Faculty of Engineering & Technology, SRM University, Kattankulathur – 603203
School of Mechanical Engineering

Department of Mechanical Engineering

Course plan

Course code	ME1010	Date	17/11/2014
Course title	Mechanics of Solids		
Semester	IV		
Academic year	2014 - 2015 / Even	Course	Ravi Krishnamoorthy S
Semester	(Jan 2015 – May 2015)	Coordinator	

Faculty details:

Section	Class room No	Details of Faculty member				
		Name	Room No.	Cell Phone No.	e-mail id (@ktr.srmuniv.ac.in)	Student contact time
		Mr. Ravi Krishnamoorthy S	MEM 12/D	94425 21224	ravikrishnamoorthy.s	12:45pm-1:30pm
		Mr. Subramanian C	H101A	94452 98940	subramanian.c	
		Mr. Kamaraj M	MEB 305A	99621 89209	kamaraj.m	
		Mr. Harris Samuel R	MEA	94434 55216	harrissamuel.r	
		Mr. Sermaraj M	MEB 405	94426 15494	sermaraj.m	
		Mr. Santhanakrishnan R	MEA 202A	94447 18578	santhanakrishnan.r	

Direct assessment details:

Name of assessment	Marks	Topics	Tentative date	Duration
Cycle test - I	10	Concept of Stress and Strain, Analysis of Beams	09 Feb 2015	100 minutes
Surprise test	05	Bending stresses, Shear stresses	Before end Feb 2015	15 minutes
Cycle test - II	10	Torsion of shafts, deflection of beams	09 Mar 2015	100 minutes
Model examination	20	Entire Syllabus	15 Apr 2015	3 hours
End semester examination	50	Entire Syllabus	06 May 2015	3 hours
Attendance	05	N/A		

	MECHANICS OF SOLIDS	L	T	P	C
ME1010	Total contact hours - 60	2	2	0	3
	Prerequisite				
	Nil				

PURPOSE
To familiarize the students with the fundamentals of deformation, stresses, strains in structural elements.
INSTRUCTIONAL OBJECTIVES

1.	Know the concepts of stress and strain.
2.	Analyze the beam of different cross sections for shear force, bending moment, slope and deflection.
3.	Understand the concepts necessary to design the structural elements and pressure vessels.

UNIT I - CONCEPT OF STRESSES AND STRAINS **(12 hours)**

Concept of stress and strain, Hooke's law - Tension, Compression, and Shear, stress-strain diagram - Poisson's ratio, elastic constants and their relationship - Deformation of simple and compound bars. Thermal stresses – simple and Composite bars. Principal plane, principal stress, maximum shearing stress - Uniaxial, biaxial state of stress - Mohr's circle for plane stresses.

UNIT II - ANALYSIS OF BEAMS **(12 hours)**

Types of beams and loads - shear force and bending moment diagrams for cantilevers, simply supported and over hanging beams. Theory of pure bending - Bending stresses in simple and composite beams. Shear stress distribution in beams of different sections.

UNIT III - TORSION OF SHAFTS **(12 hours)**

Theory of pure torsion, torsion of circular shafts and composite shafts.

UNIT IV - DEFLECTION OF BEAMS **(12 hours)**

Slope and deflection of cantilever, simply supported beam by double integration method - Macaulay's method - Moment area method - Castigliano's theorem.

UNIT V - COLUMNS AND CYLINDERS **(12 hours)**

Columns and struts: Member subjected to combined bending and axial loads, Euler's theory, Crippling load, Rankine's theory. Cylinders And Shells: Thin cylinder, thin spherical shells under internal pressure - Thick cylinders - Lame's equation - Shrink fit and compound cylinders.

TOTAL : 60 hours

TEXT BOOKS

1. Bansal.R.K, "A Text Book of Strength of Materials", Lakshmi Publications Pvt. Limited, New Delhi, 2010.

2. Prabhu.T.J, "Mechanics of solids", Private Publication, 2002.

3. Rajput.R.K, "Strength of Materials", Fourth Edition ,S. Chand Limited, 2007.

4. Ferdinand P.Beer, and Rusell Johnston.E, "Mechanics of Materials", SI Metric Edition, McGraw Hill, 2011(Hard cover).

REFERENCES

1. William A. Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, McGraw Hill International Edition, 3rd Edition, 2007.

2. Srinath.L.S, "Advanced Mechanics of Solids", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.

3. Egor P. Popov, "Engineering Mechanics of Solids", 2nd edition, Prentice Hall of India Private Limited, New Delhi, 2009.

4. James M. Gere,"Mechanics of Materials", Eighth Edition, Brooks/Cole, USA, 2013.

5. Shigley.J.E, "Applied Mechanics of Materials", International Student Edition, McGraw Hill Koyakusha Limited, 2000.

ME1010 MECHANICS OF SOLIDS	
Course Designed by	**Department of Mechanical Engineering**

1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	K
		x				x					x	
2.	Mapping of instructional objectives with student outcome	1-3				1-3						

3.	Category	General (G)	Basic Sciences (B)	Engineering Sciences and Technical Arts(E)	Professional Subjects(P)
					x
4.	Approval	23rd Meeting of Academic Council, May 2013			

SESSION PLAN

Session No.	CONTENTS	Text / Ref. book
	CONCEPT OF STRESSES AND STRAINS	
1	Concept of stress and strain, Hooke's law - Tension, compression and shear, stress – strain diagram.	T3, Ch-1 T1 , Ch- 1
2	Poisson's ratio, elastic constants and their relationship.	T3, Ch-1 T1 , Ch- 2
3	Tutorial – stress, strain, volumetric strain.	T3, Ch-1 T1 , Ch- 2
4	Analysis of bars of uniform and varying sections subjected to single load and varying loads.	T3, Ch-1 T1 , Ch- 1
5	Analysis of bars of composite sections.	T3, Ch-1 T1 , Ch- 1
6	Tutorial on Analysis of composite bars.	T3, Ch-1 T1 , Ch- 1
7	Thermal stresses – concepts and problems.	T3, Ch-1 T1 , Ch- 1
8	Thermal stresses in composite bars - problems.	T3, Ch-1 T1 , Ch- 1
9	Principal plane, principal stress - Analytical method, direct stress in one plane - Simple problems.	T3, Ch-2 T1 , Ch- 3
10	Analytical method - Direct stress in two mutually perpendicular directions accompanied by a simple shear stress.	T3, Ch-2 T1 , Ch- 3
11	Mohr's circle – direct stress in two mutually perpendicular directions.	T3, Ch-2 T1 , Ch- 3
12	Mohr's circle - Direct stress in two mutually perpendicular directions accompanied by a simple shear stress.	T3, Ch-2 T1 , Ch- 3
	ANALYSIS OF BEAMS	
13	Types of beams, Transverse loadings - Point load, uniformly distributed load (UDL) and uniformly varying load (UVL), boundary conditions.	T3, Ch-4 T1 , Ch- 6
14	Shear force and bending moment diagrams for cantilever beam - problems. (pure point load, pure UDL, pure UVL)	T3, Ch-4 T1 , Ch- 6
15	Shear force and bending moment diagrams for cantilever beam. Tutorial on Combined loading.	T3, Ch-4 T1 , Ch- 6
16	Shear force and bending moment diagrams for simply supported beam -problems. (pure point load, pure UDL, pure UVL)	T3, Ch-4 T1 , Ch- 6
17	Shear force and bending moment diagrams for simply supported beam. Tutorial on Combined loading.	T3, Ch-4 T1 , Ch- 6
18	Shear force and bending moment diagrams for overhanging beam - problems. (pure point load, pure UDL, pure UVL)	T3, Ch-4 T1 , Ch- 6

40	Problems on cantilever beam by double integration method.	T3, Ch-8 T1 , Ch- 13
41	Slope and deflection of cantilever beam with a point load and UDL at a distance from free end by Double integration method.	T3, Ch-8 T1 , Ch- 13
42	Problems - Slope and deflection of cantilever beam with a point load and UDL at a distance from free end by Double integration method.	T3, Ch-8 T1 , Ch- 13
43	Slope and deflection of simply supported beam with an eccentric point load Macaulay's method.	T3, Ch-8 T1 , Ch- 12
44	Problem on slope and deflection of simply supported beam with point load & UDL by Macaulay's method.	T3, Ch-8 T1 , Ch- 12
45	Problem on slope and deflection of simply supported beam with point load & UDL by Macaulay's method.	T3, Ch-8 T1 , Ch- 12
46	Slope and deflection of cantilever beam and simply supported beam with point load and UDL by Moment area method.	T3, Ch-8 T1 , Ch- 13
47	Problems on slope and deflection of cantilever beam with point load and UDL by Moment area method.	T3, Ch-8 T1 , Ch- 13
48	Slope and deflection of simply supported beam with point load and UDL by Moment area method.	T3, Ch-8 T3 , Ch- 12
49	Castigliano's theorem.	T3, Ch-8
	COLUMNS AND CYLINDERS	
50	Members subjected to combined bending and axial loads.	T3, Ch-16 T1 , Ch- 19
51	Euler's column theory – assumptions, limitations.	T3, Ch-16 T1 , Ch- 19
52	Expression for crippling load with different end conditions.	T3, Ch-16 T1 , Ch- 19
53	Rankine's theory –problems.	T3, Ch-16 T1 , Ch- 19
54	Tutorial – crippling load.	T3, Ch-16 T1 , Ch- 19
55	Thin cylindrical vessel subjected to internal pressure.	T3, Ch-10 T1 , Ch- 17
56	Change in dimensions due to internal pressure- problems.	T3, Ch-10 T1 , Ch- 17
57	Thin spherical shells subjected internal pressure- problems.	T3, Ch-10 T1 , Ch- 17
58	Tutorial – Thin cylinders.	T3, Ch-10 T1 , Ch- 17
59	Stresses in Thick cylinders –Lame's theory.	T3, Ch-11 T1 , Ch- 18
60	Stresses in compound thick cylinder.	T3, Ch-11 T1 , Ch- 18

19	Theory of pure bending – derivation.	T3, Ch-5 T1 , Ch- 7
20	Bending stress in simple beams – symmetrical sections problems.	T3, Ch-5 T1 , Ch- 7
21	Bending stress in simple beams – unsymmetrical sections Problems	T3, Ch-5 T1 , Ch- 7
22	Bending stress in composite beams – Problems	T3, Ch-5 T1 , Ch- 7
23	Shear stress distribution in beams of different sections–derivation.	T3, Ch-7 T1 , Ch- 8
24	Tutorial on Shear stress distribution in beams of different sections.	T3, Ch-7 T1 , Ch- 8
	TORSION OF SHAFTS	
25	Theory of pure torsion, derivation of shear stress produced in a circular shaft subjected to torsion.	T3, Ch-13 T1 , Ch- 16
26	Expression for torque interms of polar moment of inertia Strength, stiffness of shaft and Torsional rigidity & power transmitted.	T3, Ch-13 T1 , Ch- 16
27	Tutorial on solid shaft	T3, Ch-13 T1 , Ch- 16
28	Tutorial on hollow shaft - finding dimensions based on strength and rigidity.	T3, Ch-13 T1 , Ch- 16
29	Tutorial on hollow shaft - finding dimensions, problems on percentage of material savings.	T3, Ch-13 T1 , Ch- 16
30	Shafts in series and parallel - problems	T3, Ch-13 T1 , Ch- 16
31	Shafts in series and parallel - problems	T3, Ch-13 T1 , Ch- 16
32	Strain energy due to torsion - concepts	T3, Ch-13 T1-16
33	Shaft subjected to combined bending and torsion	T3, Ch-13 T1 , Ch- 16
34	Shaft subjected to combined bending and torsion - problems	T3, Ch-13 T1 , Ch- 16
35	Composite shaft tutorial.	T3, Ch-13 T1 , Ch- 16
36	Composite shaft tutorial.	T3, Ch-13 T1 , Ch- 16
	DEFLECTION OF BEAMS	
37	Relationship between deflection, slope, radius of curvature, shear force and bending moment.	T3, Ch-8 T1 , Ch- 12
38	Slope and deflection of cantilever beam with a point load at a distance from free end by Double integration method.	T3, Ch-8 T1 , Ch- 13
39	Slope and deflection of cantilever beam beam with UDL by Double integration method.	T3, Ch-8 T1 , Ch- 13

61	Tutorial - Thick cylinders.	T3, Ch-11 T1 , Ch- 18

TEXT BOOKS

1. Bansal.R.K, "A Text Book of Strength of Materials", Lakshmi Publications Pvt. Limited, New Delhi, 2010.

2. Prabhu.T.J, "Mechanics of solids", Private Publication, 2002.

3. Rajput.R.K, "Strength of Materials", Fourth Edition ,S. Chand Limited, 2007.

4. Ferdinand P.Beer, and Rusell Johnston.E, "Mechanics of Materials", SI Metric Edition, McGraw Hill, 2011(Hard cover).

REFERENCES

1. William A. Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, McGraw Hill International Edition, 3rd Edition, 2007.

2. Srinath.L.S, "Advanced Mechanics of Solids", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.

3. Egor P. Popov, "Engineering Mechanics of Solids", 2nd edition, Prentice Hall of India Private Limited, New Delhi, 2009.

4. James M. Gere,"Mechanics of Materials", Eighth Edition, Brooks/Cole, USA, 2013.

5. Shigley.J.E, "Applied Mechanics of Materials", International Student Edition, McGraw Hill Koyakusha Limited, 2000.

Name and Signature Faculty:

Section	Name	Signature
	Mr. Ravi Krishnamoorthy S	
	Mr. Subramanian C	
	Mr. Kamaraj M	
	Mr. Harris Samuel R	
	Mr. Sermaraj M	
	Mr. Santhanakrishnan R	

for HOD / Mechanical