases and Epidemics.

UNIT - II	Repercussions of Disasters and Hazards	

Economic Damage - Loss of Human and Animal Life - Destruction of Ecosystem - Natural Disasters - Earthquakes, Volcanism, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster - Nuclear Reactor Meltdown - Industrial Accidents - Oil Slick sand Spills - Outbreaks of Disease and Epidemics War and Conflicts

UNIT - III	Disaster Preparedness and Management	

Preparedness - Monitoring of Phenomena - Triggering a Disasteror Hazard - Evaluation of Risk-Application of Remote Sensing - Data from Meteorological and Other Agencies - Media Reports- Governmental and Community Preparedness

UNIT - IV	Risk Assessment	

Disaster Risk -Concept and Elements, Disaster Risk Reduction - Global and National Disaster Risk Situation -Techniques of Risk Assessment – Global Co-Operation in Risk Assessment and Warning - People's participation in Risk Assessment – Strategies for Survival

UNIT - V	Disaster Mitigation	

Meaning, Concept and Strategies of Disaster Mitigation - EmergingTrends in Mitigation - Structural Mitigation and Non- Structural Mitigation - Programs of Disaster Mitigation in India

Text books

1. Gupta, H. K. *Disaster Management*. Universities Press, 2003
2. Singh, R. B. *Natural Hazards and Disaster Management*. Rawat Publications, 2006.

Reference Books

1. Coppola, D. P. (2020). *Introduction to International Disaster Management* (4th ed.). Elsevier.
2. Shaw, R., & Izumi, T. (2022). *Science and Technology in Disaster Risk Reduction in Asia*. Springer.
3. Wisner, B., Gaillard, J. C., & Kelman, I. (2021). *Handbook of Hazards and Disaster Risk Reduction and Management* (2nd ed.). Routledge.
4. Saini, V. K. (2021). *Disaster Management in India: Policy, Issues and Perspectives*. Sage India.
5. Kelman, I. *Disaster by Choice: How Our Actions Turn Natural Hazards into Catastrophes,* Oxford University Press, 2022
6. Sahni, P. & Dhameja, A. *Disaster Mitigation: Experiences and Reflections*. Prentice Hall of India, 2004.

Online Resources

- **National Disaster Management Authority (NDMA), India**: https://ndma.gov.in – official guidelines, reports, and policy frameworks.
- **United Nations Office for Disaster Risk Reduction (UNDRR)**: https://www.undrr.org – Sendai Framework, global risk reduction strategies.
- **Global Disaster Alert and Coordination System (GDACS)**: https://www.gdacs.org – real-time disaster alerts.
- **World Health Organization (WHO)** – https://www.who.int/emergencies – disaster-related health guidelines.

Course Code	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
25MTMAC11B	(Audit Course-I)	2	0	0	0

Course Objectives:

1. To equip students with the fundamentals of academic English for research paper writing.
2. To develop students' advanced reading skills for analyzing and evaluating research articles.
3. To refine students' grammar and language skills for clarity and precision in research writing.
4. To master the skills of revising, editing, and proofreading research papers.
5. To familiarize students with the role of technology and AI in research writing, including digital literacy and ethical considerations.

Course Outcomes (CO): Student will be able to

CO1 - Recall the key language aspects and structural elements of academic writing in research papers.
CO2 –Explain the importance of clarity, precision, and objectivity in research writing.
CO3 - Apply critical reading strategies and advanced grammar skills to analyze and write research papers.
CO4 –Analyze research articles and identify the strengths and limitations of different methodologies.
CO4 – Evaluate research papers to check for plagiarism, structure, clarity, and language accuracy.
CO5 – Evaluate the effectiveness of different language and technology tools in research writing, including AI-assisted tools and plagiarism detection software.
6. CO6 – Develop a well-structured research paper that effectively communicates complex ideas.

UNIT - I	Fundamentals of Academic English	Lecture Hrs:

Academic English - MAP (Message-Audience-Purpose) - Language Proficiency for Writing - Key Language Aspects - Clarity and Precision - Objectivity - Formal Tone - Integrating References - Word order - Sentences and Paragraphs - Link Words for Cohesion - Avoiding Redundancy / Repetition - Breaking up long sentences - Structuring Paragraphs - Paraphrasing Skills – Framing Title and Sub-headings

UNIT - II	Reading Skills for Researchers	Lecture Hrs:

Reading Academic Texts - Critical Reading Strategies - Skimming and Scanning - Primary Research Article vs. Review Article - Reading an Abstract - Analyzing Research Articles - Identifying Arguments - Classifying Methodologies - Evaluating Findings - Making Notes

UNIT - III	Grammar Refinement for Research Writing	Lecture Hrs:

Advanced Punctuation Usage - Grammar for Clarity - Complex Sentence Structures - Active- Passive Voice - Subject-Verb Agreement - Proper Use of Modifiers - Avoiding Ambiguous Pronoun References - Verb Tense Consistency - Conditional Sentences

UNIT - IV	Mastery in Refining Written Content/Editing Skills	Lecture Hrs:

Effective Revisions - Restructuring Paragraph - Editing vs Proofreading, Editing for Clarity and Coherence - Rectifying Sentence Structure Issues - Proofreading for Grammatical Precision – Spellings - Tips for Correspondence with Editors - Critical and Creative Phases of Writing

UNIT - V	Technology and Language for Research	Lecture Hrs:

Digital Literacy and Critical Evaluation of Online Content - Technology and Role of AI in Research Writing – Assistance in Generating Citations and References - Plagiarism and Ethical Considerations – Tools and Awareness – Fair Practices

Textbooks:

1.Bailey. S. A*cademic Writing: A Handbook for International Students.* London and New York: Routledge,2015.
2. Adrian Wallwork, *English for Writing Research Papers*, Springer New York Dordrecht Heidelberg London, 2011.

Reference Books:

1. Craswell, G. *Writing for Academic Success,* Sage Publications, 2004.
2. Peter Elbow, *Writing With Power, E-book*, Oxford University Press, 2007
3. Oshima, A. & Hogue, A. *Writing Academic English*, Addison-Wesley, New York, 2005
4. Swales, J. & C. Feak, Academic Writing for Graduate Students: Essential Skills and Tasks. Michigan University Press, 2012.
5.Goldbort R.*Writing for Science*, Yale University Press (available on Google Books), 2006
6. Day R.*How to Write and Publish a Scientific Paper*, Cambridge University Press, 2006

Online Learning Resources:

1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ge04/
2. https://onlinecourses.swayam2.ac.in/ntr24_ed15/preview
3.. "Writing in the Sciences" – Stanford University (MOOC on Coursera) https://www.coursera.org/learn/sciwrite
4. Academic Phrasebank – University of Manchester http://www.phrasebank.manchester.ac.uk
5. OWL (Online Writing Lab) – Purdue University, https://owl.purdue.edu *(Resources on APA/MLA formats, grammar, structure, paraphrasing)*
6. Zotero or Mendeley (Reference Management Tools) – Useful for managing citations and sources.

Subject Code	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (Audit Course-I)	L	T	P	C
25MTMAC11C		2	0	0	0

COURSE OBJECTIVES : The objective of this course is	
1	To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of knowledge system.
2	To make them understand the need for protecting traditional knowledge and its significance in the global economy.
3	To make them understand the legal frame work and policies related to traditional knowledge protection.
4	To enable them to understand the relationship between traditional knowledge and intellectual property rights.
5	To make them explore the applications of traditional knowledge in different sectors, such as engineering, medicine, agriculture, and biotechnology

Unit-I: Introduction to traditional knowledge - Definition, Nature and characteristics, scope and importance - Kinds of traditional knowledge - Physical and social contexts in which traditional knowledge develop - Historical impact of social change on traditional knowledge systems - Indigenous Knowledge (IK) – Characteristics - traditional knowledge vis-à-vis indigenous knowledge -Traditional knowledge Vs western knowledge, traditional knowledge vis-à-vis formal knowledge

Learning Outcomes:

At the end of the unit the student will able to:

- Understand the concept of traditional knowledge.
- Contrast and compare characteristics, importance& kinds of traditional knowledge.
- Analyze physical and social contexts of traditional knowledge.
- Evaluate social change on traditional knowledge.

Unit-II: Protection of traditional knowledge- Need for protecting traditional knowledge - Significance of TK Protection - Value of TK in global economy - Role of Government to harness TK.

Learning Outcomes:

At the end of the unit the student will able to:

- Know the need of protecting traditional knowledge.
- Apply significance of TK protection.
- Analyze the value of TK in global economy.
- Evaluate role of government

Unit-III: Legal frame work and TK - A)The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 - Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act) – B)The Biological Diversity Act 2002 and Rules 2004 - the protection of traditional knowledge bill, 2016 - Geographical Indicators Act 2003.

Learning Outcomes:

At the end of the unit the student will able to:

- Understand legal frame work of TK.
- Contrast and compare the ST and other traditional forest dwellers
- Analyze plant variant protections
- Understand the rights of farmers forest dwellers

Unit-IV: Traditional knowledge and Intellectual property - Systems of traditional knowledge protection - Legal concepts for the protection of traditional knowledge - Certain non-IPR mechanisms of traditional knowledge protection - Patents and traditional knowledge - Strategies to increase protection of traditional knowledge -Global legal FORA for increasing protection of Indian Traditional Knowledge.

Learning Outcomes:

At the end of the unit the student will able to:

- Understand TK and IPR

- Apply systems of TK protection.
- Analyze legal concepts for the protection of TK.
- Evaluate strategies to increase the protection of TK.

Unit-V: Traditional knowledge in different sectors - Traditional knowledge and Engineering - Traditional medicine system - TK and Biotechnology - TK in Agriculture - Traditional societies depend on it for their food and healthcare needs - Importance of conservation and sustainable development of environment - Management of biodiversity, Food security of the country and protection of TK

Learning Outcomes:

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

- Know TK in different sectors.
- Apply TK in Engineering.
- Analyze TK in various sectors.
- Evaluate food security and protection of TK in the country.

Prescribed Books:

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. *Introduction to Indian Knowledge System: Concepts and Applications*, PHI Learning Pvt.Ltd. Delhi, 2022.
2.Basanta Kumar Mohanta and Vipin Kumar Singh,*Traditional Knowledge System and Technology in India,* PratibhaPrakashan 2012.

Reference Books

1. Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.
2. Kak, S.C. "On Astronomy in Ancient India", Indian Journal of History of Science, 22(3), 1987
3. Subbarayappa, B.V. and Sarma, K.V. *Indian Astronomy: A Source Book*, Nehru Centre, Mumbai, 1985.
4. Bag, A.K. *History of Technology in India*, Vol. I, Indian National Science Academy, New Delhi, 1997.
5. Acarya, P.K. *Indian Architecture*, Munshiram Manoharlal Publishers, New Delhi, 1996.
6. Banerjea, P. *Public Administration in Ancient India,* Macmillan, London, 1961.
7. Kapoor Kapil, Singh Avadhesh,*Indian Knowledge Systems Vol – I & II,* Indian Institute of Advanced Study, Shimla, H.P., 2022

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define and explain the concept of traditional knowledge, its nature, characteristics, and scope
CO2	Understand the need for protecting traditional knowledge and its significance in the global economy
CO3	Explain the legal framework and policies related to traditional knowledge protection
CO4	Apply traditional knowledge in different sectors, such as engineering, medicine, agriculture, and biotechnology
CO5	Analyze the importance of traditional knowledge in various contexts, including its historical impact and social change
CO6	Analyze the relationship between traditional knowledge and intellectual property rights, including patents and non-IPR mechanisms

E-Resources:

1.https://www.youtube.com/watch?v=LZP1StpYEPM
2.http://nptel.ac.in/courses/121106003/

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

I M.Tech II Semester

L	T	P	C
3	0	0	3

25MTESC21T QUANTUM TECHNOLOGIES AND APPLICATIONS

Course Objectives

1. Present core quantum principles such as superposition and entanglement without mathematical formalism.
2. Develop conceptual clarity on qubits, quantum states, and information frameworks.
3. Examine the theoretical challenges in realizing scalable quantum systems.
4. Introduce foundational ideas in quantum communication and computing.
5. Highlight applications, industrial adoption, and future research directions in quantum technologies.

Course Outcomes

Upon completion, the learner will be able to:
Explain fundamental quantum concepts conceptually.
Distinguish classical information systems from quantum information frameworks.
Identify the principal theoretical limitations in building quantum computers.
Describe the conceptual basis of quantum communication and computation.
Discuss current applications, technological trajectories, and career opportunities in the quantum domain.

UNIT 1: FOUNDATIONS OF QUANTUM THEORY AND TECHNOLOGIES (9)

Transition from classical to quantum physics. Key conceptual principles: Superposition, Entanglement, Uncertainty, Wave-particle duality. Quantum states and measurement; the role of the observer. Representative quantum systems: electrons, photons, atoms. Concept of quantization and discrete energy levels. Strategic relevance of quantum technologies.

Overview of major domains: Computing, Communication, Sensing. Global quantum initiatives: India's National Quantum Mission, EU Quantum Flagship, USA, China.

UNIT 2: CONCEPTUAL STRUCTURE OF QUANTUM INFORMATION (9)

Qubits: qualitative understanding using spin and polarization. Classical bits vs quantum bits: distinctions and implications. Quantum systems (non-engineering perspective): trapped ions, superconducting qubits, photonics. Coherence and decoherence mechanisms. Abstract notions: quantum states, measurement operators, Hilbert space—interpretation without mathematics. Entanglement and non-locality as foundational resources. Quantum vs classical information principles; philosophical considerations.

UNIT 3: BUILDING A QUANTUM COMPUTER – CHALLENGES AND REQUIREMENTS(9)

Conceptual prerequisites for functional quantum hardware. Fragility of quantum states: decoherence, noise, stability issues. Requirements: isolation, error resilience, scalability, control. Why maintaining entanglement is difficult; theoretical necessity of quantum error correction. Comparative overview of

hardware platforms (superconducting circuits, trapped ions, photonics).Current progress vs scientific constraints; conceptual view of quantum software's role.

UNIT 4: QUANTUM COMMUNICATION AND COMPUTING (9)

(Redundant explanations removed, retaining only unique themes.)Quantum vs classical communication paradigms. Essentials of Quantum Key Distribution (QKD) and its security rationale. Entanglement-enabled communication protocols. Concept of the Quantum Internet and secure global networking. Introduction to quantum computing and quantum parallelism.

Conceptual comparison of classical and quantum gate operations. Challenges: decoherence, noise, and the necessity of error correction frameworks.

UNIT 5: APPLICATIONS, INDUSTRY, AND FUTURE DIRECTIONS (9)

Application domains: Healthcare and drug discovery, Material science and chemistry, Optimization and logistics, Quantum sensing and precision timing. Case studies: IBM, Google, Microsoft, PsiQuantum. Ethical, societal, and policy considerations. Barriers to adoption: cost, skilled workforce, standards. Emerging research and career landscapes; India's strategic opportunity in the global quantum ecosystem.

TOTAL: 45 HOURS

TEXTBOOKS

1. Nielsen & Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 2010.
2. Rieffel & Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

REFERENCE BOOKS

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Kaye, Laflamme, Mosca, An Introduction to Quantum Computing, OUP, 2007.
   Scott Aaronson, Quantum Computing Since Democritus, CUP, 2013.
3. Susskind & Friedman, Quantum Mechanics: The Theoretical Minimum, Basic Books, 2014.
   Rosenblum & Kuttner, Quantum Enigma, OUP, 2011.
4. Benenti et al., Principles of Quantum Computation and Information, World Scientific, 2004.
   DST India and MeitY: Official Quantum Mission Reports, 2020 onwards.
5. Quantum Flagship EU: Roadmaps and Strategy Documents.

Online Learning Resources

1. IBM Quantum Experience & Qiskit Textbook Coursera – Quantum Mechanics and Quantum Computation (UC Berkeley) edX – Quantum Internet & Quantum Computers
2. YouTube – Quantum Computing for the Determined (Michael Nielsen)

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

I M.Tech II Semester

L	T	P	C
3	0	0	3

25MTPDD21T INTEGRATED PRODUCT DESIGN AND DEVELOPMENT

Course Educational Objectives:

1. To know the design concepts, product development planning and customer requirements
2. To generate the concept using creative problem solving methods, concept generation and testing
3. To understand product teardown, specifications, portfolios and Architecture, configurations and detailed design with prototyping
4. To acquaint DFN process and know design aspects for risk, reliability and safety and environments
5. To do industrial design, intellectual property and robust design and product development economics

UNIT – 1: PRODUCT DEVELOPMENT CONCEPTS (9)

Design Concepts: Design process – Considerations of a good design – Description of good design process – Design codes and standards. **Product Development and Planning Process**: Characteristics and challenges of product development – Concept development – Generic product development – Product development process flows –Tyco product development – Product development organizations – Organizational structure and design – Product and process cycles – Technological innovation – Structure of opportunity – Opportunity identification – Product planning process – Types of product development projects. **Identifying Customer Needs**: Process of identifying customer needs – Customer requirements.

UNIT – 2: CONCEPT SELECTION, GENERATION AND TESTING (9)

Concept Generation: Activity – Concept generation process – Creativity and problem solving – Creative thinking methods and design – Functional decomposition and synthesis – Morphological methods – Axiomatic design. **Concept Selection and Testing:** Development process – Choosing a concept – Concept screening and scoring – Decision making and evaluation – Methods for testing product concepts.

UNIT – 3: EMBODIMENT AND DETAIL DESIGN (9)

Product Teardown, Specifications, Portfolios and Architecture: Teardown process, methods and applications – Post teardown report – Benchmarking approach and support tools for benchmarking process – Product portfolios architecture – Architecture type – Platform architecture – Target Specifications – Setting the final specifications – Modularity – Implications of the architecture – Establishing the architecture – Delayed differentiation – Platform planning – Related system-level design. **Configuration and Detail Design:** Generating, analyzing and evaluating configuration design – Best practices for configuration design – Design for X – Design and manufacturing information – Final design review – Activities beyond detail design. **Prototyping:** Principles, types and technologies – Understanding prototypes and planning.

UNIT – 4: DESIGN FOR ENVIRONMENT, MANUFACTURING AND SAFETY (9)

Design for Manufacture and Environment: Cross-functional team – Overview of DFM process – Life cycles – Environmental impacts – Design for environment process. **Design for Risk, Reliability and Safety:** Classification of societal hazards – Standards – Risk assessment – Design for reliability – Causes of unreliability – Minimizing failure – FMEA – Fault tree analysis – Defects and failure modes – Potential dangers – Guidelines for design for safety – Warning labels.

UNIT – 5: INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ECONOMICS (9)

Industrial Design: Need – Impact – Industrial design process – Management of the industrial design process – Assessing the quality of industrial design. **Robust Design:** Robust design process. **Intellectual Property:** Disclosure – Process of pursuing a patent. **Product Development Economics:** Elements of economic analysis and process. **Managing Projects:** Understanding and representing tasks – Baseline project planning – Accelerating projects – Project execution – Postmortem project evaluation.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand To know the design concepts, product development planning and customer requirements	**PO1,PO2,PO3**
CO2	generate the concept using creative problem solving methods, concept generation and testing	**PO1,PO2,PO3, PO4**
CO3	Realize Product Teardown, Specifications, Portfolios and Architecture, configurations and prototyping	**PO1,PO2, PO3,PO4, PO5**
CO4	Demonstrate and classify The Design aspects for Risk, Reliability and Safety and environments	**PO1, PO2, PO3,PO6,PO7**
CO5	Do industrial design, understand intellectual property, robust design and product development economics	**PO1,PO2,PO3,PO6**

Text Books:

1. Product Design and Development, Karl T Ulrich, Steven D Eppinger and Maria C. Yang, 7/e, 2020, McGraw-Hill Education Pvt.Ltd., Noida.
2. Engineering Design, George E.Dieter and Linda C.Schmidt, 4/e, 2013, McGraw-Hill Education Pvt.Ltd., Noida.

Reference books:

1. Product Design, Kevin Otto and Kristin Wood, 1/e, 2003, Pearson Education, India.
2. Product Development, Anil Mital, Anoop Desai, Anand Subramanian and Aashi Mital, 1/e, 2007, Butterworth-Heinemann, Elsevier.
3. Integrated Product and Process Design and Development: the Product Realization Process (Special Indian Edition), Edward B. Magrab, Satyandra K. Gupta, F. Patrick McCluskey and Peter A. Sandborn, 2/e, 2010, CRC Press, Taylor & Francis Group, LLC.
4. Product Design for Engineers, Devdas Shetty, 1/e, 2016, Cengage Learning, India.
5. Introduction to Product Design and Development for Engineers, Ali Jamnia, 2018, CRC Press, Taylor & Francis Group, LLC.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	-	-	-	-	-	-	-
CO2	2	2	2	2	-	-	-	-	-	-	-	-
CO3	3	2	2	1	3	-	-	-	-	-	-	-
CO4	3	2	2	-	-	2	2	-	-	-	-	-
CO5	3	1	1	-	-	2	-	-	-	-	-	-
CO*	**2.8**	**2**	**2**	**1.5**	3	**2**	**2**	**-**	**-**	**-**	**-**	**-**

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

I M.Tech II Semester

L	T	P	C
3	0	0	3

25MTPDD22T ADDITIVE MANUFACTURING PROCESSES

Course Educational Objectives:

1. To have bird's eye view of Additive Manufacturing Processes
2. To educate students with development of additive manufacturing processes such as CAD modeling, DFAM
3. To educate students with Stereolithography (SLA), Digital Light Processing (DLP), FDM and LOM Applications
4. Selective Laser Melting (SLM) and Electron Beam Melting, Laser Engineered Net Shaping, jetting and product quality.
5. To Additive Manufacturing of Metals and Emerging Materials and applications

UNIT – 1: OVERVIEW OF ADDITIVE MANUFACTURING PROCESSES (9)

Additive V/s Conventional Manufacturing / CNC – Fundamentals and applications of rapid prototyping, tooling and manufacturing – Reverse engineering V/s rapid prototyping – Generic AM process – Development of AM technology – Use of layers – Classification of AM process – AM process chain – Basic steps for AM process – Differentiation between photopolymer system, powder based system, molten material system, solid sheets and metal system.

UNIT – 2: DEVELOPMENT OF ADDITIVE MANUFACTURING PROCESSES (9)

CAD Modeling: Data processing –STL format **–**Part orientation and support structure generation – Removal supports – Hollowing out, undercuts and inter locking features – Reduction of part and identification – Model slicing – Tool path generation – Data translation and loss **–** Customized design and fabrication for medical applications. **DFAM:** AM unique capabilities – DFAM concepts for complex geometry, integrated assemblies, customized geometry, multifunctional design and constraints – Part consolidation, redesign, structures and industrial applications – Light weight structure, optimization methods and topology. **Printing Processes:** Droplet formation technologies – Continuous and drop on demand mode – Bioplotter.

UNIT – 3: LIQUID AND SOLID BASED ADDITIVE MANUFACTURING PROCESSES (9)

Stereolithography (SLA): Polymerization materials – Process – Patterns – Vat photo polymerization process – Benefits – Applications. **Poly Jet:** Materials – Process – Process benefits – Applications. **Digital Light Processing (DLP)**: Materials – Process – Patterns – Limitations – Applications. **Fused Deposition Modeling (FDM):** Principle – Materials – Limitations – Applications. **Laminated Object Manufacturing (LOM):** Bonding process – Adhesive bonding and thermal bonding – Materials – Limitation – Application. **Ultrasonic Consolidation:** Principle – Materials and properties – Process – Applications.

UNIT – 4: POWDER BASED ADDITIVE MANUFACTURING PROCESSES (9)

Selective Laser Sintering (SLS): Process – Materials – Powder fusion mechanism – Powder handling – Applications. **Selective Laser Melting (SLM) and Electron Beam Melting (EBM):** Materials – Process – Applications. **Laser Engineered Net Shaping (LENS):** Materials – Material delivery – Process parameters – Applications. **Binder and Material Jetting:** Materials – Process –Modeling – Benefits. **Product Quality:** Support material removal, surface texture, accuracy and aesthetic improvements – Preparation for use of pattern – Property enhancement using thermal and non thermal techniques – Defects and their causes.

UNIT – 5: ADDITIVE MANUFACTURING OF METALS AND EMERGING MATERIALS (9)

Additive Manufacturing of Metals and Emerging Materials: Understanding metal for AM, art of the possible, process development, post processing, 3D metal design and printing – AM of in situ metal matrix

composites – Process-structure-property relationships and Laser-based AM of lightweight metal matrix composites – Corrosion behaviors and AM of titanium alloys for biomedical applications. **Applications:** AM application of aerospace, electronics, healthcare, defense, automotive, construction, food processing and machine tools.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Get an overview of Additive Manufacturing Processes Understand classify, analyze, ralize, demo, guild knowledge	**PO1,PO2**
CO2	Educate students with development of additive manufacturing processes such as CAD modeling, DFAM	**PO1,PO2,PO3, PO4, PO5**
CO3	Educate students with Stereolithography (SLA), Digital Light Processing (DLP), FDM and LOM Applications	**PO1,PO2**
CO4	Selective Laser Melting (SLM) and Electron Beam Melting, Laser Engineered Net Shaping, jetting and product quality.	**PO1, PO2, PO3**
CO5	Additive Manufacturing of Metals, Emerging Materials and applications	**PO1, PO2, PO3**

Text Books:

1. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping and Direct Digital Manufacturing, Ian Gibson, David W.Rosen and Brent Stucker, 2/e, 2015, Springer.
2. Additive manufacturing: Innovations, Advances, and Applications, T.S. Srivatsan and T.S. Sudarshan, Taylor & Francis Group, LLC.

Reference Books:

1. Additive Manufacturing of Emerging Materials, Bandar AlMangour, 2019, Springer International Publishing AG, Springer Nature.
2. Additive Manufacturing of Metals: From Fundamental Technology to Rocket Nozzles, Medical Implants, and Custom Jewelry, John O Milewski, 2017, Springer International Publishing AG, Springer Nature.
3. Rapid Prototyping: Principles and Applications, Chee Kai Chua, Kah Fai Leong and Chu Sing Lim 3/e, 2010, World Scientific Publishers.
4. 3D Printing and Additive Manufacturing Technologies, L. Jyothish Kumar, Pulak M. Pandey and David Ian Wimpenny, 2019, Springer Nature Singapore Pte Ltd.
5. Additive Manufacturing Handbook: Product Development for the Defense Industry, Adedeji B. Badiru, Vhance V. Valencia, and David Liu, 2017, CRC Press, Taylor & Francis Group.

CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	1	2	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-
CO*	**3**	**2.8**	**2.3**	**1**	2	**-**	**-**	**-**	**-**	**-**	**-**	**-**

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

Professional Elective - III
I M.Tech II Semester

L	T	P	C
3	0	0	3

25MTPDD23A INDUSTRIAL DESIGN AND ERGONOMICS

Course Educational Objectives:

1. To impart basic knowledge on human factors, psycho physics and Ergonomics
2. To educate students with anthropometry and workplace design of standing/sitting workers
3. To familiarize students with implications of repetitive, handling tasks and work psychology
4. To integrate design commensurate with physical, acoustics and environmental conditions alongwith various ergonomics standards
5. To educate students with fundamental of cognition, Display, controls and Human–Machine Interaction

UNIT – 1: HUMAN FACTORS ENGINEERING AND BIOMECHANICS (9)

HFE: Criteria of HFE – Human error, system reliability and testing. **Psychophysics**: Scaling, signal detection and multidimensional stimuli. **Biomechanics:** Human body anatomy, position, direction, movements, skeletal anatomy, joints, and muscle groups. **Human Body as a Mechanical System:** Postural stability – Anatomy of the spine and Lumbo-pelvic – HFE applications of standing, low back pain, muscular fatigue, psychosocial factors, physical stressors and musculoskeletal system – Tools, and processes of body as a mechanical system – Measurement of the physiological cost of work – Physiology in the workplace.

UNIT – 2: WORK PLACE DESIGN AND EQUIPMENT DESIGN (9)

Anthropometry: Physical variability – Functional anthropometry, anthropometry surveys and data – Obesity epidemic – Variability in human body size and shape – Basic HFE applications, tools, processes and system integration of anthropometry and workstation design. **Design for Standing and Sitting Workers:** Posture and movement – Fundamental aspects – Applications and effective workstation design for standing and sitting workers – Tools, processes and integration of workstation design for standing and sitting worker.

UNIT – 3: DESIGN OF REPETITIVE TASKS AND HANDLING DEVICES (9)

Repetitive Tasks: Functional anatomy and epidemiology of injury caused by repetitive work – Basic HFE applications, tools, processes and system integration of risk assessment and task design. **Design of Handling Tasks:** Functional anatomy of manual handling and load carriage – Basic HFE applications, tools, processes and system integration of design of manual handling tasks. **Work Physiology:** Muscles, structure, function and physical work capacity – Cardiovascular and respiratory system – Stress and fatigue – Applications, tools, processes and integration of work capacity and recovery – Industrial applications of physiology.

UNIT – 4: ENVIRONMENTAL DESIGN (9)

Physical and Visual Environment: Thermoregulation and mechanisms – Work in hot and cold climates – Protection against extreme climates – Comfort, ventilation and climate – Tools, processes and system integration of working in hot and cold climates – Fundamentals, applications, tools, processes, design factors and integration of vision and lighting. **Hearing, Sound and Vibration:** Knowledge on hearing and sound – Design of the acoustic environment – Industrial noise control and communication – Hearing protection – Measurement of sound and vibration – Exposure to shock – Nonauditory effects. **Ergonomic Standards:** PLIBEL, NIOSH, DMQ, RULA, REBA, SI, Posture check using PDA, MFA, LMM and OCRA.

UNIT – 5: HUMAN-MACHINE INTERACTION AND COGNITIVE ERGONOMICS (9)

Cognition: Human memory, decisions, cognitive workload, task and analysis. **Psychomotor Skills:** Donders' RT – Learning and skill acquisition – Manual, feedback and voice control. **Design of Displays and Controls:** Interaction at the interface – Design of visual and auditory displays – Design of controls –

Voice controls – Virtual environments. **Human–Machine Interaction:** Mental workload, memory enhancements, human error and prevention – GOMS – Accidents and safety – Visual, auditory and multimedia displays – Virtual reality and emotions in human – Macroergonomics – Psychosocial factors – Litigation.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand design aspects based on human factors, bio-mechanics, psycho physics and Ergonomics	**PO1,PO2,PO3**
CO2	Acquaint with anthropometry and workplace design of standing/sitting workers	**PO1,PO2,PO3, PO4**
CO3	Familiarize the tools, processes and design techniques for repetitive handling tasks and applications related to work psychology	**PO1,PO2, PO3,PO4,PO5**
CO4	Integrate design tools, processes and methods commensurate with physical acoustics and environmental conditions inline with various ergonomics standards	**PO1, PO2, PO3,PO4,PO6,PO7**
CO5	Apply design in the field of cognition, Display, controls and Human–Machine Interaction including litigation.	**PO1,PO2,PO3,PO6**

Text Books:

1. Introduction to Human Factors and Ergonomics, R. S. Bridger, 4/e, 2018, CRC Press - Taylor & FrancisGroup.
2. Human Factors Engineering and Ergonomics - A Systems Approach, Stephen J. Guastello, 2/e, 2014,CRC Press - Taylor & Francis Group.

Reference books:

1. Principles of Biomechanics, Ronald L. Huston, 2009, CRC Press - Taylor & Francis Group.
2. Introduction to Ergonomics, R.S.Bridger, 2/e, 2003, Taylor & Francis Group.
3. Handbook of Human Factors and Ergonomics Methods, Neville Stanton, Alan Hedge, Karel Brookhuis,Eduardo Salas and Hal Hendrick, 2005, CRC Press LLC.
4. Introduction to Human Factors and Ergonomics for Engineers, Mark R. Lehto and James R. Buck, 2008,Taylor & Francis Group, LLC.
5. Human Factors and Ergonomics in Consumer Product Design: Uses and Applications, WaldemarKarwowski, Marcelo M. Soares and Neville A. Stanton, 2011, Taylor and Francis Group, LLC.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	-	-	-	-	-	-	-	-	-
CO2	3	2	3	2	-	-	-	-	-	-	-	-
CO3	3	3	3	2	2	-	-	-	-	-	-	-
CO4	3	2	3	3	-	2	2	-	-	-	-	-
CO5	3	3	3	-	-	2	-	-	-	-	-	-
CO*	**3**	**2.6**	**2.8**	**2.3**	2	**2**	**2**	**-**	**-**	**-**	**-**	**-**

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

I M.Tech II Semester

L	T	P	C
3	0	0	3

25MTPDD23B MARKETING RESEARCH FOR NEW PRODUCT

Course Educational Objectives:

1. To introduce students with focus on nature of marketing research
2. To impart basic concepts of exploratory research design through data collection
3. To elaborate basic concepts on measurement and scaling of marketing research
4. To elaborate basic concepts frequency distribution and data analysis in marketing research
5. To be familiarized the brand management in new product development

UNIT – 1: INTRODUCTION TO MARKETING RESEARCH (9)

Introduction: Research process, classification, investment and global marketing. **Defining the Marketing Research:** Importance, components, environmental context, research proposal and approach – Discussions with decision makers and industry experts – Marketing decision, research problem, theoretical framework and analytical model. **Nature of Marketing Research:** Divisions, marketing information system, types of data, evaluating proposals, ethical considerations, researchers' obligations, use of internet in marketing research and non-response issue in marketing research – Case studies. **Planning the Research Project:** Marketing problems, uncertainty in decisions, research study and plan – Use of PERT in planning research.

UNIT – 2: EXPLORATORY RESEARCH DESIGN (9)

Research Design: Classification, exploratory, descriptive and causal research – Sources of error in research designs. **Secondary Data Collection:** Classification, evaluating secondary data, classification of online databases and syndicated sources of secondary data – Internal secondary data and analytics. **Qualitative Research:** Nature and approaches – Focus group – Interviewing and projective techniques – Qualitative research in data analysis – Survey and quantitative techniques – Causal research design and experimentation.

UNIT – 3: MEASUREMENT AND SCALING (9)

Measurement and Scaling: Fundamentals, comparative and non-comparative scaling – Scale evaluation – Scaling technique. **Questionnaire Design:** Design process, type of information and interviewing – Question structure, wording, form and layout – Pilot-testing – Summarizing the questionnaires. **Sampling:** Sampling distribution, sample size, confidence interval approach, calculation of response and non-response rates. **Survey Fieldwork:** Data-collection process and selection – Training, recording, supervising and evaluating of fieldworkers – Online research, social media and mobile research. **Data Integrity:** Integrity process, checking, editing, coding, transcribing and cleaning the data – Statistically adjusting data and analysis.

UNIT – 4: FREQUENCY DISTRIBUTION AND DATA ANALYSIS (9)

Frequency Distribution: Hypothesis testing, cross-tabulations, parametric and non-parametric tests. **ANOVA:** One-way and n-way ANOVA – Analysis of covariance – Issues in interpretation – Non-metric and multivariate ANOVA. **Regression:** Product moment, partial and non-metric correlation – Regression, bivariate regression and multiple regression – Multicollinearity, relative predictors, cross-validation and regression with dummy variables. **Factor and Cluster Analysis:** Factor analysis model – Conducting factor and cluster analysis – Non-hierarchical and two step clustering – Clustering variables. **Multidimensional Scaling:** Concepts in MDS – Conducting MDS – Scaling preference data – Concepts in conjoint analysis.

UNIT – 5: BRAND MANAGEMENT (9)

Brand Management: Brand identity – Brand architecture – Brand portfolio management – Building brands – Managing brand assets – Brand equity – Brand audit – Brand research – Market uncertainties and branding decisions. **Brand Approaches:** Economic approach – Identity approach – Consumer-based approach – Personality approach – Relational approach – Community approach – Cultural approach.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the basic concepts of marketing research for new product development	**PO1,PO2, PO6**
CO2	Analyze the various exploratory data collection for research design	**PO1,PO2,PO6, PO7**
CO3	Select the various measurement and scaling techniques for marketing research	**PO1,PO6,PO7**
CO4	Acquire knowledge on frequency distribution and data analysis for marketing research	**PO1, PO6, PO7**
CO5	Identify the different brand management approaches for the new product	**PO1, PO7**

Text books:

1. Marketing Research, Naresh K. Malhotra, Daniel Nunan and David F. Birks, 5/e, 2017, Pearson Education Ltd.,
2. Essentials of Marketing Research, Tony Proctor, 4/e, 2005, Pearson Education Limited

Reference books:

1. Essentials of Marketing Research, Joseph F. Hair, Mary Celsi,David J. Ortinau and Robert P Bush, 4/e, 2017, McGraw-Hill Education.
2. Market Research - The Process, Data, and Methods Using Stata, Erik Mooi, Marko Sarstedt & Irma Mooi-Reci, 1/e, 2018, Springer Nature Singapore Pte Ltd.,
3. Brand Management - Research, Theory and Practice, Tilde Heding, Charlotte F. Knudtzen and Mogens Bjerre, 2/e, 2008, Routledge, Taylor & Francis Group
4. Marketing Research : Tools & Techniques, Nigel Bradley, 3/e, 2013, Oxford University Press, United Kingdom.
5. Essentials of Marketing Research : Putting Research Into Practice, Kenneth E Clow and Karen E James, 2014, SAGE Publications, Inc.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	2	-	-	-	-	-	-
CO.2	3	2	-	-	-	2	2	-	-	-	-	-
CO.3	3	-	-	-	-	2	2	-	-	-	-	-
CO.4	3	-	-	-	-	2	2	-	-	-	-	-
CO.5	3	-	-	-	-	-	2	-	-	-	-	-
CO*	**3**	**2**	-	-	-	2	2	-	-	-	-	-

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

I M.Tech II Semester

L	T	P	C
3	0	0	3

25MTPDD23C DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS

Course Educational Objectives:

1. To introduce the different components of hydraulic systems and its design and selection procedures.
2. To formulate a thorough understanding on the need and use of various control and regulating elements in hydraulic systems.
3. To enable them to independently design hydraulic circuits for industrial applications.
4. To expose them to the different components of pneumatic systems and enable them to design simple pneumatic systems.
5. To make them understand the need to integrate electronics and develop low cost systems and provide solution to simple industrial applications

UNIT – 1: FLUID POWER GENERATING/UTILIZING ELEMENTS (9)

Need for Automation – Hydraulic power generators – Hydraulic and pneumatic comparison – Basics of hydraulic and pneumatic principles – Hydraulic pumps and motor gears, vane, piston pumps – Drive characteristics – Selection and specification of pumps, pump characteristics – Selection of motor and valves – Linear and rotary actuators with selection, specification and characteristics – Hydrostatic drives, types, and selection – Hydraulic and pneumatic losses – Linear actuator with types and mounting details, cushioning – Power packs with construction – Reservoir capacity, heat dissipation, accumulators – Standard circuit symbols, circuit (flow) analysis – ISO symbols for fluid power elements – Selection criteria.

UNIT – 2: CONTROL AND REGULATION ELEMENTS (9)

Direction flow and pressure control valves – Relief valves – Non-return and safety valves – Actuation systems – Methods of actuation – Types, sizing of ports – Pressure and temperature compensation – Overlapped and under lapped spool valves – Operating characteristics – Proportional electro hydraulic servo valves – Different types of servo valves with characteristics and performance.

UNIT – 3: HYDRAULIC SYSTEMS AND CIRCUITS (9)

Reciprocation, quick return, sequencing, synchronizing circuits – Accumulator circuits – Industrial circuits – Press circuits – Hydraulic milling machine, grinding, planning and copying – Forklift – Earth mover circuits design methodology – Design and selection of components – Safety and emergency mandrels – Cascade method.

UNIT – 4: PNEUMATIC SYSTEMS AND CIRCUITS (9)

Pneumatic fundamentals – Control elements, position and pressure sensing – Pneumatic equipments – Selection of components – Design calculations – Logic circuits – Switching circuits – Fringe conditions modules and the integration – Sequential circuits – Cascade methods – Mapping methods – Step counter method – Compound circuit design – Combination circuit design – Typical industrial hydraulic circuits- Design methodology – Truth table – Karnaugh – Veitch (KV) maps method – Combinational and logic circuit.

UNIT – 5: ELECTRONIC CONTROL OF HYDRAULICS & PNEUMATIC CIRCUITS (9)

Electrical control of pneumatic circuits – Use of relays, counters, and timers – Ladder diagrams – Use of microprocessor in circuit design – Use of PLC in hydraulic and pneumatic circuits – Fault finding application – Fault finding in hydro pneumatic circuits – Use of microprocessors for sequencing – PLC, low cost automation – Robotic circuits applications in hydraulics and pneumatics.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Design and select appropriate pumps in industries based on need.	**PO1,PO2,PO3, PO4,PO5**
CO2	Select correct sizing and rating of control elements in hydraulics.	**PO1,PO2,PO3, PO4,PO5**
CO3	Design basic circuits (hydraulic) for industrial applications.	**PO1,PO2,PO3, PO4,PO5**
CO4	Design basic pneumatic circuits for industrial applications.	**PO1,PO2,PO3, PO4,PO5**
CO5	Identify and provide solution for troubleshooting and design low cost automation for industrial application.	**PO1,PO2,PO3, PO4,PO5**

Text Books:

1. Fluid Power with Applications, Anthony Esposito, 7/e, 2013, Pearson Education, India.
2. Fluid Power: Generation, Transmission and Control, Jagadeesha T and Thammaiah Gowda, 2019, Wiley India.

Reference Books:

1. Hydraulic Fluid Power: Fundamentals, Applications, and Circuit Design, Andrea Vacca and Germano Franzoni, 2020, Wiley
2. Fluid Power Engineering, M. Galal Rabie, 2009, McGraw-Hill Companies, Inc.
3. Hydraulic and Pneumatic Controls, Shanmugasundaram.K, 2006, S.Chand & Co.
4. Oil Hydraulics Systems- Principles and Maintenance, Majumdar S.R., 1/e, 2001, Tata McGraw-Hill.
5. Hydraulics and Pneumatics: A Technician's and Engineer's Guide, E.A. Parr, 3/e, 2011, Butterworth-Heinemann is an imprint of Elsevier

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	3	2	1	-	-	-	-	-	-	-
CO.2	2	2	3	2	1	-	-	-	-	-	-	-
CO.3	3	2	3	2	1	-	-	-	-	-	-	-
CO.4	3	2	3	2	1	-	-	-	-	-	-	-
CO.5	3	2	3	2	1	-	-	-	-	-	-	-
CO*	**2.8**	**2**	**3**	**1.8**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Professional Elective - IV

I M.Tech II Semester

L	T	P	C
3	0	0	3

25MTPDD24A PRODUCT INNOVATION AND MANAGEMENT

Course Educational Objectives:

1. Applying the principles of innovation management in design thinking.
2. Applying the principles of innovation management in new product research.
3. Applying the principles of innovation management in new product design.
4. Applying the various innovation principles and process in new product development.
5. Applying the various marketing principles in product launch management.

UNIT – 1: CONCEPT OF INNOVATION MANAGEMENT (9)

Innovation Management: Importance, models, DUI and innovation as a management – Innovation in wider context, roles and waves in innovation – Crowdsourcing ideas, frugal innovation, diffusion theories, adopting new products, innovation in market – Entrepreneurship and innovation, technological entrepreneurship – Dilemma of innovation, dynamic capabilities, uncertainty, innovation projects, organizational characteristics, structures and industrial firms – Role of individual, IT and management in innovation. **Process Innovation:** Operations, process design and innovation – Organization, suppliers and lean innovation. **Intellectual Property:** Trade secrets, patents, trademarks, brands, infringement, registered designs and copyright.

UNIT – 2: MANAGING TECHNOLOGY AND RESEARCH AND DEVELOPMENT (9)

Organizational Knowledge: Technology trajectories, knowledgebase, learning organization, competition, innovation and business strategies. **Strategic Alliances:** Octopus strategy, complementary capabilities, forms of strategic alliances, licensing deal, risks, limitation, trust in strategic alliances and game theory to analyze strategic alliances. **Managing R&D:** Management and industrial context – Investment – Classifying R&D, business strategy, allocation of funds, expenditure, strategic pressures and decision-making –Technology management, acquisition of external technology, innovation process, effective R&D and valuating projects. **Technology Transfer:** Open innovation, models of technology transfer, absorptive capacity, and inward transfer of technology, limitations and barriers to technology transfer.

UNIT – 3: MANAGING THE NEW PRODUCT (9)

Business Models: Business plan and models – Designing a business model and licensing. **Product and Brand Strategy:** Product planning, strategy, competitive environment, differentiation and positioning, managing brands, strategy, market entry, continuing improvement, withdrawing products and mature products. **Market Research:** Product testing and techniques, discontinuous of new products, technology-intensive products, winning new markets, customer ignorance and challenge for senior management.

UNIT – 4: NEW PRODUCT DEVELOPMENT PROCESS (9)

New Product Development: Innovation and NPD – NPD strategy, defining new product, NPD theories, models of NPD, service development models and innovation. **NPD Process:** NPD as projects, valley of death, key activities, NPD across different industries, organizational structures, cross-functional teams, marketing/R&D interface and attrition rate. **Packaging:** Principles, characteristics, wrapping, packaging, product rejuvenation, NPD through packaging, pack size variation, packaging systems, retailer acceptance and revitalizing mature.

UNIT – 5: PRODUCT LAUNCH MANAGEMENT (9)

Launch Planning and Management: Strategic givens, goals and platform decisions – Market decision, product positioning, unique value, branding and packaging – Launch cycle, tactics, alliances, A-T-A-R, market testing and methods – Pseudo, controlled and full sale methods – Launch system, plan, effective metrics, knowledge creation and product failure. **Public Policy Issues:** Cycle of concerns, business attitudes, product liability and recall, attempts, product piracy and worthy, morality, monopoly and underlying issues.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the principles of innovation management in design thinking.	**PO1,PO2,PO3**
CO2	Classify and analyze various principles of innovation management in new product research.	**PO1,PO2,PO3, PO4**
CO3	Understand the principles of innovation management in new product design.	**PO1,PO2, PO3,PO4**
CO4	Demonstrate the various innovation principles and process in new product development.	**PO1, PO2, PO3,PO4**
CO5	Demonstrate the various marketing principles in product launch management.	**PO1,PO2,PO3**

Text Books:

1. Innovation Management and New Product Development, Paul Trott, 6/e, 2017, Pearson Education Ltd.,
2. New Products Management, Merle Crawford and Anthony Di Benedetto, 11/e, 2020, McGraw-Hill Education Pvt.Ltd., Noida.

Reference books:

1. Handbook of New Product Development Management, Christoph H. Loch and Stylianos Kavadias, 2008, Elsevier Ltd.
2. Managing Innovations and New Product Development: Concepts and Cases, Mukesh Chaturvedi, Aseem Kumar and Manmohan Rahul, 2009, PHI Learning, India.
3. Innovating in Product/Process Development - Gaining Pace in New Product Development, Mikel Sorli and Dragan Stokic, 2009, Springer-Verlag London Limited.
4. Knowledge Perspectives of New Product Development: A Comparative Approach, Dimitris G. Assimakopoulos, Elias G. Carayannis and Rafi q Dossani, 2012, Springer Science and Business Media, New York.
5. Strategic Management of Technological Innovation, Melissa Schillings and Ravi Shankar, 6/e, 2019, McGraw-Hill Education Pvt.Ltd.,

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	2	-	-	-	-	-	-	-	-	-
CO.2	2	2	2	1	-	-	-	-	-	-	-	-
CO.3	3	2	2	1	-	-	-	-	-	-	-	-
CO.4	3	2	2	1	-	-	-	-	-	-	-	-
CO.5	3	1	1	-	-	-	-	-	-	-	-	-
CO*	**2.8**	**2**	**1.8**	**1**	-	-	-	-	-	-	-	-

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

I M.Tech II Semester

L	T	P	C
3	0	0	3

25MTPDD24B ADVANCED MECHANISMS IN DESIGN

Course Educational Objectives:

1. To learn the concepts of gross motion capability and develop multi loop kinematic principles.
2. To study complex mechanisms to determine velocity and acceleration of output links.
3. To learn to locate inflection points and to draw the inflection circle.
4. To study the synthesis of planar mechanisms.
5. To design of driven mechanisms and cam mechanisms.

UNIT – 1: KINEMATIC ANALYSIS (9)

Kinematic Analysis: Classifications of mechanisms – Components of mechanisms – Mobility analysis – Formation of one D.O.F. – Multi loop kinematic chains – Network formula – Gross motion concepts – Position Analysis – Vector loop equations for four bar, slider crank, inverted slider crank, geared five bar and six bar linkages – Analytical methods for velocity and acceleration – Four bar linkage jerk analysis – Plane complex mechanisms – Auxiliary point method – Spatial RSSR mechanism – Denavit-Hartenberg parameters.

UNIT – 2: CURVATURE THEORY AND SPATIAL MECHANISMS (9)

Curvature Theory: Fixed and moving centrodes – Inflection points and inflection circle – Euler Savary equation – Graphical constructions – Cubic of stationary curvature – Four bar coupler curve-cusp – Crunode – Coupler driven six-bar and straight line mechanisms. **Spatial Mechanisms:** Spatial posture, velocity and acceleration – Euler angles – Denavit-Hartenberg parameters – Transformation-matrix posture – Matrix velocity, acceleration and generalized mechanism – Topological arrangements of robotic arms – Forward and inverse kinematics – Inverse velocity and acceleration – Robot actuator force analysis.

UNIT – 3: SYNTHESIS OF LINKAGES (9)

Synthesis of Four Bar Mechanisms: Types, number and dimensional synthesis – Kinematic synthesis – Precision points – Associated linkage concept – Linkage synthesis method – Dimensional synthesis – Function generation, path generation and motion generation – Graphical methods – Pole technique – Inversion technique – Point position reduction – Two, three and four position – Synthesis of four-bar mechanisms – Analytical methods – Freudenstein's equation-Bloch's synthesis. **Coupler Curve:** Cognate linkages – Parallel motion linkages – Design of six bar mechanisms – Geared five bar mechanism.

UNIT – 4: CAM MECHANISMS (9)

Cam Design: Classification of cams and followers – Displacement diagrams and layout of cam profiles – Kinematic coefficients of follower and cam motions – High-speed cams – Plate cam with reciprocating flat-face follower and roller follower – Rigid and elastic cam systems – Dynamics of an eccentric cam – Effect of sliding friction – Dynamics of disk cam with reciprocating roller follower – Dynamics of elastic cam systems – Unbalance, spring surge, and windup – Critical path motion – Sizing the cam – Practical design of cam.

UNIT – 5: DESIGN OF DRIVE MECHANISMS (9)

Spur Gears: Law of toothed gearing – Involute properties – Interchangeable gears – Gear-tooth action, interference, undercutting, contact ratio, varying centre distance and involutometry – Parallel-axis gear trains Analysis of epicyclic gear trains – Tabular analysis. **Helical, Bevel and Worms Gears:** Parallel-axis helical gears – Helical gear tooth relations and proportions – Herringbone gears – Crossed-axis helical gears – Straight-tooth bevel gears – Tooth proportions – Bevel gear epicyclic trains – Crown and face gears, spiral bevel gears, hypoid gears worms and worm gears – Summers and differentials – All-wheel drives.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Determine velocity and acceleration of complex mechanisms.	**PO1,PO2,PO3, PO4**
CO2	Evaluate inflection points and draw the inflection circle.	**PO1,PO2,PO3, PO4**
CO3	Apply the concepts of gross motion capability for spatial mechanisms.	**PO1,PO2,PO3, PO4**
CO4	Design the cam mechanisms.	**PO1,PO2,PO3, PO4**
CO5	Design of driven mechanisms and cam mechanisms.	**PO1,PO2,PO3, PO4**

Text Books:

1. Theory of Machines and Mechanisms, John J. Uicker Jr, Gordon R. Pennock & Joseph E. Shigley, SI Edition, 3/e, 2009, Oxford University Press.
2. Kinematics and Dynamics of Machinery, Robert L Norton, 1/e, 2009, Tata McGraw-Hill Education Pvt.Ltd.

Reference Books:

1. Theory of Mechanisms and Machines, Amitabha Ghosh and Asok Kumar Mallik, 3/e, 2008, East-West Press Pvt Ltd.
2. Theory of Machines and Mechanisms, S.S.Rattan, 5/e, 2019, Tata McGraw-Hill Education Pvt.Ltd., Noida.
3. Theory of Machines, Thomas Bevan, 3/e, 2009, Pearson Education, New Delhi.
4. Theory of Machines, Sadhu Singh, 3/e, 2011, Pearson Education, New Delhi.
5. Theory of Machines, PL. Ballaney, 25/e, 2011, Khanna Publishers, New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	3	2	-	-	-	-	-	-	-	-
CO.2	3	2	3	2	-	-	-	-	-	-	-	-
CO.3	3	2	3	2	-	-	-	-	-	-	-	-
CO.4	3	2	3	2	-	-	-	-	-	-	-	-
CO.5	3	2	3	2	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

I M.Tech II Semester

L	T	P	C
3	0	0	3

25MTPDD24C INTEGRATED DESIGN AND MANUFACTURING

Course Educational Objectives:

1. To provide the overview of evolution of automation and CIM.
2. To understand the various Automation tools include various material handling system and its Principles.
3. To train students to apply group technology and FMS.
4. To familiarize the computer aided process planning in manufacturing.
5. To introduce to basics of data transaction, information integration and control of CIM.

UNIT – 1: EVOLUTION OF COMPUTER INTEGRATED MANUFACTURING (9)

Introduction to CAD, CAM, CAD/CAM and CIM – Evolution of CIM – CIM wheel and cycle – Production concepts and mathematical models – Simple problems in production models – CIM hardware and software – Major elements of CIM system – Three step process for implementation of CIM – Computers and computer networks in CIM – The future automated factory – Management and Impact of CIM on personnel.

UNIT – 2: AUTOMATED MANUFACTURING SYSTEMS (9)

Automated production line – System configurations, work part transfer mechanisms – Fundamentals of automated assembly system – System configuration, part delivery and workstations – Design for automated assembly – Material handling equipments and system design – Principles of material handling – Conveyor systems types and operations – Types of AGVs and its applications – Vehicle guidance technology – Vehicle management and safety – Storage system performance – Storage location strategies – Conventional storage methods and equipments – Automated storage/retrieval system – Carousel storage system – Deadlocks in automated manufacturing systems – Petrinet models – Applications in dead lock avoidance – Smart manufacturing – Industry 4.0 – Digital manufacturing – Virtual manufacturing

UNIT – 3: GROUP TECHNOLOGY AND FMS (9)

Part families – Visual -parts classification and coding – Production flow analysis – Grouping of parts and machines by rank order clustering method – Benefits of GT – Case studies. FMS components, layout configurations and workstations – Computer control systems – FMS planning and implementation issues – Architecture of FMS – Flow chart showing various operations in FMS – Machine cell design – Composite part concept, Holier method, key machine concept – Quantitative analysis of FMS – Bottleneck model – Simple and complicated problems – Extended Bottleneck model – Sizing the FMS – FMS applications.

UNIT – 4: PROCESS PLANNING (9)

Process planning – Activities in process planning – Information's required from design to process planning – Classification of manufacturing processes – Selection of primary manufacturing processes – Sequencing of operations according to Anteriorities – Forming of Matrix of Anteriorities – Case study – Typical process sheet – Case studies in manual process planning – Computer aided process planning – Process planning module and data base – Variant process planning – Two stages in VPP – Generative process planning – Flow chart showing various activities in generative PP – Semi generative process planning.

UNIT – 5: TYPES OF PROCESS CONTROL AND AUTOMATIC DATA CAPTURE (9)

Introduction to process model formulation – Linear feedback control systems – Optimal control – Adaptive control –Sequence control and PLC – Computer process control – Computer process interface – Interface hardware – Computer process monitoring – Direct digital control – Supervisory computer control – Overview of automatic identification methods – Bar code technology – Automatic data capture technologies.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the basics of computer aided engineering.	**PO1,PO2,PO3, PO4**
CO2	Choose appropriate automotive tools and material handling systems.	**PO1,PO2,PO3, PO4**
CO3	Understand the overview of group technology, FMS and automation identification methods.	**PO1,PO2,PO3, PO4**
CO4	Design using computer aided process planning for manufacturing of various components.	**PO1,PO2,PO3, PO4**
CO5	Acquire knowledge in computer process control techniques.	**PO1,PO2,PO3, PO4**

Text Books:

1. Automation, Production Systems and Computer-Integrated Manufacturing, Mikell.P.Groover, 4/e, 2016, Pearson Education, New Delhi.
2. CAD/CAM, Mikell.P.Groover and Emory W Zimmers, 1/e, 2003, Pearson Education, New Delhi.

Reference Books:

1. CAD/CAM: Theory & Practice, Ibrahim Zeid and R Sivasubramanian, 2/e, 2015, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. CAD/CAM/CIM, V.Raju, S.Subramanyam, P.Radhakrishnan, 3/e, 2007, New Age International (P) Ltd, Publishers, New Delhi.
3. CAD/CAM-Principles and Applications, P.N. Rao, 3/e, 2010, Tata McGraw-Hill Education Pvt. Ltd., Noida.
4. Computer Integrated Manufacturing, James A. Regh and Henry W. Kreabber, 3/e, 2005, Prentice Hall of India Pvt. Ltd., New Delhi.
5. Computer-integrated Manufacturing: Automation in Manufacturing, R. Panneerselvam, P. Senthilkumar and P. Sivasankaran , 1/e, 2020, Cengage Learning, India.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	3	2	-	-	-	-	-	-	-	-
CO.2	3	2	3	2	-	-	-	-	-	-	-	-
CO.3	3	2	3	2	-	-	-	-	-	-	-	-
CO.4	3	2	3	2	-	-	-	-	-	-	-	-
CO.5	3	2	3	2	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

I M.Tech II Semester

L	T	P	C
0	0	4	2

25MTPDD26L PRODUCT DESIGN AND DEVELOPMENT LAB

Course Educational Objectives:

1. To familiarize the students with part programming for various operations in CNC machine tools and operations in CNC.
2. To provide exposure to develop digital and physical prototype models using RP machine / clay models of a new product / existing product.

List of Experiments:

1. Study of CNC machines and part programming.
2. Part programming exercise on turning operations.
3. Part programming exercise on milling operations.
4. Part programming exercise on drilling operations.
5. Experiments on CNC lathe machine: Facing, turning, step, and tapper tuning operations.
6. The student have to develop digital and physical prototype models using rapid prototype / 3D printing machine / clay models of a new product / existing product with enhanced feature involving the following areas:
    a. Automotive components
    b. Tool and die components
    c. Press tool components
    d. Consumer product
    e. Injection molded products and etc.,

Note: The fabricated models may be in the form of rapid prototype models, clay models, sheet metal models or cardboard models etc…

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Acquire knowledge in computer numerical Control machines for turning, drilling and milling operations; develop digital and physical prototype models using RP/ 3D printer.	**PO1**
CO2	Analyze part programming/prototype development and offer an optimum problem solutions	**PO2**
CO3	Study the part and design/select/develop tooling and methods for the parts	**PO3**
CO4	Identify different programming/tooling techniques to produce complex shapes	**PO4**
CO5	Manufacture simple parts using CNC/RP machines and parameters verified by standard metrology instruments	**PO5**
CO6	Follow the ethical principles in conducting the experiments	**PO8**
CO7	Perform Experiments individually and also a team to complete the work	**PO9**
CO8	Communicate in verbally or in written form their understanding about the experiments	**PO10**
CO9	Continue updating their skill related to CNC Machine Tools and RP/3D printing machines for various applications during their life time	**PO12**

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-
CO7	-	-	-	-	-	-	-	-	3	-	-	-
CO8	-	-	-	-	-	-	-	-	-	3	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**3**	**3**	-	-	**3**	**3**	**3**	-	**3**

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

I M.Tech II Semester

L	T	P	C
0	0	4	2

25MTPDD27L PRODUCT TESTING AND MULTIBODY BODY DYNAMICS LAB

Course Educational Objectives:

1. To study and acquire knowledge on Product Testing, multibody dynamics and their applications.

List of Experiments:

Product Testing lab:

1. Tension test on mild/high yield strength deformed bars.
2. (a) Compression test (b) Torsion test (c) Spring test (d) Impact test
3. b) Brinell's and Rockwells hardness tests.
4. Load-deflection test.

Multibody Body Dynamics Lab:

1. Determination of mass moment of inertia of axisymmetric bodies using turn table apparatus.
2. Motorized gyroscope – Study of gyroscopic effect and couple.
3. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
4. Cams – Cam profile drawing, motion curves and study of jump phenomenon.
5. Single degree of freedom spring mass system – determination of natural frequency and verification of laws of springs – damping coefficient determination.
6. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
7. a) Transverse vibration of Free-Free beam – with and without concentrated masses. b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies. c) Determination of transmissibility ratio using vibrating table.
8. Study of Balancing of rotating masses and reciprocating masses.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Understand the concept of product testing and multibody dynamics	**PO1**
CO2	Explain the practical knowledge about the elements and techniques involved in the product testing and multibody dynamics	**PO2**
CO3	Describe the parameter of product testing under various loading conditions.	**PO3**
CO4	Determine the material properties and dynamic mechanical parameters.	**PO4**
CO5	Determine material properties and dynamic mechanical parameters of standard testing and multibody equipments.	**PO5**
CO6	Follow the ethical principles while doing the experiments	**PO8**
CO7	Do the experiments effectively as an individual and as a team member in a group.	**PO9**
CO8	Communicate verbally and in written form pertaining to results of the experiments	**PO10**
CO9	Continue updating their skill related to product testing and multibody dynamics in future.	**PO12**

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-
CO7	-	-	-	-	-	-	-	-	3	-	-	-
CO8	-	-	-	-	-	-	-	-	-	3	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

Audit Course - II

I M.Tech II Semester

25MTMAC21A	PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0

Course Objectives:

1. To enable the students to understand the aims, rationale, policy background, and conceptual frameworks in pedagogy, curriculum, and teacher education research.
2. To develop an understanding of diverse pedagogical practices
3. To make them learn the methodologies for assessing the effectiveness of pedagogical practices and teacher education models.
4. To enable them to learn professional development strategies, including peer support, community engagement, and alignment with curriculum and assessment.

Course Outcomes(CO):Students will be able to

1. Define and explain key concepts, frameworks, and methodologies in pedagogy and teacher education research.
2. Critically analyze pedagogical practices used in diverse classroom settings, with reference to teacher education and curriculum design.
3. Evaluate the effectiveness of pedagogical approaches using quality assessment tools and theory of change models.
4. Apply evidence-based strategies to improve classroom practices, curriculum alignment, and teacher professional development.
5. Identify and address barriers to learning through innovative pedagogical strategies.
6. Design and propose research studies that contribute to filling gaps in pedagogy, curriculum, and teacher education, with focus on dissemination and impact.

UNIT -I	**Foundations of Pedagogy**	

Introduction to pedagogy and its importance in education - Historical and philosophical foundations of pedagogy - Theories of learning and teaching (behaviorist, cognitive, constructivist) - Role of pedagogy in shaping educational practices - Role of technology in modern pedagogy (ICT, e-learning, blended learning)

UNIT - II	**Teaching-Learning Processes**	

Understanding the teaching-learning process - Lesson planning and curriculum design - Strategies for effective teaching and learning (expository, collaborative, experiential) - Use of technology to enhance teaching-learning processes (multimedia, simulations, gamification)

UNIT - III	**Technology Integration in Education**	

Educational technology and system design - Instructional design models (ADDIE, ASSURE, Dick and Carey Model) - Emerging trends in e-learning (social learning, MOOCs, mobile learning) - ICT tools for teaching and learning (Learning Management Systems, online resources)

UNIT - IV	**Pedagogy and Assessment**	

Pedagogy, pedagogical analysis, and assessment - Types of assessment (placement, formative, diagnostic, summative) - Technology-based assessment tools (online quizzes, polls, discussions) - Rubrics for self and peer evaluation- Reflective Practices

UNIT - V	**Contemporary Issues and Trends**	

Inclusive education and technology (assistive technology, accessibility) - Change management and innovation in education - Quality assurance and evaluation in education (TQM, Six Sigma) - Future trends in pedagogy and technology (AI, AR, VR in education) - Personalized learning and adaptive teaching

Textbooks

1. Alexander, R. J. *Essays on Pedagogy*. Routledge, 2008.
2. Shulman, L. S. *The Wisdom of Practice: Essays on Teaching, Learning, and Learning to Teach*. Jossey-Bass, 2004

Reference Books

1. *Teaching for the Future: Effective Teacher Education and Pedagogical Practices*. OECD Publishing., 2021
2. Fullan, M., & Edwards, M. *System Change in Education: Sustainability and Impact*. Routledge, 2022.
3. Coe, R., Rauch, C., Kime, S., & Singleton, D. *Great Teaching Toolkit: Evidence Review*. Evidence Based Education., 2020
4. Zeichner, K. M. *The Struggle for the Soul of Teacher Education*. Routledge, 2024
5. UNESCO. *Global Education Monitoring Report: Pedagogy, Teachers and Learning*. UNESCO Publishing, 2024
6. Hattie, J. *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement*. Routledge., 2009
7. Darling-Hammond, L. *Teacher Education Around the World: What Can We Learn from International Practice?* Routledge, 2007

Online Resources

- **UNESCO Education Resources** – https://www.unesco.org/education
- **OECD Education and Skills** – https://www.oecd.org/education
- **ERIC (Education Resources Information Center)** – https://eric.ed.gov (peer-reviewed papers, reports).
- **World Bank Education** – https://www.worldbank.org/en/topic/education (research reports on teacher development in developing countries).
- **NPTEL/SWAYAM MOOCs** – Teacher education and pedagogy-focused courses.
- **Google Scholar Alerts** – set alerts for "pedagogical practices", "teacher education", "curriculum research" for the latest academic papers.

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

I M.Tech II Semester

25MTMAC21B	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L	T	P	C
		2	0	0	0

Course Objectives: This course will enable students:

- To develop students' self-awareness by identifying their strengths, weaknesses, opportunities, and challenges (SWOC analysis).
- To enable students to understand and apply the principles of emotional intelligence and effective interpersonal communication.
- To cultivate positive thinking, resilience, mindfulness, and a growth-oriented mindset.
- To enhance verbal and non-verbal communication skills, including confidence in public speaking and professional presentations.
- To familiarize students with leadership styles, teamwork strategies, and collaborative problem-solving in personal and professional contexts.

Course Outcomes(CO):Student will be able to

1. Define and explain key concepts of self-awareness, personality, and personal growth.
2. Identify and apply strategies of emotional intelligence to regulate emotions and build effective interpersonal relationships
3. Demonstrate positive thinking, gratitude, and resilience to overcome personal and professional challenges
4. Analyze barriers to effective communication and apply verbal and non-verbal communication techniques in diverse contexts.
5. Prepare, deliver, and evaluate effective presentations and public speeches with confidence
6. Develop leadership and teamwork skills to collaborate, negotiate, and solve problems in group settings.

UNIT –I	Self-Awareness and Personal Growth	

Understanding personality and its development- Identifying strengths, weaknesses, opportunities, and challenges (SWOC analysis)- Setting personal and professional goals- Practicing Self-Reflection and Journaling

(Activities: Personalitya assessments, self reflection exercises, group discussions, SWOC analysis worksheet, Action Plan, SMART goal activities, Reflective journaling, Self-care Planning)

UNIT – II	Emotional Intelligence and Interpersonal Skills	

Understanding emotional intelligence and its importance - Developing self-awareness, self-regulation, and motivation - Building effective communication and interpersonal skills

- Conflict resolution and negotiation strategies.

(Activities: Emotional Intelligence Quiz, Self-Reflection exercises, feedback sessions, mindfulness exercises, Positive self-talk, Active Listening exercises, conflict-resolution Role-play, Case studies & Group activities)

UNIT – III	Positive Thinking and Attitude	

Understanding the power of positive thinking- Developing a growth mindset and resilience - Practicing gratitude and mindfulness- Overcoming negative thoughts and behaviors

(Activities on positive thinking, growth mindset, mindfulness and self-care plan for overcoming negative thoughts)

UNIT – IV	Effective Communication and Presentation Skills	

Understanding the importance of effective communication- Developing verbal and non-verbal communication skills- Preparing and delivering effective presentations- Building confidence and public speaking skills

(Activities: Group discussions, Case studies, Role-Play, Non-verbal communication exercises, Practice presentations, Peer feedback, Public speaking exercises, Storytelling, Debates)

UNIT – V	Leadership and Teamwork	

Understanding leadership styles and qualities - Developing leadership skills and qualities- Building effective teams and teamwork strategies- Practicing collaboration and problem-solving

(Activities: Case studies, Group discussions, Debates, Leadership role-playing, team building activities, Group projects, Collaborative problem-solving exercies, feedback sessions)

Prescribed Books

1. Daniel Goleman,*Emotional Intelligence: Why It Can Matter More Than IQ*, Bantam Books, 2017.
2. Stephen R. Covey, *The 7 Habits of Highly Effective People*, Simon & Schuster, 2020.

Reference Books

1. Dale Carnegie, *How to Win Friends and Influence People*, Simon & Schuster, 2020.
2. Brian Tracy, *Goals!: How to Get Everything You Want Faster Than You Ever Thought Possible*, Berrett-Koehler Publishers, 2021.
3. Robin Sharma, *The 5 AM Club: Own Your Morning, Elevate Your Life*, HarperCollins, 2020.
4. Carol S. Dweck, *Mindset: The New Psychology of Success*, Random House, 2016.
5. Daniel H. Pink,*Drive: The Surprising Truth About What Motivates Us*, Riverhead Books, 2018.
6. John C. Maxwell, *Leadershift: 11 Essential Changes Every Leader Must Embrace*, HarperCollins, 2019.

Online Resources

1. **Coursera** – *Personal Development Specialization* (https://www.coursera.org)
2. **edX** – *Leadership and Emotional Intelligence Courses* (https://www.edx.org)
3. **FutureLearn** – *Mindfulness and Resilience Training* (https://www.futurelearn.com)
4. **MindTools** – Practical resources on leadership, communication, and emotional intelligence (https://www.mindtools.com)
5. **Positive Psychology** – Articles and tools on resilience, gratitude, and well-being (https://positivepsychology.com)
6. **TED Talks** – Inspirational talks on leadership, communication, and self-growth (https://www.ted.com)
7. **Harvard Business Review (HBR)** – Leadership, negotiation, and workplace communication (https://hbr.org)

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

I M.Tech II Semester

25MTMAC21C	YOGA FOR STRESS MANAGEMENT	L	T	P	C
		2	0	0	0

Course Objectives:

1. To make the students understand the foundational concepts of Yoga, including Ashtanga (eight limbs) as prescribed in classical texts.
2. To enable them analyze the principles of Yama and Niyama, and their role in ethical, personal, and social development.
3. To make them learn do's and don'ts of life through the practice of ahimsa, satya, astheya, brahmacharya, aparigraha, shaucha, santosh, tapa, swadhyaya, and ishwar-pranidhana.
4. To make them practice asanas and pranayama techniques for physical fitness, mental balance, and spiritual awareness.
5. To make them understand the holistic lifestyle through regular yoga practice, leading to personality development.

Course Outcomes(CO):Student will be able to

1. Explain the eight limbs of Yoga (Ashtanga) and their interrelationship in holistic development.
2. Demonstrate understanding of Yama and Niyama as ethical guidelines and apply them in personal and professional life.
3. Differentiate between do's and don'ts in daily life with reference to Yogic principles like ahimsa, satya, and swadhyaya.
4. Perform selected asanas and pranayama techniques with correct posture, breathing, and awareness.
5. Evaluate the physical, mental, and emotional benefits of yoga practices in stress reduction, concentration, and self-discipline.
6. Integrate yoga philosophy and practices into a personal routine for sustainable health and inner growth.

UNIT -I

Definitions of Eight parts of yoga.(Ashtanga)

UNIT - II

Yam and Niyam.

UNIT - III

Do's and Don'tsin life.
i) Ahinsa, satya,astheya, bramhacharya and aparigraha ii) Shaucha,santosh,tapa,swadhyay,ishwarpranidhan

UNIT - IV

Asanand Pranayam

UNIT - V

i) Various yoga poses and their benefits for mind and body
ii) Regularization of breathing techniques and its effects-Types of pranayam

Textbooks

1. Swami Prabhavananda and Christopher Isherwood (translation & commentary), *Patanjali Yoga Sutras*,Sri Ramakrishna Math, 1953.
2. B.K.S. Iyengar, *Light on Yoga*, Thorsons, 2003.

Reference Books

. T.K.V. Desikachar, *The Heart of Yoga: Developing a Personal Practice*, Inner Traditions 2nd Edition, 1999.

. Acharya Yatendra, *Yoga & Stress Management*, Fingerprint Publishers, 2019

. Yamini Muthanna, *The Power of Yoga*, Om Books International, 2015.

. Nayaswami Devarshi, *Kriya Yoga: Spiritual Awakening for the New Age,* Ananda Sangha Publications, 2023.

Online Resources

- **NPTEL / SWAYAM Online Courses** – Yoga and Physical Education modules.
- **AYUSH Ministry Website**: https://yoga.ayush.gov.in – official yoga resources, protocols, and research.
- **Yoga Journal**: https://www.yogajournal.com – practical guides, research updates, asana tutorials.
- **Art of Living Foundation**: https://www.artofliving.org – pranayama, meditation, and wellness practices.
- **YouTube Channels** (scholarly & practice-based):
  - *Sivananda Yoga Vedanta Centre*
  - *Yoga with Adriene* (for practical asana guidance)

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

Professional Elective - V

II M.Tech III Semester

L	T	P	C
3	0	0	3

25MTPDD31A DESIGN OF HYBRID AND ELECTRIC VEHICLES

Course Educational Objectives:

1. To introduce the fundamental concepts of automotive system components and principles.
2. To understand the fundamental concepts of electric and hybrid vehicle operation and architectures.
3. To provide the knowledge about design of series and parallel hybrid electric vehicles.
4. To provide the knowledge about design of hybrid electric hybrid electric drive train.
5. To provide the knowledge about regenerative braking system and fuel cell vehicles.

UNIT – 1: FUNDAMENTALS OF TO AUTOMOTIVE SYSTEMS (9)

Environmental Impact: Air pollution, global warming, petroleum resources and different transportation development strategies – History of EVs, HEVs and Fuel Cell Vehicles. **IC Engines:** Operation principle with Otto and Atkinson cycle – Techniques for improving engine performance, efficiency, and emissions – SI and CI control system – Alternative fuels and alternative fuel engines. **Vehicle Propulsion, Braking and Transmission:** Vehicle movement, resistance and dynamic equation – Tire-ground adhesion, tractive effort, vehicle speed and performance – Operating fuel economy and brake performance – Manual gear, automatic transmission, continuously variable transmission, infinitely variable and dedicated hybrid transmission.

UNIT – 2: ENERGY SOURCES, ELECTRIC VEHICLES & HYBRID ELECTRIC VEHICLES (9)

Energy Sources: Battery basics, parameters, power and characteristics – Electrochemical batteries – Ultracapacitors – Ultra-high-speed flywheels – Hybridization of energy storages. **Electric Vehicles:** Configurations and performance of EVs – Tractive effort – Energy consumption. **Hybrid Electric Vehicles:** Concept and architectures of hybrid electric drivetrains. **Electric Propulsion Systems:** DC motor drives – Induction motor drives – Permanent magnetic BLDC motor drives – SRM drives.

UNIT – 3: SERIES AND PARALLEL HYBRID ELECTRIC DRIVE TRAIN DESIGN (9)

Electrical Coupling: Operation patterns – Control strategies – Design principles of a series hybrid drivetrain – Design examples. **Mechanically Coupling:** Drivetrain configuration and design objectives – Control strategies – Parametric design of a drivetrain. **Torque and Speed Coupling:** Drivetrain configuration – Drivetrain control methodology – Drivetrain parameter design.

UNIT – 4: HYBRID ELECTRIC DRIVE TRAIN DESIGN (9)

Design and Control Principles: Statistics of driving distance – Energy management strategy and storage design. **Hybrid Electric Drivetrain Design:** Energy consumed in braking and transmission – Series and parallel mild hybrid electric drivetrain. **Hybrid Drivetrain for Off-Road Vehicles:** Motion resistance – Tracked series architecture – Parametric design of drivetrain – Engine/generator power design – Power and energy design. **Design of Full-Size HEV Engine:** Optimal hybridization ratio – Electrical drive packages. **Powertrain Optimization:** Modelling techniques, performance and powertrain structure.

UNIT – 5: REGENERATIVE BRAKING AND FUEL CELL VEHICLES (9)

Fundamentals of Regenerative Braking: Braking energy consumed in urban driving – Braking energy versus vehicle speed, braking power and vehicle deceleration rate – Braking energy on front and rear axles – Brake system of EV, HEV, and FCV. **Fuel Cells:** Types, operation principles, electrode potential and current-voltage curve – Fuel and oxidant consumption – Fuel cell system characteristics, technologies and fuel supply – Non-hydrogen fuel cells. **Fuel Cell Hybrid Electric Drivetrain Design:** Configuration, control strategy, parametric design and design examples.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Describe the components of automotive systems and working performance.	**PO1,PO2,PO3, PO4**
CO2	Select the proper energy storage systems for vehicle applications.	**PO1,PO2,PO3, PO4**
CO3	Design the series and parallel hybrid electric drive train design.	**PO1,PO2,PO3, PO4**
CO4	Design the hybrid electric drive train design.	**PO1,PO2,PO3, PO4**
CO5	Select the proper regenerative braking systems and design the fuel cell vehicles.	**PO1,PO2,PO3, PO4**

Text Books:

1. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, Mehrdad Ehsani, Yimin Gao, Stefano Longo, and Kambiz M. Ebrahimi 3/e, 2018, CRC Press, Taylor & Francis Group, LLC.
2. Electric and Hybrid Vehicles: Design Fundamentals, Husain Iqbal, 2/e, 2016, CRC Press, Taylor & Francis Group, LLC.

Reference Books:

2. Electric and Hybrid Vehicles, Technologies, Modeling and Control: A Mechatronic Approach, Amir Khajepour, Saber Fallah and Avesta Goodarzi, 2014, John Wiley & Sons Ltd.
3. Electric and Hybrid Vehicles, Tom Denton, 2/e, 2020, Routledge and CRC Press.
4. Automotive Engineering: Powertrain, Chassis System and Vehicle Body, David A. Crolla, 2009, Butterworth-Heinemann, Elsevier Inc.
5. Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, Chris Mi, M. Abul Masrur and David Wenzhong Gao, 1/e, 2011, John Wiley & Sons, Ltd.
6. Hybrid Electric Vehicle Design and Control: Intelligent Omnidirectional Hybrids, Yangsheng Xu, Jingyu Yan, Huihuan Qian and Tin Lun Lam, 2014, Mc-Graw-Hill Education.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	3	2	-	-	-	-	-	-	-	-
CO.2	3	2	3	2	-	-	-	-	-	-	-	-
CO.3	3	2	3	2	-	-	-	-	-	-	-	-
CO.4	3	2	3	2	-	-	-	-	-	-	-	-
CO.5	3	2	3	2	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

II M.Tech III Semester

L	T	P	C
3	0	0	3

25MTPDD31B INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS

Course Educational Objectives:

1. To comprehend the basic elements of a robot, it's anatomical features, the types of actuators, sensors, end effectors in robots, their design aspects and about the robotic machine vision.
2. To familiarize the students with kinematic behaviour of serial and parallel manipulators.
3. To familiarize the students with dynamic behaviour of serial and parallel manipulators.
4. To acquaint the students with design and control of robot cell and the safety aspects to be followed in a robot cell.
5. To introduce the evolution, types and principle of robot programming, the basic artificial intelligence techniques and the machine learning algorithms considering robot intelligence.

UNIT – 1: ELEMENTS OF ROBOT (9)

Introduction to robotics – Definition, need and scope – Industrial robots – Robot anatomy – Joints, links, actuators – Work volume – Hydraulic and pneumatic drives – Linear and rotary actuators – Control valves, electro hydraulic servo valves, electric drives and motors – Design of drive systems – Sensors for robots – End effectors – Vacuum, magnetic and air operated grippers – Design of end effectors – Robot machine Vison – Applications – Case study

UNIT – 2: KINEMATICS AND DYNAMICS OF SERIAL & PARALLEL MANIPULATORS (9)

Kinematics of Robotics: Science of robotics – Robot kinematics – Direct and inverse kinematics – Kinematics of serial robots – D-H transformation – Kinematics of parallel robots – Velocity and static analysis of manipulators – Robot trajectories – Kinematic simulation. **Dynamics of Robotics:** Lagrangian formulation – Examples of equations of motion – Inverse dynamics and simulation of equations of motion – Recursive formulations of dynamics of manipulators – Articulated-body algorithm – Dynamic simulation.

UNIT – 3: ROBOT CELL DESIGN AND APPLICATION (9)

Robot work cell design and control – Safety in robotics– Robot cell layouts – Multiple robots and machine interference – Robot cycle time analysis – Industrial application of robots – Simulation. **Robot Applications in Industry:** Material transfer and machine loading / unloading – Processing applications in spray coating – Assembly and inspection automation – Future applications of robot in mines, under water and space. **Implementation Principles:** Selection of robots in industry applications – Economic analysis of the robot.

UNIT – 4: ROBOT PROGRAMMING (9)

Lead through programming – Robot language structure – Motion commands of move, speed control, workplace, path, frames, end effecter operation, sensor operation and react statement – Program sequence and subroutine – Teach pendant programming – VAL II programming

UNIT – 5: ROBOT INTELLIGENCE (9)

Artificial intelligence basics – Goals of artificial intelligence – AI techniques – Problem representation in AI – Problem reduction and solution techniques – Application of AI and KBES in Robots – Machine learning basics – Introduction to types of algorithm – Application – Cobot- Swarm Robotics – Soft robotics – Bio robots – Case study.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Apprehend the preliminary concepts that comprise a robotic system.	**PO1,PO2,PO3,PO5**
CO2	Acquire knowledge on robot kinematic and dynamic system	**PO1,PO2,PO3,PO5**
CO3	Create a typical robot work cell for a problem	**PO1,PO2,PO3,PO5**
CO4	Acquire knowledge on robot programming fundamentals	**PO1,PO2,PO3,PO4,PO5**
CO5	Recognize the importance of robot intelligence in all applications	**PO1,PO2,PO3,PO5**

Text Books:

1. Industrial Robotics: Technology, Programming and Applications, Mikell P Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G Odrey and Ashish Dutta 2/e, 2012, Tata McGraw-Hill Education Pvt. Ltd.,
2. Robotics: Control, Sensing, Vision and Intelligence, K.S. Fu, R.C.Gonzales and C.S.G.Lee, 1/e, 2008, Tata McGraw-Hill Education Pvt. Ltd., Noida.

References:

1. Introduction to Robotics: Analysis, Control, Applications, 3/e, 2020, Saeed B.Niku, Wiley India Pvt, Ltd., New Delhi.
2. Robotics Technology and Flexible Automation, S.R.Deb and Sankha Deb, 2/e, 2010, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. Robots and Robotics - Principles, Systems, and Industrial Applications, Mark R Miller & Rex Miller 2017, McGraw-Hill Education.
4. Introduction to Robotics: Mechanics and Control, John J. Craig, 3/e, 2008, Pearson Education, New Delhi.
5. Robotics: Fundamental Concepts and Analysis, Ashitava Ghosal, 1/e, 2006, Oxford University Press, New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	1	-	-	-	-	-	-	-
CO.2	3	2	2	-	1	-	-	-	-	-	-	-
CO.3	3	2	2	-	1	-	-	-	-	-	-	-
CO.4	3	2	2	-	1	-	-	-	-	-	-	-
CO.5	3	2	2	1	1	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	**1**	**1**	-	-	-	-	-	-	-

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING

II M.Tech III Semester

L	T	P	C
3	0	0	3

25MTPDD31C MECHATRONICS SYSTEM DESIGN

Course Educational Objectives:

1. To provide the various electrical and electronic control techniques used in modern mechatronics.
2. To know the basic working principle of sensors and transducers of use for manufacturing systems
3. To know the basic working principle of drives and actuators of use for manufacturing systems
4. To know the features, modules and interfaces of microcontrollers and microprocessors
5. To gain the knowledge of mechatronic systems in automation of modern manufacturing systems

UNIT – 1: INTRODUCTION TO MECHATRONICS IN SYSTEM DESIGN (9)

Introduction to mechatronics systems and measurements. **Control Systems:** Open loop, closed loop, automatic control, block diagram, pneumatic control and hydraulic control systems – Assembly, inspection – and transportation – Identification of mechatronics' Entities – Mechanical, fluid, thermal, electrical, electronics, communication, control systems and software integration for design – Manufacturing based on mechatronics – CNC based subtractive manufacturing – Rapid prototyping based additive manufacturing – Automated assembly stations – Modern quality inspection and transportation systems.

UNIT – 2: SENSORS AND TRANSDUCERS (9)

Transducers: Actuating mechanisms – Electro-mechanical, resistance, variable inductance, capacitive, piezoelectric, photoelectric, thermo electric and Hall Effect transducers – Strain gauge. **Sensors:** Proximity, pneumatic, light, tactile and smart sensors – Load cells – Digital encoders – Selection of sensors – Chemical and gas sensors – Concepts of signal conditioning – Condition monitoring with applications.

UNIT – 3: DRIVES, ACTUATORS AND CONTROLLERS (9)

Mechanical Actuator: Gear drive, belt drive, chain drive and bearings. **Electrical Actuator:** Mechanical and solid state switches – Construction and working principle of stepper motor and servo motor. **Hydraulic Actuators:** Hydraulic systems – Pumps, regulator, compressors and valves – Linear and rotary actuator. **Pneumatic Actuators:** Pneumatic systems – Valves – Linear and rotary actuator. **System Models:** Basic system models – Mechanical system buildings – Electrical system buildings – Fluid system buildings – Thermal system buildings – Rotational-translational systems – Electro mechanical systems – Hydraulic mechanical systems. **Controller:** Control, two step, proportional and derivative mode – Combination of PD, PI and PID – PID and igital controllers – Concepts in adaptive control systems.

UNIT – 4: MICROPROCESSORS AND MICROCONTROLLERS (9)

Microprocessors: Requirement for processor – Comparison of 8085 and 8051 – Architecture of 8085 – Pin configuration, addressing modes and instruction set – Timing diagram of 8085 – Concepts of 8051 with block diagram. **Programmable Peripheral Interface:** Architecture of 8255 – Keyboard interfacing – LED display – Interfacing – ADC and DAC interface – Temperature control – Stepper motor control – Traffic control interface – Embedded Systems concepts. **PLC:** Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.

UNIT – 5: INTEGRATION OF MANUFACTURING AND MECHATRONIC SYSTEMS (9)

Mechatronic Systems: Design process of engine management system, automatic camera, automatic washing machine, pick and place robot, automatic car park barrier, wireless surveillance balloon and uninterruptible power supply – Skeletal structure and block diagram of CNC – Vertical Machining Centre, turning centre, Water Jet Machine and Electrical Discharge Machine – Serial Manipulator and hydraulic press – 3D printers – Coordinate Measuring Machine – Automated conveyors – Extended transportation system – Total integration of manufacturing systems for production automation.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to Cos
CO1	Imply the knowledge to study the mechatronics in modern system design.	**PO1,PO2,PO3,PO5**
CO2	Identify and select the sensors and transducers based on the application.	**PO1,PO2,PO3,PO5**
CO3	Identify the principles and functions of drives and actuators.	**PO1,PO2,PO3,PO5**
CO4	Get knowledge of microprocessor and microcontrollers and its functions.	**PO1,PO2,PO3,PO5**
CO5	Apply the knowledge about integration of mechatronic systems design in various real time applications.	**PO1,PO2,PO3,PO5**

Text Books:

1. Mechatronics: Electronic control systems in mechanical and electrical engineering, William Bolton, 6/e, 2019, Pearson Education, India.
2. A Textbook of Mechatronics, R.K.Rajput, 4/e, 2007, S. Chand & Co.

Reference books:

2. Mechatronics Systems Design, Devdas Shetty and Richard A. Kolk, 2/e, 2011, Cengage Learning.
3. Mechatronics, Principles and Applications, Godfrey Onwubolu, 1/e, 2005, Elsevier Butterworth-Heinemann.
4. Mechatronics: A Foundation Course, Clarence W. de Silva, 1/e, 2010, CRC Press, Taylor & Francis Group
5. Mechatronics with Experiments, Sabri Cetinkunt, 2/e, 2015, John Wiley & Sons Ltd
6. Mechatronics: Principles, Concepts and Applications, Nitaigour Premchand Mahalik, 1/e, 2003, Tata McGraw Hill Education.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	1	-	-	-	-	-	-	-
CO.2	3	2	2	-	1	-	-	-	-	-	-	-
CO.3	3	2	2	-	1	-	-	-	-	-	-	-
CO.4	3	2	2	-	1	-	-	-	-	-	-	-
CO.5	3	2	2	-	1	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	-	**1**	-	-	-	-	-	-	-