

# MOHAMMED SATHAK A J COLLEGE OF ENGINEERING

Siruseri IT park, OMR, Chennai - 603103

LESSON PLAN							
Department of <u>Mechanical</u> Engineering							
Name of the Subject	STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS			Name of the handling Faculty	Dr. B. Janarthanan		
Subject Code	CE8395			Year / Sem	II / IV		
Acad Year	2020-2021			Batch	2019-2023		
Course Objective							
To understand the concepts of stress, strain, principal stresses and principal planes.							
To study the concept of shearing force and bending moment due to external loads indeterminate beams and their effect on stresses							
To determine stresses and deformation in circular shafts and helical spring due to torsion.							
To compute slopes and deflections in determinate beams by various methods.							
To study the stresses and deformations induced in thin and thick shells.							
Course Outcome							
CO1: Explain the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes							
CO2: Discuss the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.							
CO3: Apply basic equation of simple torsion in designing of shafts and helical spring							
CO4: Apply basic equation of simple torsion in designing of helical spring and Determine the slope and deflection in beams using different methods.							
CO5: Analyze and design thin and thick shells for the applied internal and external pressures.							
Lesson Plan							
Sl. No.	Topic(s)	T / R*	Periods Required	Mode of Teaching (BB / PPT / NPTEL / MOOC / etc )	Blooms Level (L1-L6)	CO	PO
		Book					
UNIT I-STRESS, STRAIN AND DEFORMATION OF SOLIDS							
1	Introduction to basic types of loading	R1	1	BB/PPT	L3	CO1	PO1, PO2, PO3
2	Rigid bodies and deformable solids	R1	1	BB/PPT	L3	CO1	PO1, PO2, PO3
3	Tension, Compression and Shear Stresses	R1	1	BB/PPT	L3	CO1	PO1, PO2, PO3
4	Mechanical properties	R1	1	BB/PPT	L3	CO1	PO1, PO2, PO3
5	Stress-strain curve	R1	1	BB/PPT	L3	CO1	PO1, PO2, PO3
6	Deformation of simple and compound bars	R1	1	BB/PPT	L3	CO1	PO1, PO2, PO3
7	Deformation of simple and compound bars	R1	1	BB/PPT	L4	CO1	PO1, PO2, PO3
8	Thermal stresses	R1	1	BB/PPT	L4	CO1	PO1, PO2, PO3
9	Elastic constants	R1	1	BB/PPT	L4	CO1	PO1, PO2, PO3

10	Volumetric strains	R1	1	BB/PPT	L4	CO1	PO1, PO2, PO3
11	Stresses on inclined planes	R1	1	BB/PPT	L4	CO1	PO1, PO2, PO3
12	Principal stresses and principal planes – Mohr's circle of stress.	R1	1	BB/PPT	L4	CO1	PO1, PO2, PO3

**Suggested Activity: Assignment given**

**Evaluation method : Evaluation of Assignment**

## UNIT II-TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM

13	Beams – types transverse loading on beams	R1	1	BB/PPT	L3	CO2	PO1, PO2, PO3
14	Shear force and bending moment in beams – Cantilevers	R1	1	BB/PPT	L3	CO2	PO1, PO2, PO3
15	Shear force and bending moment in beams – Cantilevers	R1	1	BB/PPT	L3	CO2	PO1, PO2, PO3
16	Simply supported beams	R1	1	BB/PPT	L3	CO2	PO1, PO2, PO3
17	Simply supported beams	R1	1	BB/PPT	L3	CO2	PO1, PO2, PO3
18	Over-hanging beams	R1	1	BB/PPT	L3	CO2	PO1, PO2, PO3
19	Theory of simple bending	R1	1	BB/PPT	L4	CO2	PO1, PO2, PO3
20	bending stress distribution	R1	1	BB/PPT	L3	CO2	PO1, PO2, PO3
21	Load carrying capacity	R1	1	BB/PPT	L3	CO2	PO1, PO2, PO3
22	Proportioning of sections	R1	1	BB/PPT	L4	CO2	PO1, PO2, PO3
23	Flitched beams – Shear stress distribution.	R1	1	BB/PPT	L4	CO2	PO1, PO2, PO3
24	Tutorial problems	R1	1	BB/PPT	L3	CO2	PO1, PO2, PO3

**Suggested Activity: Tutorial Given**

**Evaluation method : Evaluation of Tutorial**

## UNIT III-TORSION

25	Torsion equation	R1	1	BB/PPT	L4	CO3	PO1, PO2, PO3
26	Torsion formulation stresses and deformation in circular and hollows shafts	R1	1	BB/PPT	L4	CO3	PO1, PO2, PO3
27	Torsion formulation stresses and deformation in circular and hollows shafts	R1	1	BB/PPT	L4	CO3	PO1, PO2, PO3
28	Stepped shafts	R1	1	BB/PPT	L3	CO3	PO1, PO2, PO3
29	Deflection in shafts fixed at the both ends	R1	1	BB/PPT	L3	CO3	PO1, PO2, PO3
30	Deflection in shafts fixed at the both ends	R1	1	BB/PPT	L3	CO3	PO1, PO2, PO3

31	Stresses in helical springs	R1	1	BB/PPT	L3	CO4	PO1, PO2, PO3
32	Deflection of helical springs	R1	1	BB/PPT	L3	CO4	PO1, PO2, PO3
33	Carriage springs	R1	1	BB/PPT	L3	CO4	PO1, PO2, PO3
34	Tutorial problems	R1	1	BB/PPT	L3	CO4	PO1, PO2, PO3

**Suggested Activity: Quiz given**

**Evaluation method : Evaluation of Quiz**

#### **UNIT IV-DEFLECTION OF BEAMS**

37	Double Integration method	R1	1	BB/PPT	L4	CO4	PO1, PO2, PO3
38	Double Integration method	R1	1	BB/PPT	L4	CO4	PO1, PO2, PO3
39	Macaulay's method	R1	1	BB/PPT	L4	CO4	PO1, PO2, PO3
40	Macaulay's method	R1	1	BB/PPT	L4	CO4	PO1, PO2, PO3
41	Area moment method for computation of slopes and deflections in beams	R1	1	BB/PPT	L3	CO4	PO1, PO2, PO3
42	Area moment method for computation of slopes and deflections in beams	R1	1	BB/PPT	L3	CO4	PO1, PO2, PO3
43	Conjugate beam and strain energy	R1	1	BB/PPT	L3	CO4	PO1, PO2, PO3
44	Conjugate beam and strain energy	R1	1	BB/PPT	L3	CO4	PO1, PO2, PO3
45	Maxwell's reciprocal theorems	R1	1	BB/PPT	L4	CO4	PO1, PO2, PO3
46	Maxwell's reciprocal theorems	R1	1	BB/PPT	L4	CO4	PO1, PO2, PO3
47	Maxwell's reciprocal theorems	R1	1	BB/PPT	L4	CO4	PO1, PO2, PO3
48	utorial problems	R1	1	BB/PPT	L3	CO4	PO1, PO2, PO3

**Suggested Activity: Case Study given**

**Evaluation method : Evaluation of Case Study**

#### **UNIT V-THIN CYLINDERS, SPHERES AND THICK CYLINDERS**

49	Stresses in thin cylindrical shell due to internal pressure	R1	1	BB/PPT	L3	CO5	PO1, PO2, PO3
50	Circumferential and longitudinal stresses	R1	1	BB/PPT	L3	CO5	PO1, PO2, PO3
51	Circumferential and longitudinal stresses	R1	1	BB/PPT	L3	CO5	PO1, PO2, PO3
52	Deformation in thin and thick cylinders	R1	1	BB/PPT	L3	CO5	PO1, PO2, PO3
53	Deformation in thin and thick cylinders	R1	1	BB/PPT	L3	CO5	PO1, PO2, PO3
54	Spherical shells subjected to internal pressure	R1	1	BB/PPT	L3	CO5	PO1, PO2, PO3
55	Deformation in spherical shells	R1	1	BB/PPT	L3	CO5	PO1, PO2, PO3

<b>56</b>	Lame's theorem	R1	1	BB/PPT	L4	CO5	PO1, PO2, PO3
<b>57</b>	Tutorial problems	R1	1	BB/PPT	L4	CO5	PO1, PO2, PO3
<b>58</b>	Tutorial problems	R1	1	BB/PPT	L3	CO5	PO1, PO2, PO3

**Suggested Activity: Tutorial Given**

**Evaluation method : Evaluation of Tutorial**

**Content Beyond the Syllabus Planned**

<b>1</b>	
<b>2</b>	

#### Text Books

<b>1</b>	Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2016
<b>2</b>	Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2009

#### Reference Books

<b>1</b>	Egor. P.Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2002
<b>2</b>	Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.
<b>3</b>	Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2013
<b>4</b>	Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2010.

#### Website / URL References

<b>1</b>	
<b>2</b>	
<b>3</b>	

#### Blooms Level

<b>Level 1 (L1) : Remembering</b>	Lower Order Thinking	Fixed Hour Exam	<b>Level 4 (L4) : Analysing</b>		Higher Order Thinking	Projects / Mini Projects
<b>Level 2 (L2) : Understanding</b>			<b>Level 5 (L5) : Evaluating</b>			
<b>Level 3 (L3) : Applying</b>			<b>Level 6 (L6) : Creating</b>			

#### Mapping syllabus with Bloom's Taxonomy LOT and HOT

Unit No	Unit Name	L1	L2	L3	L4	L5	L6	LOT	HOT	Total
<b>Unit 1</b>	Stress, Strain And Deformation Of Solids	0	0	6	6	0	0	6	6	12
<b>Unit 2</b>	Transverse Loading On Beams And Stresses In Beam	0	0	9	3	0	0	9	3	12
<b>Unit 3</b>	Torsion	0	0	7	3	0	0	7	3	10
<b>Unit 4</b>	Deflection Of Beams	0	0	5	7	0	0	5	7	12
<b>Unit 5</b>	Thin Cylinders, Spheres And Thick Cylinders	0	0	8	2	0	0	8	2	10
<b>Total</b>		0	0	35	21	0	0	35	21	56
<b>Total Percentage</b>		0	0	62.5	37.5	0	0	62.5	37.5	100

CO PO Mapping														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2										2	1
CO2	3	2	2										2	1
CO3	3	2	2										2	1
CO4	3	2	2										2	1
CO5	3	2	2										2	1
CO6													2	1
Avg	3	2	2										2	1
Justification for CO-PO mapping														
CO1	Engineering Knowledge is very much required (PO1), problem analysis is also needed (PO2), design and development is also introduced (PO3)													
CO2	Engineering Knowledge is very much required (PO1), problem analysis is also needed (PO2), design and development is also introduced (PO3)													
CO3	Engineering Knowledge is very much required (PO1), problem analysis is also needed (PO2), design and development is also introduced (PO3)													
CO4	Engineering Knowledge is very much required (PO1), problem analysis is also needed (PO2), design and development is also introduced (PO3)													
CO5	Engineering Knowledge is very much required (PO1), problem analysis is also needed (PO2), design and development is also introduced (PO3)													
3		High level			2		Moderate level			1		Low level		
Name & Sign of Faculty Incharge : Dr. B. Janarthanan														
Name & Sign of Subject Expert   :														
Head of the Department       :														