IV Semester

MECHANICS OF MATERIALS			
Course Code	**21ME44**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2-2-0-0	SEE Marks	50
Total Hours of Pedagogy	26+26	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:
Students will be able

- To know the different types of stresses and strains developed in the member subjected to axial, bending, shear, torsion & thermal loads.
- To know behaviour & properties of engineering materials.
- To understand the stresses developed in bars, compounds bars, beams, shafts, and cylinders.
- To understand the concepts of calculation of shear force and bending moment for beams with different supports.
- To expose the students to concepts of Buckling of columns and strain energy.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

- Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
- Chalk and Talk method for Problem Solving.
- Adopt flipped classroom teaching method.
- Adopt collaborative (Group Learning) learning in the class.
- Adopt Problem Based Learning (PBL), which fosters students' analytical skills and develops thinking skills such as evaluating, generalizing, and analysing information..

Module-1
Stresses and Strains: Introduction, Properties of materials, Stress, Strain and Hooke's law, Stress strain diagram for brittle and ductile materials, True stress and strain, Calculation of stresses in straight, Stepped and tapered sections, Composite sections, Stresses due to temperature change, Shear stress and strain, Lateral strain and Poisson's ratio, Elastic constants and relations between them.

Teaching- Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

Module-2
Analysis of Stress and Strain: Introduction to three-dimensional state of stress, Stresses on inclined planes, Principal stresses and maximum shear stress, Principal angles, Shear stresses on principal planes, Maximum shear stress, Mohr circle for plane stress conditions.

Teaching- Learning Process	. 1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

Module-3
Shear Force and Bending Moment: Type of beams, Loads and reactions, Relationship between loads, shear forces and bending moments, Shear force and bending moments of cantilever beams, Pin support and roller supported beams subjected to concentrated loads, uniformly distributed constant / varying loads. **Concept of shear center.** **Stress in Beams:** Bending and shear stress distribution in rectangular, I and T section beams.

Teaching-	1. Power-point Presentation,
Learning	2. Video demonstration or Simulations,
Process	3. Chalk and Talk are used for Problem Solving./White board

Module-4	

Deflection of Beams: Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Problems to calculate slope and deflection for determinant beams, Beams of uniform strength, Leaf springs.

Torsion: Circular solid and hallow shafts, Torsional moment of resistance, Power transmission of straight and stepped shafts, Twist in shaft sections,

Teaching-	1. Power-point Presentation,
Learning	2. Video demonstration or Simulations,
Process	3. Chalk and Talk are used for Problem Solving./White board

Module-5	

Thick & Thin Cylinders: Thin cylinder: Hoop's stress, maximum shear stress, circumferential and longitudinal strains, Thick cylinders: Lames equations.

Columns: Buckling and stability, Critical load, Columns with pinned ends, Columns with other support conditions, Effective length of columns, Secant formula for columns.

Introduction to Strain Energy: Strain energy due to axial, shear, bending, torsion and impact load. Castigliano's theorem I and II and their applications.

Teaching-	1. Power-point Presentation,
Learning	2. Video demonstration or Simulations,
Process	3. Chalk and Talk are used for Problem Solving./White board

Course outcome (Course Skill Set)

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

1. Understand simple, compound, thermal stresses and strains their relations and strain energy.
2. Analyse structural members for stresses, strains and deformations.
3. Analyse the structural members subjected to bending and shear loads.
4. Analyse shafts subjected to twisting loads.
5. Analyse the short columns for stability.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**
➢ First test at the end of 5th week of the semester
➢ Second test at the end of the 10th week of the semester
➢ Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**
➢ First assignment at the end of 4th week of the semester
➢ Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)
➢ At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**
➢ The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be reduced proportionally to 50 marks
➢ There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

Suggested Learning Resources:

Books

1. Mechanics of Materials J M Gere, B J Goodno, Cengage Eighth edition 2013
2. Fundamentals of Strength of Materials P N Chandramouli PHI Learning Pvt. Ltd 2013
3. Strength of Materials R K Rajput S. Chand and Company Pvt. Ltd 2014
4. Strength of Materials R. Subramanian Oxford 2005
5. Strength of Materials S. S. Ratan Tata McGraw Hill 2nd Edition, 2008
6. Mechanics of materials and Strength of Materials S C Pilli and N Balasubramanya Cengage 2019
7. Mechanics of Materials Ferdinand Beer, Russell Johston, John Dewolf, David Mazurek McGraw Hill Education (India) Pvt. Ltd Latest edition
8. Mechanics of Materials R C Hibbeler Pearson Latest edition

Web links and Video Lectures (e-Resources):

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
- Course seminar
- Term project