

KL UNIVERISTY
FIRST SEMESTER 2010-11
Course Handout
Academic Division

Dated: 07-07-2010

Course No. : CE C204
Course Title : Strength of Materials
Course Structure : 3-1-0
Course coordinator : Dr. P Saha
Instructors : P.Poluraja

1. Course Description:

Strength of materials is a basic engineering subject must be understood by any one concerned with the strength and physical performance of the structure, whether those structures are man made or natural. The subject matter includes such fundamental concepts as stresses and strains, shear force, loads , bending moments, pure bending of beams, columns and their load carrying capacity. These concepts underlie the design and analysis of a huge variety of structural systems.

2. Scope and Objective of the Course:

After thorough learning of STRENGTH OF MATERIAL

The student should be able to:

1. Determine stresses, strains and forces in the structure and their components due to loads acting on them.
2. Find the loads that cause failure, they have complete picture of the behavior of the structure.
3. Understand the mechanical behavior of the structure to design safe structures like building, bridges, dams, highways, tanks etc.
4. Solve many real life problems and they can understand the cause behind those structural behaviours.
5. This course is prerequisite to the subjects like structural analysis, design of steel and concrete structures etc.

3. Books:

(i) Textbook:

1. Mechanics of materials by J.M. Gere , THOMSOMBROOKS/COLE India edition, Sixth edition,2006.
2. Mechanics of materials by Beer, Johnston and DeWolf., Mcgraw- Hill Publishers, Third Edition,2006.

(ii) Reference Book:

1. Strength of materials Part I & II by S P Timoshenko. CBS Publishers and distributors, New Delhi, 3rd Edition.
2. Mechanics of materials by Riley, Strurges and Morris., John Wiley and Sons Inc. fifth Edition.
3. Strength of materials by A Pytel and F. L. Singer. Harpers Collins Publishers India.

4. Syllabus:

UNIT – 1

SHEAR FORCE AND BENDING MOMENT :

Introduction; Diagrammatic conventions for supports; Diagrammatic conventions for loading; Classification of beams; Concept of shear force and bending moment; relationship between load, shear force and bending moment, Shear force and bending moment diagrams for statically determinate beams and frames.

UNIT – 2

PURE BENDING AND SHEARING STRESSES OF BEAMS:

Introduction; Some important limitations of the theory; Basic assumptions; The flexure formula; Computation of the moment of inertia; Remarks on the flexure formula.

Introduction; Shear flow; The shearing stress formula for beams; Shear stress distribution for various sections; Shear centre.

UNIT – 3

ANALYSIS OF PLANE STRESS:

Introduction; Equations for the transformation of plane stress; Principal Stresses; Principal planes; Maximum shearing stresses; Mohr's circle of stress; Construction of Mohr's circle of stress.

UNIT – 4

TORSION:

Introduction, torsional deformations of a circular bar, circular bar of elastic materials, stresses and strain in pure shear, relationship between E and G, thin walled tubes. circumferential and longitudinal stresses.

UNIT – 5

COLUMNS:

Introduction; Stability of equilibrium; The Euler's formula for columns with different end restraints; Limitations of the Euler's formulas; Generalized Euler buckling - load formulas; The Secant formula; Rankine's empirical formula.

5.Course Plan:

No.of hours	Learning Objectives	Topics to be covered	Chapter in the text book
Unit I			
1	Introduce the concept of Strength of materials	Introduction given about the subject, Reference text books	T1-4.1
2	To understand different loads, beams and reaction	Types of beams, loads, reactions	T1-4.2
3	To understand shearing force and bending moment	Shearing forces and bending moments	T1-4.3
4	To establish the relation between the load, shear force and B.M	Relationship between loads, shear forces and bending moments	T1-4.4

5	Drawing of shear force and B.M diagrams	Shear force and bending moments diagrams	T1-4.5
6	To practice the problems	Problems on Shear force and bending moments diagrams	T1-4.5
7	Introduce the concept of pure bending	Introduction, pure bending	T1-5.1 & 5.2
8	To understand the importance of curvature and longitudinal strains	Curvature and Longitudinal strains in beams	T1-5.3 & 5.4
9	To establish the flexure formula	Normal stresses in beams and Flexure formula	T1-5.5
10	To understand the limitations	Limitations of flexure formula	T1-5.5
11	To find the centroids of areas	Centroids of areas	T1-12.2 & 12.3
12	To determine the moment of inertia	Moment of inertia of plane areas	T1-12.3
13	To understand the shearing stresses	Shearing stresses in beams	T1-5.8
14	To derive the shearing formula	Derivation of shearing formula	T1-5.8
15	To understand the shear stress distribution in beams	Distribution of shear stresses in rectangular beam	T1-5.8
16	To know the limitations of the theory	Limitations of shear theory	T1-5.8
17	To determine the shearing stresses in the webs of flanged beams	Shear stresses in the webs of beams with flanges	T1-5.10
18	To understand the concept of shear flow	Shear flow in beams	T1-5.11
19	To understand the concept of shear centre	Shear centre	T1-6.6
20	Introduce fundamental knowledge of Plane stress, plane strain	Plane stress, plane strain-definitions, Problems on stress and strain	T1 - 7.2 & 7.7
21	Study classifications of Stresses	Types of stresses, strains, Principal stress, Principal strain	T1 - 7.2,7.3 & 7.7
22	Establish the transformation equations for plane stress	Transformation equations for plane stress	T1-7.2
23	To understand the concept of principle stress	Principle stresses	T1-7.3
24	To understand the concept of principle planes	Principle planes	T1-7.3
25	To understand the concept of maximum shear stress	Maximum shear stress	T1 - 7.3

26	To introduce the concept of Mohr's Circle	Mohr's Circle-formation	T1 - 7.4
27	To understand the importance Mohr's Circle	Applications of Mohr's Circle	T1 - 7.4
28	To solve problems on Mohr's circle	Problems on Mohr's circle	T1 - 7.4
29	Introduce fundamental knowledge of Torsion	Torsion, introduction	T1-3.1
30	To know the deformations due to torsion	Torsion deformations of a circular bar	T1-3.2
31	To establish the torsion formula	Circular bars of linearly elastic material, torsion formula	T1-3.3
32	To know the limitations of torsion formula	Limitation of the torsion formula	T1-3.3
33	To solve problems on torsion	Problems on torsion	T1-3.3
34	To understand the concept of stresses in pure shear	Stresses in pure shear	T1-3.5
35	To understand the concept of strains in pure shear	strains in pure shear	T1-3.5
36	To establish the relationship between E and G	Relationship between E and G	T1-3.6
37	Stresses on thin walled tubes	Thin walled tubes	T1-3.10
38	Thin cylinders- Circumferential and longitudinal stresses	Thin cylinders- Circumferential and longitudinal stresses	T1-8.1 TO 8.3
39	Introducing the column theory	Columns: Introduction , examples of instability and criteria for stability	T1-11.1 to 11.2
40	Analyzing Euler formulas & their limitations	Euler formulas and limitations , both end pinned	T1- 11.3
41	Critical load for the columns with the support condition other than pinned	Columns with the support conditions other than pinned	T1- 11.4
42	To solve the problems on Euler formula	Problems on Euler formula	T1- 11.3
43	Generalization of Euler formulas	Generalized Euler buckling load formulas	T1-11.5
44	Introduce and analyze the case for eccentric loads	Eccentric loads and the secant formulas	T1-11.5 to 11.6
45	To know the critical load formula other than Euler formula	Design formulas for column	T1-11.9

6.Self learning material:

Unit	Topic	Source
I	SHEAR FORCE AND BENDING MOMENT :	www.nptel.ac.in http://pubs.asce.org/journals/materials/default.htm http://pubs.asce.org/journals/engineeringmechanics/ http://en.wikipedia.org/wiki/Strength_of_materials http://www.engineersedge.com/strength_of_materials.htm
II	PURE BENDING AND SHEARING STRESSES OF BEAMS:	www.nptel.ac.in http://pubs.asce.org/journals/materials/default.htm http://pubs.asce.org/journals/engineeringmechanics/ http://en.wikipedia.org/wiki/Strength_of_materials http://www.engineersedge.com/strength_of_materials.htm
III	ANALYSIS OF PLANE STRESS:	www.nptel.ac.in http://pubs.asce.org/journals/materials/default.htm http://pubs.asce.org/journals/engineeringmechanics/ http://en.wikipedia.org/wiki/Strength_of_materials http://www.engineersedge.com/strength_of_materials.htm
IV	TORSION:	www.nptel.ac.in http://pubs.asce.org/journals/materials/default.htm http://pubs.asce.org/journals/engineeringmechanics/ http://en.wikipedia.org/wiki/Strength_of_materials http://www.engineersedge.com/strength_of_materials.htm
V	COLUMNS:	www.nptel.ac.in http://pubs.asce.org/journals/materials/default.htm http://pubs.asce.org/journals/engineeringmechanics/ http://en.wikipedia.org/wiki/Strength_of_materials http://www.engineersedge.com/strength_of_materials.htm

7.Evaluation Scheme:

Component	Duration (minutes)	% Weightage	Marks	Date & Time	Venue
Test-1	50 Min	10	10	11-08-2010 9.30 to 10.20 A.M	CSE002, 103, 104, 502
Test-2	50 Min	10	10	15-09-2010 9.30 to 10.20 A.M	CSE002, 103, 104, 502
Assignment submission		5	5	Continuous	
Assignment Test	50 Min	5	5	27-10-2010 9.00 to 10.20 A.M	CSE002, 103, 104, 502
Quiz	30 Min	5	5	27-10-2010 9.00 to 10.20 A.M	CSE002, 103, 104, 502
Regular Lab Evaluation	Continuous	0	0		
Comprehensive Lab Exam	3 Hrs	0	0		
Comprehensive Exam	3 Hrs	60	60		
Attendance for Theory & Tutorial		5	5	Continuous	
Attendance for Lab		0	0	Continuous	

8. Chamber consultation hour: Informed in the class in first week.

9. Notices: All notices regarding the course will be put in E-learning website.

10. Tutorial: Tutorial will be conducted by the respective in charge faculty. The tutorials are planned to supplement the material taught in the lectures and clear doubts. Student must attend registered section for tutorial in the respective classroom. Class assignment, class tests and other evaluation components will also be conducted during tutorials. Students must actively participate in the tutorial and come prepared for it.

Course Coordinator