Department of Production Engineering

Fr. Conceicao Rodrigues College of Engineering (CRCE)

Lesson plan

Subject:	**Mechanics of Solids**
Academic Year:	**2018-19**
Name of the Teacher:	**Mrs. Deepika Singh Singraur**
Class	**S. E. Production**
Credits	**04**

1. **Syllabus.**

Module	Contents	Hrs
01	**Direct stress and direct strain:** Concept of different types of stresses; Stress–strain curves for ductile and brittle material; factor of safety; deformation of uniform/tapering rectangular and circular and circular cross–section bars; deformation of members made of composite materials; shear stress and shear strain; Poisson's ratio; volumetric strain; bulk modulus; relationship between Young's modulus, bulk modulus and modulus of elasticity; temperature stresses in simple and compound bars. **Introduction to Moment of Inertia:** Theorem of parallel and perpendicular Axis, Polar Moment of Inertia.	10
02	**Shear Force and Bending Moment:** Axial force, shear force and bending moment diagrams for statically determinate beams excluding beams with internal hinges for different types of loading.	08
03	**3.1 Theory of Bending:** Flexure formula for straight beams; principal axes of inertia; moments of inertia about principal axes; transfer theorem. Simple problems involving application of flexure formula, section modulus and moment of resistance of a section. **3.2 Shear Stress in Beams:** Distribution of shear stress across plane sections used commonly for structural purposes; shear connectors.	10
04	**4.1 Bending Moment Combined with Axial Loads:** Application to members subjected to eccentrics loads, core of section. **4.2 Deflection of Beams:** Deflection of cantilevers sample supported and overhanging beams using double integration and Macaulay's method for different types of loadings	08
05	**5.1 Theory of Torsion:** Torsion of circular shafts–solid and hollow, stresses in shafts transmitting power, shafts in series and parallel. **5.2 Principal Stresses:** General equations for transformation of stress; principal planes and principal stresses, determination using Mohr's circle maximum shear stress, principal stresses in beams principal stresses in shafts subjected to torsion, bending and axial thrust; concept of equivalent torsion and bending moments.	08
06	**6.1 Struts:** Struts subjected to axial loads, concept of buckling. Euler's formula for struts with different support conditions. Euler's and Rankin's design formulae. **6.2 Strain energy:** Strain energy due to axial loads gradually applied transverse loads and under impact load.	06

2. CO Statements.

Learner will be able to...

1. Illustrate stress-strain behavior of various materials under load
2. Demonstrate the basic concepts related to material properties and stress strain behavior of material.
3. Illustrate the basic concept of Bending moment and Shear force
4. Develop skills to analyze the stresses and deformation due to axial loading.
5. Illustrate basic concepts of bending, torsion, buckling, deflection and strain energy
6. Develop skills to visualize with analysis of stresses under various loading conditions.

3. CO-PO-PSO Mapping.

CO# / PO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEC305.1	3	3	2	-	-	-	-	-	-	-	-	-
PEC305.2	3	3	2	-	-	-	-	-	-	-	-	-
PEC305.3	3	3	2	-	-	-	-	-	-	-	-	-
PEC305.4	3	3	2	-	-	-	-	-	-	-	-	-
PEC305.5	3	3	2	-	-	-	-	-	-	-	-	-
PEC305.6	3	3	2									

CO# / PSO#	PSO1	PSO2
PEC305.1	-	-
PEC305.2	-	-

PEC305.3	-	-
PEC305.4	-	-
PEC305.5	-	-
PEC305.6	-	-

4. CO Assessment tools with target.

Co Statement #	Target for Assessment Tools		
	Unit Test	End Semester Exam	Course Exit Survey
PEC305.1	50%	50%	60%
PEC305.2	50%	50%	60%
PEC305.3	50%	50%	60%
PEC305.4	50%	50%	60%
PEC305.5	50%	50%	60%
PEC305.6	50%	50%	60%

5. Curriculum Gap/Content beyond syllabus (if any).

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6. Lecture/Lab/Mini Project/Assignment Plan.

	Topics	Module	Hours
Week1 (2.07.18 - 8.07.18)	**Direct stress and direct strain:** Concept of different types of stresses; Stress−strain curves for ductile and brittle material **Factor of safety;** deformation of uniform/tapering rectangular and circular and circular cross−section bars; deformation of members made of composite materials; shear stress and shear strain **Poisson's ratio**; volumetric strain; bulk modulus; relationship between Young's modulus, bulk modulus and modulus of elasticity	**1**	**4**

Week 2 (9.07.18 - 15.07.18)	**Temperature stresses** in simple and compound bars. **Introduction to Moment of Inertia:** Theorem of parallel and perpendicular Axis, Polar Moment of Inertia.	**1**	**4**
Week 3 (16.07.18 - 22.07.18)	**Moment of Inertia** **5.1 Theory of Torsion:** Torsion of circular shafts−solid and hollow, stresses in shafts transmitting power	**5**	**4**
Week 4 (23.07.18 - 29.07.18)	5.1 Shafts in series and parallel. **5.2 Principal Stresses:** General equations for transformation of stress	**5**	**4**
Week 5 (30.07.18 - 5.08.18)	5.2 Principal planes and principal stresses 5.2 Determination using Mohr's circle maximum shear stress, Principal stresses in beams principal stresses in shafts subjected to torsion, bending and axial thrust;	**5**	**4**
Week 6 (6.08.18 - 12.08.18)	5.2 Concept of equivalent torsion and bending moments. **2.1 Shear Force and Bending Moment:** Axial force, shear force and bending moment diagrams for statically determinate beams excluding beams with internal hinges for different types of loading.	**2**	**4**
Week 7 (13.08.18 - 19.08.18)	**Unit Test 1 SE, TE.**		
Week 8 (20.08.18 - 26.08.18)	**2.1 Shear Force and Bending Moment:** Axial force, shear force and bending moment diagrams for statically determinate beams excluding beams with internal hinges for different types of loading. **6.1 Struts:** Struts subjected to axial loads, concept of buckling. Euler's formula for struts with different support conditions. Euler's and Rankin's design formulae.	**6**	**4**
Week 9 (27.08.18 – 2-09.18)	**6.2 Strain energy:** Strain energy due to axial loads gradually applied transverse loads and under impact load. **3.1 Theory of Bending:** Flexure formula for straight beams; principal axes of inertia; moments of inertia about principal axes; transfer theorem.	**6**	**4**
Week 10 (3.09.18 - 9.09.18)	**3.1 Theory of Bending:** Flexure formula for straight beams; principal axes of inertia; moments of inertia about principal axes; transfer theorem.	**3**	**4**
Week 11 (10.09.18 – 16.09.18)	**3.1** Numerical on application of flexure formula, section modulus and moment of resistance of a section.	**3**	**4**

Week 12 (17.09.18 - 23.09.18)	**3.2** Shear Stress in Beams: Distribution of shear stress across plane sections used commonly for structural purposes; shear connectors.	**3**	**2**
Week 13 (24.09.18 - 30.9.18)	**4.1 Bending Moment Combined with Axial Loads:** Application to members subjected to eccentrics loads, core of section.	**4**	**4**
Week 14 (1.10.18 - 7.10.18)	**4.2 Deflection of Beams:** Deflection of cantilevers sample supported and overhanging beams using double integration and Macaulay's method for different types of loadings	**4**	**4**
Week 15 (08/10/18 – 12/10/18)	**Unit Test 2 SE, TE.**		
Week 16 (13/10/18 – 21/10/18)	**Term End**		