SARDAR RAJA COLLEGE OF ENGINEERING, ALANGULAM

DEPARTMENT OF CIVIL ENGINEERING

MICRO LESSON PLAN

SUBJECT : STRENGTH OF MATERIALS

CODE : CE2252

CLASS : II Year / IV SEM

STAFF: Prof. B. KANAGAPANDIAN,

DEPT. OF CIVIL ENGG

CE 2252 STRENGTH OF MATERIALS 3 1 0 4

OBJECTIVE

This subject is useful for a detailed study of forces and their effects along with some suitable protective measures for the safe working condition. This knowledge is very essential for an engineer to enable him in designing all types of structures and machines.

1. ENERGY PRINCIPLES 9+3

Strain energy and strain energy density – strain energy in traction, shear in flexure and torsion – castigliano's theorems – principle of virtual work – application of energy theorems for computing deflections in beams and trusses – Maxwell's reciprocal theorems

2. INDETERMINATE BEAMS 9+3

Propped cantilever and fixed beams-fixed end moments and reactions for concentrated load (central, non central), uniformly distributed load, triangular load (maximum at centre and maximum at end) – theorem of three moments – analysis of continuous beams – shear force andbending moment diagrams for continuous beams – slope & deflections in continuous beams (qualitative study only)

3. COLUMNS 9+3

Eccentrically loaded short columns – middle third rule – core section – columns of unsymmetrical sections – (angle channel sections) – Euler's theory of long columns – critical loads for prismatic columns with different end conditions; Rankine-Gordon formula for eccentrically loaded columns – thick cylinders – compound cylinders.

4. STATE OF STRESS IN THREE DIMENSIONS 9+3

Spherical and deviatory components of stress tensor - determination of principal stresses and principal planes – volumetric strain – dilatation and distortion – theories of failure – principal stress dilatation – principal strain – shear stress – strain energy and distortion energy theories – application in analysis of stress, load carrying capacity and design of members – residual stresses

5. ADVANCED TOPICS IN BENDING OF BEAMS 9+3

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – curved beams – Winkler Bach formula – stress concentration – fatigue and fracture.

TOTAL (L:45+T:15): 60 PERIODS

TEXT BOOKS

1. Egor P Popov, "Engineering Mechanics of Solids", Prentice Hall of India, New Delhi,2003
2. Rajput R.K. Strength of Materials, S.Chand&company Ltd., New Delhi - 2006

REFERENCES

1. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2003
2. William A .Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, Tata McGraw Hill Publishing company Ltd, 2007.
3. Srinath, L.S. Advanced mechanics and solids, Tata-McGraw Hill publishing company ltd, 2005.
4. Punmia B.C.Theory of Structures (SMTS) Vol 1&II, Laxmi publishing Pvt Ltd,New Delhi, 2004.

SUBJECT DESCRIPTION AND OBJECTIVES

The endeavor of engineers to create safe, economical and durable systems has led to the accumulation of vast knowledge and its applications to the benefit of society. This is evident more in the subject of the Strength of Materials than any other. Strength of Materials is a subject that deals with the behavior, load carrying capacity, rigidity and stability of isolated members such as bars, shafts, beams, arches, slabs and columns. The methods employed to predict the response of a structure under loading and its susceptibility to various failure modes may take into account various properties of the materials other than material yield strength and ultimate strength; for example, failure by buckling is dependent on material stiffness and thus Young's Modulus.

This subject deals with

- Energy Principles
- Indeterminate beams
- Columns
- Stress in three dimensions
- Thick Cylinder &
- Unsymmetrical bending of beams

MICRO LESSON PLAN

NO.OF HOURS	LECTURE TOPICS	READINGS
UNIT I ENERGY PRINCIPLES		
1	Strain energy	T-2
2	Strain energy density	T-2
3	Strain energy in traction (AV Class)	T-2
4	Shear in flexure	T-2
5	Shear in torsion	T-2
6	Castigliano's theorems	T-2
7	Principle of virtual work	T-2
8	Application of energy theorems for computing deflections in beams	T-2
9	Problems	T-2
10	Application of energy theorems for computing deflections in trusses	T-2
11	Maxwell's reciprocal theorems	T-2
12	Problems	T-2
UNIT II INDETERMINATE BEAMS		
13	Propped cantilever	T-2
14	Fixed beams	T-2
15	Fixed end moments and reactions for concentrated load (central, non central)	T-2
16	Fixed end moments and reactions for uniformly distributed load	T-2
17	Fixed end moments and reactions for triangular load (maximum at centre and maximum at end)	T-2
18	Theorem of three moments	T-2
19	Analysis of continuous beams (AV Class)	T-2
20	Shear force diagram for continuous beams	T-2
21	Bending moment diagram for continuous beams	T-2
22	Slope in continuous beams	T-2
23	Deflections in continuous beams (qualitative study only)	T-2
24	Problems	T-2
UNIT III COLUMNS		
25	Eccentrically loaded short columns	T-2
26	Middle third rule	T-2
27	Core section	T-2
28	Columns of unsymmetrical sections (angle and channel sections)	T-2
29	Problems	T-2
30	Critical loads for prismatic columns with different end conditions	T-2
31	Euler's theory of long columns (AV Class)	T-2
32	Problems	T-2

33	Rankine-Gordon formula for eccentrically loaded columns	T-2
34	Problems	T-2
35	Thick cylinders	T-2
36	Compound cylinders	T-2
UNIT IV STATE OF STRESS IN THREE DIMENSIONS		
37	Spherical and deviatory components of stress tensor	T-2
38	Determination of principal stresses (AV Class)	T-2
39	Determination of principal planes (AV Class)	T-2
40	Volumetric strain	T-2
41	Dilatation and distortion	T-2
42	Theories of failure	T-2
43	Principal stress dilatation	T-2
44	Principal strain	T-2
45	Shear stress	T-2
46	Strain energy and distortion energy theories	T-2
47	Application in analysis of stress, load carrying capacity and design of members	T-2
48	Residual stresses	T-2
UNIT V ADVANCED TOPICS IN BENDING OF BEAMS		
49	Unsymmetrical bending of beams of symmetrical sections	T-2
50	Problems	T-2
51	Unsymmetrical bending of beams of unsymmetrical sections (AV Class)	T-2
52	Problems	T-2
53	Problems	T-2
54	Curved beams	T-2
55	Problems	T-2
56	Winkler Bach formula	T-2
57	Problems	T-2
58	Fracture	Vol-III -PRAKASH RAO
59	Fatigue	
60	Stress concentration	