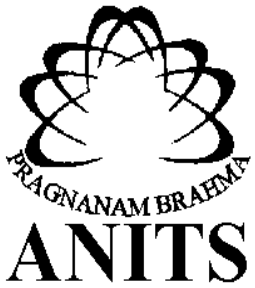
ANIL NEERUKONDA
INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)

Affiliated to Andhra University




# M.Tech
# (Mechanical Engineering Department)

Academic Regulations
Curriculum &
Syllabi (First Year I-Sem)

ACCREDITED BY NBA & NAAC WITH 'A' GRADE

# ACADEMIC REGULATIONS FOR M.TECH PROGRAMME UNDER AUTONOMOUS STATUS
# W.E.F. THE ADMITTED BATCH OF 2015-16

## I. Admissions:

Admissions into first year of M.Tech Programme of the Institute will be as per the norms stipulated by Andhra University & Andhra Pradesh State Council for Higher Education (APSCHE), Govt. of Andhra Pradesh.

## II. Programmes Offered:

The following are the M.Tech. programmes offered by the Institute.

01. Control Systems Engineering – EEE Department
02. Computer Science and Technology – CSE Department
03. Communication Systems – ECE Department
04. Machine Design – Mech. Engg Department

## III. Structure Of The M. Tech. Programme:

The normal duration of the course is 2 academic years for M.Tech Degree. Candidates should pursue a regular course of study, as detailed below, for not less than two academic years which consists of 4 semesters and should fulfil the academic requirements and pass all the prescribed examinations for the award of the degree.

The curriculum of M.Tech programme is designed to have a total of about 80 credits of which a student should acquire a minimum of 74 credits to get the degree awarded. If a student earns all the total credits, then the best 74 credits are considered to determine the final CGPA. However, the credits which a student can forego will be in accordance with the mandatory courses and electives offered by the individual departments.

## IV. Duration of the Programme:

The duration of the programme is 2 academic years consisting of 2 semesters in each academic year. A student is permitted to complete the Programme in a stipulated time frame of 4 consecutive academic years from the date of initial admission and if fails will forfeit his seat in M. Tech Programme.

## V. Medium of Instruction:

The medium of instruction and examination is English.

## VI. Minimum Instruction Days:

Each semester normally consists of a minimum of 16 weeks of instruction.

## VII. Academic Calendar:

The dates of all important events, such as commencement of class work, examinations, vacations, etc., during the academic year will be specified in the Academic Calendar of the Institute, as approved by the Academic Council.

## VIII. Examinations & Evaluation Process:

The performance of a student in each semester shall be evaluated course-wise with a maximum of 100 marks each for theory and practical courses.

### (a) Theory Course:

For all lecture based theory courses, the assessment shall be for 40 marks through internal evaluation and 60 marks through external semester-end examination of three hours duration.

The sessional marks shall be awarded through internal evaluation by the teachers concerned based on the continuous assessment which includes class tests, quiz, viva-voce, assignments, student regularity, two mid-examinations etc., according to a scheme notified by the department at the beginning of the semester.

Out of the 40 internal evaluation marks, 20 marks are assigned for 2 internal-mid exams, 10 marks are assigned for assignments, 5 marks are assigned for projects/ case studies /quiz/tests and 5 marks are assigned for attendance. The average of 2 internal-mid exams is considered for the 20 marks allocated.

Under any circumstances, no re-examination shall be conducted for the internal mid examinations.

**ii) External evaluation:**

The question paper shall be set externally and the answer scripts are valued through a double valuation system.

The average of the two valuations will be taken for award of marks. In case, the difference of the marks obtained in the two valuations is more than 20% then a third examiner shall value the script. Out of the three valuations, the average of marks obtained in third valuation and the marks obtained nearer to third valuation out of first two valuations shall be considered. No revaluation for any subject/course shall be entertained as already double valuation system is in existence. However, recounting is allowed on the request of the candidate on payment of specified fee. Challenge valuation shall also be entertained on payment of specified fee.

**(b) Laboratory Course:**

Each student will perform about 10 to 12 experiments in each laboratory course. Laboratory course will be evaluated for 100 marks, out of which 50 marks are for external examination and 50 marks are for internal evaluation. The internal marks are awarded based on continuous assessment, record work, internal lab examination and student regularity. The external examination will be conducted by two examiners, one of them being laboratory class teacher as internal examiner (nominated by the Principal on recommendation of HOD) and an external examiner nominated by the Principal from the panel of experts recommended by the HOD.

***A candidate shall be declared to have passed in any theory subject/course if he secures not less than 40% in external theory examination and also a minimum of 50% of total marks of that course which assures a minimum of 'E' grade.***

***A candidate shall be declared to have passed in any practical course if he secures not less than 50% of total marks of that course which assures a minimum of 'E' grade.***

***Any student appearing for the semester-end practical examination is eligible only if he submits the bonafide record certified by the laboratory class teacher and the HOD.***

**(C ) Thesis Work:**

The thesis work shall be carried out in two semesters of one full academic year. The students will be allotted for thesis by the Department committee to various faculty members who act as guides. However, a student can carry-out his thesis work either in the Department or in any other industry / research institute. In any such request to carryout thesis work outside the college, the permission of the Principal and an internal guide is mandatory. Such students should report to the internal guide once in a week essentially through mail or other communication.

The progress report of such work is to be submitted by the guide/external guide every month to the HOD. If the work is not found satisfactory, the HOD has the right to call back the student with the permission of the Principal. In any case the time and conditions for submission of the thesis will be same as for the regular candidates working in the college.

The third semester work is evaluated internally by the committee nominated by the HOD consisting a minimum of four members (concerned in area of specialization) including the HOD. If the work is not satisfactory, the candidate has to improve to the satisfaction of the committee within one month from the end of the semester to carry on his fourth semester work. If he fails to satisfy the committee in the second attempt he has to get readmitted into the third semester as per college norms. The grades will be awarded just as in the case of laboratory work. An internal viva voce by a committee nominated by the HOD is a prerequisite for the submission of the thesis. The fourth semester evaluation will be done through the viva voce examination on the thesis by a board consisting of the

following four examiners after submission of the thesis by the candidate duly certified by the Guide and the HOD.

1. The Head of the Department as Chairman
2. Senior Professor in the Department
3. Internal Guide and External Guide ( if any)
4. External examiner nominated by the Principal from a panel recommended by the HOD.

The panel of the external subject experts shall be submitted to the Principal by the HOD in mutual consent with the guide and other subject experts of the Department.

The valuation of the thesis shall be as specified in the scheme of examination of the laboratory course.

If the candidate fails in the viva voce examination of the thesis he has to reappear for the viva voce. The candidate has to bear the charges for re-conducting the viva voce.

The prerequisite for submission of the M.Tech. thesis is that one should have published a paper in a reputed international journal/ proceedings of an annual conference.

**(d) Supplementary Exam:**

There will be **NO** Supplementary examination for M.Tech courses.

## IX. Attendance Regulations:

Attendance of a student is computed by considering total number of periods conducted in all courses as the denominator and the total number of periods actually attended by the student in all courses, as the numerator. It is desirable for a student to put in 100% attendance in all the subjects. However, a candidate shall be permitted to appear for the semester end examination provided he/she maintains a minimum of 75% overall attendance in the semester.

The shortage of attendance on medical grounds can be condoned up to a maximum of 9% provided the student puts in at least 66% attendance and provided the Principal is satisfied with the genuineness of the reasons. The Medical Certificates are to be

submitted to the Head of the Department when the candidate reports to the classes immediately after the leave. Certificates submitted afterwards shall not be entertained. Condonation fee as fixed by the college for those who put in attendance between ≥ 66% and <75% shall be charged before the semester-end examinations.

In the case of students who participate in co-curricular, extra-curricular activities like student seminars, N.S.S, N.C.C, Inter-collegiate tournaments and any such other activities involving the representation of the Institute, with the prior approval of the Principal, the candidate may be deemed to have attended the classes during the actual period of such activity, solely for the purpose of attendance.

A student, who could not satisfy the minimum attendance requirement of 66% in any semester, shall be declared 'Detained'. He/she is not eligible to appear for the semester end examinations. He will not be promoted to the next semester and shall have to repeat that semester with the next batch(es) of students. Such students who are detained and seek readmission, should submit undertaking/declaration that they will abide by the regulations existing at the time of readmission.

## X. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item No. IX.

- A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory subject if only he secures not less than 40% marks in the semester-end examination and a minimum of 50% marks in the sum of the internal evaluation and semester-end examination taken together. In the labs/projects, the student should secure a minimum of 50% marks in the external examination and a minimum of 50% marks in the sum of internal evaluation and external examination evaluation taken together.

- A student will be promoted to the next semester, if only he satisfies the minimum attendance requirement.

- Students, who fail to complete their two year course study within Four academic years from the year of their admission or fail to acquire the credits stipulated for the course shall forfeit their seat in M. Tech course and their admission shall stand cancelled.

## XI. Award Of Grades:

The absolute grading system is adopted as follows:

| S.No. | Range of Marks {%} | Grade | Description | Grade Points |
|---|---|---|---|---|
| 1 | 90-100 | O | Outstanding | 10 |
| 2 | 80-89 | A | Excellent | 9 |
| 3 | 70-79 | B | Very Good | 8 |
| 4 | 60-69 | C | Good | 7 |
| 5 | 55-59 | D | Fair | 6 |
| 6 | 50-54 | E | Satisfactory | 5 |
| 7 | 49 and below | F | Fail | 0 |
| 8 | The grade 'I' represents absent (subsequently changed into pass or higher grades.) | I | Absent | 0 |

The performance of a student at the end of the each semester is indicated in terms of Semester Grade Point Average (SGPA). The SGPA is calculated as below:

$$\text{SGPA} = \frac{\Sigma \text{ (Credits of a course x Grade points awarded for a course)}}{\Sigma \text{ (Credits of a course)}}$$

SGPA is calculated for the candidates who have passed in all the courses in that semester.

Cumulative Grade Point Average (CGPA) will be calculated from II semester onwards up to the final semester and its calculation is similar to that of SGPA, considering all the courses offered from the first semester onwards.

CGPA is calculated for those who clear all the courses in all the previous semesters.

## XII. Award of Class:

For the award of class, a total of best 74 credits are considered. A candidate, who becomes eligible for the award of M.Tech. Degree, shall be placed in one of the following classes.

| S.No. | Class | CGPA |
|---|---|---|
| 1 | First Class with Distinction | 7.5 or more* |
| 2 | First Class | 6.5 or more but less than 7.5 |
| 3 | Second Class/Pass | 5.0 or more but less than 6.5 |

***First class with Distinction will be awarded only to those students who clear all the subjects of the program in first attempt of regular examinations.**

The CGPA can be converted to aggregate percentage by multiplying CGPA with 10, in case of requirement by any other university or for any other purpose.

## XIII. Eligibility for Award of M.Tech. Degree:

A student shall be eligible for the award of the M.Tech degree if he/she fulfils all the following conditions:

1) Registered and successfully completed all the components prescribed for eligibility in the programme of study to which he/she is admitted within the stipulated period,
2) Obtained CGPA greater than or equal to 5.0 (Minimum requirement for Pass),
3) No disciplinary action is pending against him/her and
4) Has no dues to the Institute including hostels.

## XIV. Malpractices:

The Controller of Examinations/Dean of Examinations shall refer the cases of suspected malpractices in mid examinations and semester-end examinations to Malpractice Enquiry Committee constituted by the Institute. Such committee shall follow the approved scales of punishment. The Principal shall take necessary final action against the erring students based on the recommendations of the committee.

## XV. Amendments to Regulations:

The Institute may, from time to time, revise, amend, or change the Regulations, Schemes of Examinations, and / or Syllabi and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute.

## XVI. General:

**(i) Where the words 'he', 'him', 'his', occur in the regulations, they include 'she', 'her', 'hers'.**

**(ii) The academic regulation should be read as a whole for the purpose of any interpretation.**

**(iii) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.**

# COURSE STRUCTURE FOR M TECH (Machine Design)

# DEPT. OF MECHANICAL ENGINEERING: ANITS

## I Year – I Semester

| Code | Name of the course | Periods per week | | Max. marks | | Credits |
|---|---|---|---|---|---|---|
| | | Lec. | Lab | Sess. | Exams | |
| PMECMDG111 | Advanced Mechanics of Solids | 4 | — | 40 | 60 | 4 |
| PMECMDG112 | Mechanics of Machinery | 4 | — | 40 | 60 | 4 |
| PMECMDG113 | Advanced Optimization Techniques | 4 | — | 40 | 60 | 4 |
| PMECMDG114 | Design Engineering | 4 | — | 40 | 60 | 4 |
| PMECMDG115 | Elective-I | 4 | — | 40 | 60 | 4 |
| PMECMDG116 | Elective - II | 4 | — | 40 | 60 | 4 |
| PMECMDG117 | CAD Lab | — | 3 | 50 | | 2 |
| PMECMDG118 | *Online Open Elective (MOOCS) | | | | 100 | 4 |
| PMECMDG119 | Seminar | — | 3 | 50 | | 2 |
| Total | | 24 | 6 | 340 | 460 | 32 |

## I Year – II Semester

| Code | Name of the course | Periods per week | | Max. marks | | Credits |
|---|---|---|---|---|---|---|
| | | Lec. | Lab | Sess. | Exams | |
| PMECMDG121 | Mechanical Vibrations | 4 | — | 40 | 60 | 4 |
| PMECMDG122 | Instrumentation & Experimental Stress Analysis | 4 | | 40 | 60 | 4 |
| PMECMDG123 | Advanced Finite Element Analysis | 4 | — | 40 | 60 | 4 |
| PMECMDG124 | Robotics | 4 | — | 40 | 60 | 4 |
| PMECMDG125 | Elective – III | 4 | — | 40 | 60 | 4 |
| PMECMDG126 | Elective – IV | 4 | — | 40 | 60 | 4 |
| PMECMDG127 | Instrumentation & Experimental Stress Analysis Lab | — | 3 | 50 | - | 2 |
| PMECMDG128 | *Online Open Elective (MOOCS) | | | | 100 | 4 |
| Total | | 24 | 3 | 290 | 460 | 30 |

| | | |
|---|---|---|
| **Elective–I:** | A. Integrated Computer Aided Design | B. Pressure Vessel Design |
| | C. Fatigue, Creep & Fracture Mechanics | D. DBMS |
| **Elective–II:** | A. Theory of Elasticity and Plasticity | B. Computational Methods in Engg. |
| | C. Theory of Plates and Shells | D. Vehicle Dynamics |
| **Elective–III**: | A. Concurrent Engineering | B. Mechatronics |
| | C. Computational Fluid Dynamics | D. Tribology |
| **Elective - IV** | A. Gear Engineering | B. Quality concepts in design |
| | C. Signal analysis & Condition Monitoring | D. Composite Materials |

***Online Open Elective** MOOCS{Massive online open courses} in any of the courses offered by Premium institutions such MIT, Stanford etc.,

## II Year – I Semester

| Code | Name of the course | Periods per week | Exam (Hrs) | Max. marks | | Credits |
|---|---|---|---|---|---|---|
| | | | | Sessionals | Exam | |
| PMECMDG211 | Project Seminar | 12 | — | 100 | - | 6 |

## II Year – II Semester

| Code | Name of the course | Periods per week | Duration of exam (hours) | Max. marks | Max. marks | Credits |
|---|---|---|---|---|---|---|
| | | | | Exam | | |
| PMECMDG221 | Project | 12 | — | Recommended with grade O,A,B,C,D /Not recommended | 200 | 14 |

The prerequisite for submission of the M Tech thesis is that one should communicate his/her work to any referred journal or Publication in a conference.

*A student can also opt for MOOCS{Massive online open courses} at any time during the 1 Year M Tech course in any of the courses offered by Premium institutions such MIT, Stanford etc., and have to provide course completion certificate for award of credits.

To award degree, a student has to obtain 74 credits. For a student who has obtained all 82 credits by successfully completing all courses and 4 electives + 2 MOOCS , the best 74 credits will be considered for calculating final CGPA.

*I YEAR – I SEMESTER*

## ADVANCED MECHANICS OF SOLIDS

**Course Code: PMECMDG 111**

| Credits | Instruction periods per Week | | | Exam Hrs. | SESSIONAL MARKS | SEMESTER END MARKS | Total Marks |
|---|---|---|---|---|---|---|---|
| | LECTURE | TUTORIAL | PRACTICAL | | | | |
| 4 | 4 | 0 | 0 | 3 | 40 | 60 | 100 |

## COURSE OBJECTIVES:

- To make students understand the advanced topics related to flat plates, torsion in rectangular and circular bars, stress concentration and experimental techniques, assumptions and analysis of contact stresses.

## . SYLLABUS

### UNIT – I

**Flat plates:** Introduction - Stress resultants in a flat plate - Kinematics: Strain - Displacement relations for plates - Equilibrium equations for small displacement theory of flat plates - Stress-strain-temperature relations for isotropic elastic plates - Strain energy of a plate - Boundary conditions for plates - Solutions of rectangular and circular plate problems.

### UNIT – II

**Torsion:** Torsion of cylindrical bar of circular cross-section Saint-Venant's semi-inverse method - Linear elastic solution - The Prandtl elastic - Membrane (soap-film) analogy - Narrow rectangular cross-section - Hollow thin-wall torsion members: Multiply connected cross-section - Thin-wall torsion members with restrained ends - Fully plastic torsion.

### UNIT – III

**Beams on elastic foundation**: General theory - Infinite beam subjected to concentrated load: Boundary conditions - Infinite beam subjected to a distributed load segment - Semi-infinite beam subjected to loads of its end - Semi-infinite beam with concentrated load near its end - Short beams - Thin-wall circular cylinders.

### UNIT – IV

**Stress concentrations**: Basic concepts - Nature of a stress concentration problem. Stress concentration factor - Stress concentration factor. Theory of elasticity - Stress concentration factors. Experimental techniques - Stress gradients due to concentrated load - The stationary crack - Crack propagation. Stress intensity factor. Effective stress concentration factor: Applications - Stress concentration factor. Combined loads - Effective stress concentration

factors - Effective stress concentration factors. Repeated loads - Effective stress concentration factors - Other influences - Effective stress concentration factors - In-elastic strains.

**UNIT – V**

**Contact stresses**: Introduction - The problem of determining contact stresses - Assumptions on which a solution for contact stresses is based - Notation and meaning of terms - Expressions for principal stresses - Method of computing contact stresses - Deflection of bodies in point contact - Stress for two bodies in contact over narrow rectangular area (line contact). Loads normal to area - Stresses for two bodies in line contact. Loads normal and tangent to contact area.

**REFERENCE BOOKS:**


1. Advanced Mechanics of Materials by Boresi, A.P. and Sidebottm, O.M.
2. Advanced Mechanics of Materials by Seely and Smith.
3. Advanced Strength of Materials by Den Hartog.
4. Advanced Strength of Materials by Timoshenko S.P.

*I YEAR – I SEMESTER*

# MECHANICS OF MACHINERY

**Course Code: PMECMDG 112**

| Credits | Instruction periods per Week | | | Exam Hrs. | SESSIONAL MARKS | SEMESTER END MARKS | Total Marks |
|---|---|---|---|---|---|---|---|
| | LECTURE | TUTORIAL | PRACTICAL | | | | |
| 4 | 4 | 0 | 0 | 3 | 40 | 60 | 100 |

## COURSE OBJECTIVES

- To make the students to understand synthesis and analysis of complex mechanisms and concepts of cam dynamics.

## . SYLLABUS

**UNIT-I:**

**Kinematics of complex mechanisms** - Complex mechanisms, Low and high degree of complexity, Goodman's indirect acceleration analysis, Method of normal accelerations, Hall and Ault's auxiliary point method, Carter's method and comparison of methods.

**UNIT-II:**

**Advanced kinematics of plane motion** - The inflexion circle - Euler-Savary equation, Analytical and graphical determination of diameter of inflection circle - Bobbileier's construction, Collineation axis - Hartman's construction, Application of inflection circle to kinematic analysis - Polode curvature - General case and special case, Polode curvature in the four-bar mechanism - Coupler motion, Relative motion of the output and input links, Freudenstein'scollineation axis theorem - Carter Hall circle, Circling-point curve (general case).

**UNIT-III:**

**Introduction to synthesis (graphical methods)** guiding a point through two, three and four distinct positions - Burmaster's curve, Function generation - Overlay's method, Path generation - Robert's theorem.

**UNIT-IV:**

**Introduction to synthesis (analytical methods**) - Freudenstein's equation - Precision point approximation - Precision derivative approximation - Method of components - Block synthesis and Reven's method.

**UNIT-V:**

**Cam dynamics** - Forces in rigid systems, Mathematical models, Response of a uniform - Motion undamped cam mechanism - Analytical method, Follower response by phase - Plane method - Position error, Jump, Crossover shock - Johnson's numerical analysis.

**REFERENCE BOOKS:**


1. Kinematics and Dynamics of Plane Mechanisms by J. Hirschhorn, McGraw Hill Book Co., 1962.
2. Theory of Mechanics by J.E. Shigley, McGraw Hill Book Co., 1961 .
3. Theory of Mechanisms and Machines/ Amitabh Ghosh and Ashok Kumar Mallik/ E. W.P.Publishers
4. Kinematics and Linkage Design/ Allen S.Hall Jr./ PHI,1964.

5. Kinematics and Dynamics of Machinery/Charles E Wilson/Pearson/3rd Edition

*I YEAR – I SEMESTER*

## ADVANCED OPTIMIZATION TECHNIQUES

**Course Code: PMECMDG113**

| Credits | Instruction periods per Week | | | Exam Hrs. | SESSIONAL MARKS | SEMESTER END MARKS | Total Marks |
|---|---|---|---|---|---|---|---|
| | LECTURE | TUTORIAL | PRACTICAL | | | | |
| 4 | 4 | 0 | 0 | 3 | 40 | 60 | 100 |

**COURSE OBJECTIVES:**

**The objective of the course is to provide students**

- Ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively;
- Knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry;
- Skills in the use of optimization approaches and computer tools in solving real problems in industry;
- Ability to develop mathematical models for analysis of real problems in optimization

**SYLLABUS**

**UNIT I**

**Geometric programming (G.P):** Solution of an unconstrained geometric programming, differential calculus method and arithmetic method. Primal dual relationship and sufficiency conditions. Solution of a constrained geometric programming problem (G.P.P), Complementary Geometric Programming (C.G.P)

**UNIT II**

**Dynamic programming(D.P):** Multistage decision processes. Concepts of sub optimization and Principal of optimality, computational procedure in dynamic programming calculus method and tabular methods. Linear programming as a case of D.P. and continuous D.P.

**UNIT III**

**Integer programming(I.P):** Graphical representation. Gomory's cutting plane method. Bala's algorithm for zero-one programming problem. Branch-and-bound method, Sequential linear discrete Programming, Generalized penalty function method.

**UNIT IV**

Stochastic Programming (S.P.): Basic Concepts of Probability Theory, Stochastic Linear programming.

**UNIT V**

**Non-traditional optimization techniques:** Multi-objective optimization - Lexicographic method, Goal programming method, Genetic algorithms, Simulated annealing, Neural Networks based Optimization.

**REFERENCE BOOKS:**


1. Operations Research- Principles and Practice by Ravindran, Phillips and Solberg, John Wiely
2. Introduction to Operations Research by Hiller and Lieberman, Mc Graw Hill
3. Engineering Optimization - Theory and Practice by Rao, S.S., New Age International (P) Ltd. Publishers.
4. Engineering Optimization By Kalyanmanai Deb, Prentice Hall of India, New Delhi.
5. Genetic Algorithms - In Search, Optimization and Machine Learning by David E. Goldberg, Addison-Wesley Longman (Singapore) Pvt. Ltd.

*I YEAR – I SEMESTER*

# DESIGN ENGINEERING

**Course Code: PMECMDG114**

| Credits | Instruction periods per Week | | | Exam Hrs. | SESSIONAL MARKS | SEMESTER END MARKS | Total Marks |
|---|---|---|---|---|---|---|---|
| | LECTURE | TUTORIAL | PRACTICAL | | | | |
| 4 | 4 | 0 | 0 | 3 | 40 | 60 | 100 |

## COURSE OBJECTIVES:

**To develop the ability:**

- To identify different design models, steps involved in it and he ability to apply the fundamentals of product design and manufacturing design techniques for metallic and non metallic parts along with material selection criteria in design.
- To gain knowledge of economic factors, human engineering, ergonomics, and value engineering and modern approaches in design.
- To find static failure theories, surface failures and fatigue strengths.

## . SYLLABUS

### Unit-I

**Design philosophy**: Design process, Problem formation, Introduction to product design, various design models-Shigley model, Asimov model and Norton model, Need analysis, Strength considerations -standardization. Creativity, Creative techniques, Material selections, Notches and stress concentration, design for safety and Reliability

### Unit –II

**Product Design**: Product strategies, Product value, Product planning, product specifications, concept generation, concept selection, concept testing.

Design for manufacturing: Forging design, Casting design, Design process for non metallic parts, Plastics, Rubber, Ceramic, Wood, Glass parts. Material selection in machine design

**Unit –III**

**Failure theories**: Static failure theories, Distortion energy theory, Maximum shear stress theory, Coulomb-Mohr's theory, Modified Mohr's theory, Fracture mechanics theory., Fatigue mechanisms, Fatigue failure models, Design for fatigue strength and life, creep: Types of stress variation, design for fluctuating stresses, design for limited cycles, multiple stress cycles, Fatigue failure theories ,cumulative fatigue damage, thermal fatigue and shock, harmful and beneficial residual stresses, Yielding and transformation

**Unit -IV**

**Surface failures**: Surface geometry, mating surfaces, oil film and their effects, design values and procedures, adhesive wear, abrasive wear, corrosion wear, surface fatigue, different contacts, dynamic contact stresses, surface fatigue failures, surface fatigue strength,

**Unit -V**

**Economic factors influencing design**: Economic analysis, Break-even analysis, Human engineering considerations, Ergonomics, Design of controls, Design of displays. Value engineering, Material and process selection in value engineering, Modern approaches in design.

**REFERENCE BOOKS:**


1. Machine Design An Integrated Approach by Robert L. Norton, Prentice-Hall New Jersey, USA.
2. Mechanical Engineering Design by J.E. Shigley and L.D. Mitchell published by McGraw-Hill International Book Company, New Delhi.
3. Fundamentals of machine elements by Hamrock, Schmid and Jacobian, 2nd edition, McGraw- Hill International edition.
4. Product design and development by Karl T. Ulrich and Steven D. Eppinger. 3rd edition, Tata McGraw Hill.
5. Product Design and Manufacturing by A.K. Chitale and R.C. Gupta, Prentice Hall

*I YEAR – I SEMESTER*

## ELECTIVE-I A

## INTEGRATED COMPUTER AIDED DESIGN

**Course Code: PMECMDG115**

| Credits | Instruction periods per Week | | | Exam Hrs. | SESSIONAL MARKS | SEMESTER END MARKS | Total Marks |
|---|---|---|---|---|---|---|---|
| | LECTURE | TUTORIAL | PRACTICAL | | | | |
| 4 | 4 | 0 | 0 | 3 | 40 | 60 | 100 |

## COURSE OBJECTIVES

**To make students**

- Learn advanced concepts of feature based modeling
- Understand the methods of representation of wireframe, surface, and solid modeling systems.
- Learn role of CAD in MDO (Multidisciplinary Design Optimization).
- Gain extensive hands-on experience with two commercial CAD systems to gain proficiency in using the systems at advanced levels, migrating and sharing data between systems, and applying the theory covered in this course.
- Understand the tools and techniques used to come up with a proper design
- Better communicate their design to an audience

## . SYLLABUS

### UNIT-I

**Fundamentals of CAD:** Introduction, Design process, Application of computer for design, Creating the manufacturing database, Benefits of CAD, Design work station, CAD hardware.

### UNIT-II

**Geometric modeling:** Geometric modeling techniques - Multiple view 2D input, Wire frame geometry, Surface models, Geometric entities - Curves and Surfaces, Solid modelers, Feature recognition.

**Computer aided drafting:** AutoCAD tools, 3D model building using solid primitives and boolean operations, 3D model building using extrusion, Editing tools, Multiple views: Orthogonal, Isometric.

**UNIT-III**

**Visual realism:** Shading solids, Coloring, Color models, Using interface for shading and coloring.

**Graphic aids:** Geometric modifiers, Naming scheme, Layers, Grids, Groups, Dragging and rubber banding.

**UNIT-IV**

**Computer animation:** Conventional animation, Computer animation - Entertainment animation, Engineering animation, Animation types, Animation techniques.

**Mechanical assembly:** Assembly modeling, Part modeling, Mating conditions, Generation of assembling sequences, Precedence diagram, Liaison-sequence analysis.

**UNIT-V**

**Mechanical tolerancing**: Tolerance concepts, Geometric tolerancing, Types of geometric tolerances, Location tolerances, Drafting practices in dimensioning and tolerancing, Tolerance analysis.

**Mass property calculations**: Geometrical property formulation - Curve length, Cross-sectional area, Surface area, Mass property formulation - Mass, Centroid, Moments of inertia, Property mapping. Properties of composite objects.

**REFERENCE BOOKS:**


1. CAD/CAM Theory and Practice by Ibrahim Zeid.
2. CAD/CAM Principles and Applications by P.N. Rao, Tata McGraw Hill Publishing Company Ltd.
3. CAD/CAM Computer Aided Design and Manufacturing by Mikell P. Groover and Emory W. Zimmer, Jr.
4. Computer Integrated Design and Manufacturing by David D. Bedworth, Mark R. Henderson, Philip M. Wolfe.

*I YEAR – I SEMESTER*

**ELECTIVE-I B**
**PRESSURE VESSEL DESIGN**

**Course Code: PMECMDG115**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

| Credits | Instruction periods per Week | | | Exam Hrs. | SESSIONAL MARKS | SEMESTER END MARKS | Total Marks |
|---|---|---|---|---|---|---|---|
| | LECTURE | TUTORIAL | PRACTICAL | | | | |
| 4 | 4 | 0 | 0 | 3 | 40 | 60 | 100 |

**COURSE OBJECTIVES:**

**To make students:**

- Develop an ability to apply knowledge of mathematics, science, and engineering.
- Develop an ability to design a pressure vessel system, component, or process to meet desired needs within realistic constraints.
- Develop an ability to identify, formulate, and solve engineering problems.
- Develop an ability to identify discontinuity stresses in pressure vessels.

. **SYLLABUS**

**Unit-I**

**Introduction**, Materials- shapes of Vessels –stresses in cylindrical spherical and arbitrary, shaped shells. Cylindrical Vessels subjected to internal pressure, wind load bending and torque-ilation of pressure vessels –conical and tetrahedral vessels.

**Theory of thick cylinders**; Shrink fit stresses in built up cylinders – auto frettage of thick Cylinders Thermal stresses in Pressure Vessels.

**Unit-II**

**THEORY OF RECTANGULAR PLATES:** Pure bending – different edge conditions.

**Theory circular plates**: Simple support and clamped ends subjected to concentrated and Uniformly distributed loads-stresses from local loads. Design of dome bends, shell connections, flat heads and cone openings.

**DISCONTINUITY STRESSES IN PRESSURE VESSELS**: Introduction beam on an elastic Foundation, infinitely long beam semi infinite beam, cylindrical vessel under axially symmetrical Loading, extent and significance of load deformations on pressure vessels, discontinuity stresses in vessels, stresses in a bimetallic joints, deformation and stresses in flanges.

**Unit-III**

**Pressure vessel materials and their environment:** Introduction ductile material tensile tests, Structure and strength of steel Leuder's lines determination of stress patterns from plastic flow Observations, behavior of steel beyond the yield point, effect of cold work or strain hardening on The physical properties of pressure vessel steels fracture types in tension. Toughness of Materials, effect of neutron irradiation of steels, fatigue of metals, fatigue crack growth fatigue life.

Prediction cumulative fatigue damage stress theory of failure of vessels subject to steady state And fatigue conditions.

**Unit-IV**

**STRESS CONCENTRATIONS**: Influence of surface effects on fatigue, effect of the environment

And other factors on fatigue life thermal stress fatigue creep and rupture of metals at elevated Temperatures, hydrogen embitterment of pressure vessel steels brittle fracture effect of Environment on fracture toughness, fracture toughness relationships criteria for design with Defects, significance of fracture mechanics evaluations, effect of warm prestressing on the Ambient temperature toughness of pressure vessel steels.

**Unit-V**

**DESIGN FEATURES:** Localized stresses and their significance, stress concentration at a Variable thickness transition section in a cylindrical vessel, stress concentration about a circular Hole in a plate subject to tension, elliptical openings, stress concentration, stress concentration Factors for position, dynamic and thermal transient conditions, theory of reinforced openings and Reinforcement, placement and shape fatigue and stress concentration.

**REFERENCE BOOKS:**

1. Theory and design of modern Pressure Vessels / John F. Harvey 'Van/ Nostrand Reihold Company / New York.
2. Pressure Vessel Design and Analysis / Bickell M. B. Ruizes / Macmillan Publishers
3. Process Equipment design / Beowll & Yound Ett.
4. Indian standard code for unfired Pressure vessels IS 2825.
5. Pressure Vessels Design Hand Book Henry H. Bednar PE / CB S Publishers / New Delhi.
6. Theory of plates and shells / Timoshenko& Noinosky / Dover Publications.
7. Stress in Beams, Plates and Shells / Ansel C. Ugural / CRC Press / 3rd Edition**SIGNAL**

*I YEAR – I SEMESTER*

## ELECTIVE-I C
## FATIGUE, CREEP AND FRACTURE MECHANICS

**Course Code: PMECMDG 115**

| Credits | Instruction periods per Week | | | Exam Hrs. | SESSIONAL MARKS | SEMESTER END MARKS | Total Marks |
|---|---|---|---|---|---|---|---|
| | LECTURE | TUTORIAL | PRACTICAL | | | | |
| 4 | 4 | 0 | 0 | 3 | 40 | 60 | 100 |

**COURSE OBJECTIVES:**

**To make students:**

- Develop an ability to apply knowledge of mathematics, science, and engineering.
- Develop an ability to design a system, component, or process to meet desired needs within realistic constraints
- Develop an ability to identify the Crack growth in fracture mechanics.
- Develop an object or component subjected to creep and fluctuating loads.

. **SYLLABUS**

**UNIT-I**

**INTRODUCTION**: Fracture behaviour of metals and alloys. The ductile/brittle transition temperatures for notched and un-notched components, Ductile rupture as a failure mechanism Fracture at elevated temperature.

Definitions of types of fracture and failure, Introduction to stress intensity factor and strain energy release rate, Equivalence of energy approach and stress intensity approach.

**Basic stress analysis and mechanical properties**: Elasticity, General 3-D relations, Plane stress and plane strain, Mohr's circle-principal stresses, Yield in materials, Tresca and Von Mises criteria, Ideal and actual strength of materials. Typical stress/strain curves for different classes of materials.

**UNIT-II:**

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

Superposition of crack tip stress fields, Direction of crack growth under mixed mode loadings. Crack tip plasticity, Early estimates of plastics zone, Irwin plastic zone correction and Dugdale approach, Plastic zone shape in three dimensions and shape under plane stress and plane strain conditions, Allowable plasticity for LEFM to apply, the thickness criterion Experimental methods for measuring Kic.

**UNIT-III:**

**ELASTIC/PLASTIC FRACTURE MECHANICS**: Elastic/plastic fracture mechanics: The crack opening displacement and J-integral approaches, R-curve analysis Testing procedures, Measurement of these parameters, RAD, Fail sage and safe life design approaches, Practical applications. Advanced topics in EOFM.

**UNIT-IV:**

**FATIGUE**: Importance of fatigue in engineering, Low cycle fatigue, Coffin-Manson law, Cyclic work hardening and softening. Micro structural models of crack initiation. Stage I, II and III crack growth.

**Analysis of Fatigue**: The empirical laws of fatigue failure. High cycle-low strain fatigue, Basquin's law, Goodman, Soderberg and Gerber mean stress corrections, Miner's law of damage summation. Low cycle fatigue, Crack growth and application of fracture mechanics to fatigue, Paris-Ergodan law, Threshold stress intensity range. Crack closure and its theories Cycle counting methods, Developments in using rain-flow counting methods to recreate fatigue standard spectra. Standard spectra suitable for different applications.

**UNIT-V:**

**FATIGUE OF WELDED STRUCTURES**: Factors affecting the fatigue lives of welded joints, the codes and standards available to the designer, the use of fracture mechanics to supplement design rules. Practical examples.

**Creep**: Phenomenology, Creep curves, Creep properties, Multi-axial creep, Creep-fatigue interaction, Creep integrals.

**REFERENCE BOOKS:**

1. Mechanical Metallurgy / Dieter / McGraw Hill
2. Fracture Mechanics: Fundamental and Applications /Anderson T.L & Boca Raton/ CRC Press, Florida, 1998.
3. Deformation and Fracture mechanics of Engineering Materials / Richard W Hertz /Wiley
4. Plasticity for structural Engineers / W.F. Chen and D.J,. Ha,
5. Engineering Fracture Mechanics/ D.R.J. Owen and A.J. Fawkes /Pincridge press, Swansea, U.K.
6. Fracture and fatigue control in structures/ S.T. Rolfe and J.M. Barsom/ Printice Hall, Eglewood cliffs, N.J..
7. Fracture of brittle solids/ B.R. Lawn and T.R. Wilshaw/ Cambridge university press.
8. Plastic deformation of Metals/ R.W.K. Honeycombe/ 2nd edition, Edward

*I YEAR – I SEMESTER*

**ELECTIVE-I D**
**DATA BASE MANAGEMENT SYSTEMS**

**Course Code: PMECMDG 115**

| Credits | Instruction periods per Week | | | Exam Hrs. | SESSIONAL MARKS | SEMESTER END MARKS | Total Marks |
|---|---|---|---|---|---|---|---|
| | LECTURE | TUTORIAL | PRACTICAL | | | | |
| 4 | 4 | 0 | 0 | 3 | 40 | 60 | 100 |

**COURSE OBJECTIVES:**

- To make students understand the concepts of Data Base Management Systems.

. **SYLLABUS**

**UNIT- I**

Introduction-Database System Applications, Purpose. of Database Systems, View of Data — Data Abstraction, lnstan.ces and Schemés, Data Models, Database Languages — DDL, DML, Database.Access from Application Programs, Transaction Management, Data"htoragé bnd Querying, Database Architecture, Database Users and Administrators, History of Data base Systems.
Introduction to Data base design, ER diagrams, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprise9.. Relational Model: Introduction to the Relational Model — Integrity Constraints over Relations, Enforcing Integrity consti aints, Querying relational data, Logical data base Design, Introduction to Views — Destroying /altering Tables and Views.

**UNIT- II**

Relational Algebra and Calculus: Relational Algebra — Selection and Projection, Set operations, Renaming, Joins, Division, Examples of Algebra Queries, Relational calculus — Tuple relational Calculus - Domain relational calculus — Expressive Power of Algebra and calculus.
Form of Basic SQL Oue•y — Examples of Basic SQL Queites, Introduction to Nested Queries, Correlated Nested Queries, Set — Comparison Operators, Aggregate Operators. NULL values — Comparison using Null values — Logical connectives — AND, OR and NOT — Impact on SQL Constructs, Outer Joins, Disallowing NULL values, Complex Integrity Constraints in SQL Triggers and Active Data bases.

**UNIT- III**

Introduction to Schema Refinement — Problems Caused by redundancy, Decompositions — Problem related to decomposition, Functional Dependencies - Reasoning about FDS, Normal Forms — FIRST, SECOND, THIRD Normal forms — BCNF —Properties of Decompositions- Loss less- join Decomposition, Dependency preserving Decomposition, Schema Refinement in Data base Design — Multi valued Dependencies — FOURTH Normal Form, Join Dependencies, FIFTH Normal form, Inclusion Dependencies.

**UNIT- IV**

Transaction Management-Transaction Concept- Transaction State- Implementation of Atomicity and Durability — Concurrent — Executions Serializabil'ity- Recoverability — Implementation of Isolation — Testing for serializability.

Concurrency Control- Lock —Based Protocols — Timestamp Based Protocols- Validation-Based Protocols — Multiple Granularity.

Recovery System-Failure Classification-Storage Structure-Recovery and Atomicity — Log - Based Recovery — Recovery with Concurrent Transactions— Buffer Management — Failure with loss of nonvolatile storage-Advance Recovery systems- Remote Backup systems.

**UNIT- V**

Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing — Clustered Indexes, Primary and Secondary Indexes, Index data Structures — Hash Based Indexing, Tree based Indexing, Comparison of File Organizations.

Tree Structured Indexing: Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM) B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.

Hash Based Indexing: Static Hashing, Extendable hashing, Linear Hashing, Exlendible vs. Linear Hashing.

**REFERENCE BOOKS:**


1. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, TMH, 3rd Edition, 2003.
2. Data base System Concepts, A.SiIberschatz, H.F. Korth, S.Sudarshan, McGraw hill, Vl edition, 2006.
3. Database Systems, 6th edition, Ramez Elmasri, Shamkant B.Navathe, Pearson Education, 2013.
4. Database Principles, Programming, and Performance, P.O'Neil, E.O’NeiI, 2nd ed., ELSEVIER.

*I YEAR – I SEMESTER*

## ELECTIVE-II A
## THEORY OF ELASTICITY AND PLASTICITY

**Course Code: PMECMDG 116**

| Credits | Instruction periods per Week | | | Exam Hrs. | SESSIONAL MARKS | SEMESTER END MARKS | Total Marks |
|---|---|---|---|---|---|---|---|
| | LECTURE | TUTORIAL | PRACTICAL | | | | |
| 4 | 4 | 0 | 0 | 3 | 40 | 60 | 100 |

**COURSE OBJECTIVES:**

- To study the classical theory of linear elasticity for two and three dimensional state of stress and obtain solutions for selected problems in rectangular and polar coordinates as well as torsion of prismatic bars.
- To understand the plastic stress strain relations, criteria of yielding and elasto- plastic Problems.

. **SYLLABUS**

**UNIT-I:**

**Elasticity:** Two dimensional stress analysis - Plane stress - Plane strain - Equations of compatibility - Stress function - Boundary conditions.

**Problem in rectangular coordinates** - Solution by polynomials - Saint Venent's principles - Determination of displacement - Simple beam problems.

**UNIT-II:**

**Problems in polar coordinates** - General equations in polar coordinates - Stress distribution symmetrical about axis - Strain components in polar coordinates - Simple and symmetric problems.

**Analysis of stress and strain in three di**mensions - Principle stresses - Homogeneous deformations - Strain spherical and deviatoric stress - Hydrostatic strain.

**UNIT-III:**

**General theorems**: Differential equations of equilibrium and compatibility - Displacement - Uniqueness of solution - Reciprocal theorem.

**Bending of prismatic bars** - Stress function - Bending of cantilever beam - Beam of rectangular cross-section - Beams of circular cross-section.

**UNIT-IV:**

**Plasticity**: Plastic deformation of metals - Structure of metals - Deformation - Creep stress relaxation of deformation - Strain rate condition of constant maximum shear stress - Condition of constant strain energy - Approximate equation of plasticity.

**UNIT-V:**

**Methods of solving practical problems** - The characteristic method - Engineering method - Compression of metal under press - Theoretical and experimental data drawing.

**REFERENCE BOOKS:**


1. Theory of Elasticity by Timoshenko, S.P. and Goodier, J.N.
2. An Engineering Theory of Plasticity by E.P. Unksov.
3. Applied Elasticity by W.T. Wang.
4. Theory of Plasticity by Hoffman and Sacks.

*I YEAR – I SEMESTER*

**ELECTIVE-II B**
**COMPUTATIONAL METHODS IN ENGINEERING**

**Course Code: PMECMDG 116**

| Credits | Instruction periods per Week | | | Exam Hrs. | SESSIONAL MARKS | SEMESTER END MARKS | Total Marks |
|---|---|---|---|---|---|---|---|
| | LECTURE | TUTORIAL | PRACTICAL | | | | |
| 4 | 4 | 0 | 0 | 3 | 40 | 60 | 100 |

**COURSE OBJECTIVES:**

- To make students familiar with the numerical methods for scientific and engineering computation.

. **SYLLABUS**

**UNIT-I**

Linear System of Equations: Gauss elimination method, Triangularization method, Cholesky method, Partition method, Error Analysis for Direct Methods. Iteration Methods: Jacobi Iteration Method, Gauss Seidel Iteration Method, SOR Method

**UNIT-II**

Eigenvalue and Eigen Vectors, Bounds on Eigen values, Jacobi Method for symmetric Matrices, Givens Method for Symmetric Matrices, Householders Method, Power Method

**UNIT-III**

Numerical differentiation: Introduction, Methods based on undetermined coefficients, Optimum choice of step length, Extrapolation Methods, Partial Differentiation Numerical Integration: Introduction, Open type integration rules, Methods based on undetermined coefficients: Gauss-Legendre, Gauss- Chebyshev, Romberg Integration. Double integration: Trapezoidal method, Simpson‟s method.

**UNIT-IV**

Numerical Solutions of Ordinary Differential Equations (Boundary Value Problem): Introduction, Shooting Method: Linear and Non Linear Second order Differential Equations.

**UNIT-V**

Numerical Solutions of Partial Differential Equations: Introduction, Finite difference Approximation to Derivatives. Laplace equation- Jacobi method, Gauss Seidel Iteration Method, SOR Method. Parabolic Equations, Iterative methods for Parabolic Equations, Hyperbolic equations.

**REFERENCE BOOKS:**

1. M.K. Jain, S.R.K. Iyengar and R.K.Jain, "Numerical Methods for Scientific and Engineering Computation", New Age International (P) Limited, Publishers, 4th edition, 2003.

2. S.S. Sastry, "Introductory Methods of Numerical Analysis", Prentice Hall India Pvt., Limited, 4th edition, 2009.

3. Samuel Daniel Conte, Carl W. De Boor, "Elementary Numerical Analysis: An Algorithm Approach", 3rd edition, McGraw-Hill, 2005.

*I YEAR – I SEMESTER*

## ELECTIVE-II C
## THEORY OF PLATES AND SHELLS

**Course Code: PMECMDG 116**

| Credits | Instruction periods per Week | | | Exam Hrs. | SESSIONAL MARKS | SEMESTER END MARKS | Total Marks |
|---|---|---|---|---|---|---|---|
| | LECTURE | TUTORIAL | PRACTICAL | | | | |
| 4 | 4 | 0 | 0 | 3 | 40 | 60 | 100 |

**COURSE OBJECTIVES:**

**To make students:**

- Familiar with the concepts allied to Bending of long rectangular plates to a cylindrical surface, Pure bending of plates which consists of small deflections of laterally loaded plates with various edge conditions.

- Familiar with the various views of deformation of shells in the form of a surface of revolution.

. **SYLLABUS**

**Unit I:**

**Bending of long rectangular plates to a cylindrical surface:** Differential equation for cylindrical bending of plates - Cylindrical bending of uniformly loaded rectangular plates with simply supported edges - Cylindrical bending of uniformly loaded rectangular plates with built-in edges

**Pure bending of plates:** Slope and curvature of slightly bent plates - Relations between bending moments and curvature in pure bending of plates - Particular cases of pure bending - Strain energy in pure bending of plates.

**Unit II:**

**Symmetrical bending of circular plates:** Differential equation for symmetrical bending of laterally loaded circular plates - Uniformly loaded circular plates - Circular plate with a circular hole at the center - Circular plate concentrically loaded - Circular plate loaded at the center.

**Unit III:**

**Small deflections of laterally loaded plates:** The differential equation of the deflection surface - Boundary conditions - Alternate method of derivation of the boundary condition - Reduction of the problem of bending of a plate to that of deflection of a membrane

**Unit IV:**

**Simply supported rectangular plates**: Simply supported rectangular plates under sinusoidal load - Navier solution for simply supported rectangular plates.

**Rectangular plates with various edge conditions:** Bending of rectangular plates by moments distributed along the edges - Rectangular plates with two opposite edges simply supported and the other two edges clamped.

**Continuous rectangular plates**: Simply supported continuous plates - Approximate design of continuous plates with equal spans - Bending symmetrical with respect to a center.

**Unit V:**

**Deformation of shells without bending:** Definition and notation - Shells in the form of a surface of revolution and loaded symmetrically with respect to their axis - Particular cases of shells in the form of surfaces of revolution - Shells of constant strength.

**General theory of cylindrical shells:** A circular cylindrical shell loaded symmetrically with respect to its axis - Particular cases of symmetrical deformation of circular cylindrical shells - Pressure vessels.

**REFERENCE BOOKS:**

1. Theory of Plates and Shells / Timoshenko, S. and Woinowsky-Krieger, S/McGraw Hill

2. Stress in Beams, Plates and Shells / Ansel C. Ugural / CRC Press / 3rd Edition.

*I YEAR – I SEMESTER*

**ELECTIVE-II D**
**VEHICLE DYNAMICS**

**Course Code: PMECMDG 116**

| Credits | Instruction periods per Week | | | Exam Hrs. | SESSIONAL MARKS | SEMESTER END MARKS | Total Marks |
|---|---|---|---|---|---|---|---|
| | LECTURE | TUTORIAL | PRACTICAL | | | | |
| 4 | 4 | 0 | 0 | 3 | 40 | 60 | 100 |

## COURSE OBJECTIVES

- To make the students understand the intricacies of vehicle dynamics and apply them for road safety and ride comfort.

## . SYLLABUS

**UNIT-I:**

**Introduction to Vehicle Dynamics:** Various kinds of vehicles, Motions, Mathematical modelling methods, Multibody system approach, Lagrangian formulations, Methods of investigations, Stability concepts.

**UNIT-II:**

**Mechanics of pneumatic tyres:**Tyre construction, SAE recommended practice, Tyre forces and moments, Rolling resistance of tyres, Tractive effort and longitudinal slip, Cornering properties of tyres, Performance of tyre traction on dry and wet surfaces, Ride properties of tyres.

**UNIT-III:**

**Performance characteristics of road vehicle:** Equation of motion and maximum tractive effort, Aerodynamic forces and moments, Vehicle power plant and transmission characteristics, Prediction of vehicle performance, Operating fuel economy, Braking performance.

**UNIT-IV:**

**Handling and stability characteristics of road vehicles:** Steering geometry, Steady state handling characteristics, Steady state response to steering input, Testing of handling characteristics, Transient response characteristics, Directional stability, Effects of tyre factors, Mass distribution and engine location on stability of handling.

**UNIT-V:**

**Vehicle ride characteristics:** Human response to vibration, Vehicle ride models, Introduction to random vibration - 1) Road suirface profile as a random function, 2) Frequency response function, 3) Evaluation of vehicle vertical vibration in relation to ride comfort criteria, 4) Active and semi active systems, 5) Optimum design for ride comfort and road holding.

**REFERENCE BOOKS:**


1. Theory of Ground Vehicles by Wong, J.Y., John Wiley and Sons, NY, 1993.
2. Fundamentals of Vehicle Dynamics by Gillespie, T.D., SAE Publication, Warrendal, USA, 1992.
3. Tyres, Suspension and Handling by Dixon, J.C., SAE Publication, Warrendal, USA and Arnold Publication, London, 1997.

*I YEAR – I SEMESTER*

## CAD LAB

**Course Code: PMECMDG 117**

| Credits | Instruction periods per Week | | | Exam Hrs. | SESSIONAL MARKS | SEMESTER END MARKS | Total Marks |
|---|---|---|---|---|---|---|---|
| | LECTURE | TUTORIAL | PRACTICAL | | | | |
| 2 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |

## COURSE OBJECTIVES:

- To train students in such way that they can prepare Part model, Assembly of parts and obtaining the final production drawing from the assembly.
- To explain basics concepts of 2D drafting using Auto CAD.
- 3D modelling techniques are explained using Autodesk Inventor.
- Model the 3-D geometric information of machine components including assemblies, and automatically generate 2-D production drawings.
- To enhance the students knowledge in presentation and simulation of the assemblies.
- To impart the analysis skills in student by performing various Finite Element Analysis in ANSYS.

## . SYLLABUS

2D and 3D modeling and assembly modeling using modeling packages like AutoCAD, Auto Desk Mechanical desktop, ProEngineer, IDEAS.

Linear and non-linear static and dynamic analysis using any FEA package ANSYS / CAEFEM / NASTRAN.