



Department of Civil Engineering		LP: Sub Code
B.E/B.Tech/M.E/M.Tech : Civil Engineering Regulation: R 2018		Rev. No: 01
PG Specialisation : Not Applicable		Date:02/03/2022
Sub. Code / Sub. Name : CE 18401 Strength of Materials - II		
Unit : I		

**UNIT I ENERGY PRINCIPLES**

Strain energy and strain energy density – strain energy due to axial load (gradual, sudden and impact load), shear, flexure and torsion – Castigliano's theorems – Maxwell's reciprocal theorems – Principle of virtual work – unit load method- application of energy theorems for computing deflections in determinate beams, plane frames and plane trusses – lack of fit- temperature effects- Williot Mohr's Diagram.

**Objective:** To know the method of finding slope and deflection of beams and trusses using energy theorems.

Session No *	Topics to be covered	Ref	Teaching Aids
01	Overall introduction of the subject - Strain energy and strain energy density – Strain energy due to axial load (gradual, sudden, impact load) and flexure	1-ch15, pg. 861,862, 881, 882	PPT & BB
02			PPT & BB
03	Problems on strain energy due to axial load and flexure.	1-ch15, pg.864 to 869, 882 to 889	PPT & BB
04	Strain energy in shear and torsion	1-ch15, pg.876 to 881,	PPT & BB
05	Tutorial		PPT & BB
06	Castigliano's theorems - Maxwell's reciprocal theorems - Principle of virtual work – unit load method	1-ch15, pg.900 to 903, 916,917 2-ch 17, pg.736-740 10-Ch.16; pg.627-656	PPT & BB
07			
08	Application of energy theorems for deflections in beams and trusses, frames – Discussion & Tutorial (1 session)	1-ch 15, 903 to 916 6-ch12, pg.321 to 325 10-Ch.16; pg.629-639 11-Ch.9; pg.606-626	PPT & BB
09			
10	Lack of fit – temperature effects	9-ch 10, pg.456 to 462	PPT & BB
11	Williot Mohr's Diagram	6-ch13, pg.325 to 329	PPT & BB
12	Tutorial		PPT & BB

**Content beyond syllabus covered (if any):**

\* Session duration: 50 minutes



Sub. Code / Sub. Name: CE 18401 Strength of materials -II  
 Unit : II

**UNIT II INDETERMINATE BEAMS**

Concept of Analysis - Propped cantilever and fixed beams-fixed end moments and reactions – Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

**Objective:** To know the concept of analyzing indeterminate beams

Session No *	Topics to be covered	Ref	Teaching Aids
13	Concept of Analysis - Fixed beams – Fixed end moments and reactions for concentrated load (central, non-central)	4-ch 13, pg.13.1 to 13.3	PPT & BB
14		1-ch 9, pg.529 to 542	PPT & BB
15	Fixed beams -Fixed end moments for Uniformly distributed load	1-ch 9, pg.545 to 551	PPT & BB
16			PPT & BB
17	Tutorial		PPT & BB
<b>CAT 1</b>			
18	Fixed beams -Fixed end moments for triangular load (maximum at center and maximum at end)	1-ch 9, pg.551 to 552, 560	PPT & BB
19	Theorem of three moments – Analysis of continuous beams – SFD and BMD for continuous beams	7-ch 8, pg.380 to 389	PPT & BB
20			PPT & BB
21	Tutorial		PPT & BB
22	Propped cantilever -Fixed end moments for Uniformly distributed load	5-ch 11, pg. 356, 357	PPT & BB
23	Propped cantilever –Fixed end moments for triangular load (maximum at centre and maximum at end)	1-Ch.8; pg.501-504	PPT & BB
24	Tutorial		PPT & BB
<b>Content beyond syllabus covered (if any):</b>			

\* Session duration: 50 mins



Sub. Code / Sub. Name: CE 18401 Strength of materials-II

Unit : III

### UNIT III COLUMNS AND CYLINDERS

Euler's theory of long columns – critical loads for prismatic columns with different end conditions; Rankine-Gordon formula for eccentrically loaded columns – Eccentrically loaded short columns – middle third rule – core section – Thin cylindrical and spherical shells- Stresses and change in dimensions – Thick cylinders – Compound cylinders – shrinking on stresses.

**Objective:** To estimate the load carrying capacity of columns and stresses in cylinders

Session No *	Topics to be covered	Ref	Teaching Aids
25	Euler's theory of long columns- critical loads for prismatic columns with different end conditions	3-ch 8, pg. 326 to 337	PPT & BB
26			
27	Tutorial		PPT & BB
28	Rankine-Gordon formula for eccentrically loaded columns	3-ch 8, pg. 342 to 344	PPT & BB
29			
30	Eccentrically loaded short columns – middle third rule – core section	5-ch 17, pg.529 to 540	PPT
31	Tutorial		PPT & BB
32	Thin cylindrical and spherical shells- Stresses and change in dimensions	1 – Ch.10; Pg.589-605	PPT & BB
33			
34	Thick cylinders, compound cylinders, shrinking on stresses	5-ch 23, pg. 695 to 703, pg. 703 to 712	PPT & BB
35			
36	Tutorial		PPT & BB
	<b>CAT II</b>		

Content beyond syllabus covered (if any):

\* Session duration: 50 mins





Sub. Code / Sub. Name: CE 18401 Strength of materials-II

Unit : IV

**UNIT IV STATE OF STRESS IN THREE DIMENSIONS**

Determination of principal stresses and principal planes – Volumetric strain –Theories of failure – Principal stress - Principal strain – shear stress – Strain energy and distortion energy theories – application in analysis of stress, load carrying capacity.

**Objective:** To determine principal stresses and planes for an element in three dimensional state of stress and to study various theories of failure of material.

Session No *	Topics to be covered	Ref	Teaching Aids
37	3D stress -Determination of principal stresses and principal planes – Volumetric strain	8-ch 3, pg.109 to 123	PPT
38			PPT & BB
39			PPT & BB
40			PPT & BB
41	Tutorial		PPT & BB
42	Theories of failure – Principal stress	1-ch 18, pg.1103 to 1106	PPT & BB
43	Theories of failure -Principal strain	1-ch 18, pg.1112 to 1113	PPT & BB
44	Theories of failure -shear stress	1-ch 18, pg.1106 to 1108	PPT & BB
45	Tutorial		PPT & BB
46	Strain energy and distortion energy theories- application in analysis of stress, load carrying capacity	1-ch 18, pg.1108 to 1112	PPT & BB
47			PPT & BB
48	Tutorial		PPT & BB
<b>Content beyond syllabus covered (if any):</b>			

\* Session duration: 50 mins



Sub. Code / Sub. Name: CE 18401 Strength of materials-II  
 Unit : V

**UNIT V ADVANCED TOPICS IN BENDING OF BEAMS**

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – Shear Centre - curved beams – Winkler Bach formula.

**Objective:** To estimate stresses due to unsymmetrical bending and stresses in curved beams

Session No *	Topics to be covered	Ref	Teaching Aids
49	Unsymmetrical bending of beams of symmetrical sections	1-ch 21, pg.1222 to 1226, 1229 to 1230, 1232 to 1234	PPT
50			PPT& BB
51	Unsymmetrical bending of beams of unsymmetrical sections	1-ch 21, pg.1226 to 1229 10- Ch.18; pg.706-718	PPT
52			PPT & BB
53	Tutorial		PPT & BB
54	Shear Centre	1-ch 21, pg.1234 to 1244 10-Ch.18; pg.727-746	PPT
55	Tutorial		PPT & BB
56	Curved beams – Winkler Bach formula.	1-ch 20, pg. 1163 to 1217 10-Ch.17; pg.661-703 11-Ch.13; pg.810-828	PPT
57			PPT & BB
58			PPT & BB
59			PPT & BB
60	Tutorial		PPT & BB
Content beyond syllabus: Plastic theory of bending		7-ch 17, pg.684-690	PPT & BB
<b>CAT III</b>			

\* Session duration: 50 mins




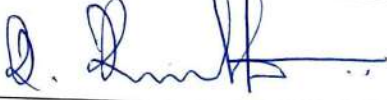
## SRI VENKATESWARA COLLEGE OF ENGINEERING

## COURSE DELIVERY PLAN - THEORY

Sub Code / Sub Name: CE 18401 Strength of materials-II

## REFERENCES:

1. **Rajput.R.K.** "Strength of Materials", S.Chand and Co, New Delhi, 2013
2. **Egor P Popov**, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., Delhi, 2012
3. **Kazimi S.M.A.**, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2003
4. **William A .Nash**, "Theory and Problems of Strength of Materials", Schaum"s Outline Series, Tata McGraw Hill Publishing company, 2007.
5. **Punmia B.C.**"Strength of materials" (SMTS- Vol 1), Laxmi Publishing Pvt Ltd, New Delhi 2013.
6. **Punmia B.C.**"Theory of Structures" (SMTS-Vol II), Laxmi Publishing Pvt Ltd, New Delhi 2004.
7. **Rattan.S.S.**, "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.
8. **Holzapfel. G.A** "Nonlinear solid Mechanics", John Wiley & sons Ltd., England, 2000
9. **Vazirani V.N. & Ratwani. M.M.** " Analysis of Structures" Vol-II, Khanna Publishers 1996.
10. **U.C. Jindal**, "Strength of materials", Pearson Education in South Asia, 2012
11. **R.Subramanian**, "Strength of materials", 3<sup>rd</sup> edition, Oxford university press, 2016

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Date	02/03/2022	23/03/2022
Remarks *:		
Remarks *:		

\* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD