SRI VIDYA COLLEGE OF ENGINEERING & TECHNOLOGY

COURSE PLAN (THEORY)

ACADEMIC YEAR: 2018 -2019 ODD

Subject Code	CE8301		**L**	**P**	**T**	**C**
Subject Title	STRENGTH OF MATERIALS - I		3	1	0	3
Year / Dept / Sem	II/CIVIL/III	Regulation Year	2017			
Faculty Name / Desg / Dept	Mr. S.KEERTHI PRIYAN AP/CIVIL					
Course Prerequisite	1. The students must have more knowledge about basic fundamentals of stress and strain 2. They have details about types of beams and basic concepts about Design					

CE8301 STRENGTH OF MATERIALS - I L T P C

3 1 0 3

OBJECTIVES:

- To learn fundamental concepts of Stress, Strain and deformation of solids
- To know the mechanism of load transfer in beams, the induced stress resultants and deformations.
- To understand the effect of torsion on shafts and springs.
- To analyze space and plane trusses.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Simple Stresses and strains – Elastic constants - Relationship between elastic constants – Stress Strain Diagram – Ultimate Stress – Yield Stress – Deformation of axially loaded member - Composite Bars - Thermal Stresses – State of Stress in two dimensions – Stresses on inclined planes – Principal Stresses and Principal Planes – Maximum shear stress - Mohr's circle method.

UNIT II TRANSFER OF LOADS AND STRESSES IN BEAMS 9

Types of loads, supports, beams – concept of shearing force and bending moment - Relationship between intensity of load, Shear Force and Bending moment - Shear Force and Bending Moment Diagrams for Cantilever, simply supported and overhanging beams with concentrated load, uniformly distributed load, uniformly varying load and concentrated moment. Theory of Simple Bending – Stress Distribution due to bending moment and shearing force - Flitched Beams - Leaf Springs.

UNIT III DEFLECTION OF BEAMS 9

Elastic curve – Governing differential equation - Double integration method - Macaulay's method - Area moment method - conjugate beam method for computation of slope and deflection of determinant beams.

UNIT IV TORSION 9

Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – combined bending moment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – springs in series and parallel – Design of buffer springs.

UNIT V ANALYSIS OF TRUSSES 9

Determinate and indeterminate trusses - Analysis of pin jointed plane determinate trusses by method of joints, method of sections and tension coefficient – Analysis of Space trusses by tension coefficient method.

TOTAL :45 PERIODS

OUTCOMES:

Students will be able to

- Understand the concepts of stress and strain, principal stresses and principal planes.
- Determine Shear force and bending moment in beams and understand concept of theory of simple bending.
- Calculate the deflection of beams by different methods and selection of method for determining slope or deflection.
- Apply basic equation of torsion in design of circular shafts and helical springs,
- Analyze the pin jointed plane and space trusses.

TEXTBOOKS :

1. Rajput.R.K. “Strength of Materials”, S.Chand and Co, New Delhi, 2015.
2. Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain, SMTS –I Strength of materials, Laxmi publications. New Delhi, 2015
3. Rattan . S. S, “Strength of Materials”, Tata McGraw Hill Education Private Limited, New Delhi, 2012
4. Bansal. R.K. “Strength of Materials”, Laxmi Publications Pvt. Ltd., New Delhi, 2010

REFERENCES:

1. Timoshenko.S.B. and Gere.J.M, “Mechanics of Materials”, Van Nos Reinbhold, New Delhi 1999.
2. Vazirani.V.N and Ratwani.M.M, “Analysis of Structures”, Vol I Khanna Publishers, New Delhi,1995.
3. Junnarkar.S.B. and Shah.H.J, “Mechanics of Structures”, Vol I, Charotar Publishing House, New Delhi 2016.
4. Singh. D.K., “ Strength of Materials”, Ane Books Pvt. Ltd., New Delhi, 2016
5. Basavarajaiah, B.S. and Mahadevappa, P., Strength of Materials, Universities Press, Hyderabad, 2010.
6. Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2009.

Course Objectives (CO)	CO1: To learn fundamental concepts of Stress, Strain and deformation of solids with applications to bars, beams and thin cylinders. CO2: To know the mechanism of load transfer in beams, the induced

	stress resultants and deformations CO3: To understand the effect of torsion on shafts and springs. CO4: To analyze a complex two dimensional state of stress and plane trusses
Expected Course Outcomes (ECO)	At the end of the course, the students should be able to: ECO1: Thorough understanding of the fundamental concepts of stress and strain in mechanics of solids and structures. ECO2: The ability to analyse determinate beams and trusses to determine shear forces, bending moments and axial forces. ECO3: A sufficient knowledge in designing shafts to transmit required power and also springs for its maximum energy storage capacities.

Mapping of CO & PO(Specify the PO's)

PROGRAM OUTCOMES (Pos)

Engineering graduates will be able to:

1. ENGINEERING KNOWIEDGE: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. PROBLEM ANALYSIS: identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principals of mathematics, natural sciences and engineering sciences.

3. DESIGN/ DEVELOPMENT OF SOLUTIONS: Design solutions for complex engineering problems and design systems components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural societal, and environmental considerations.

4. CONDUCT INVESTIGATIONS COMPLEX PROBLEMS: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

5. MODERN TOOL USAGE: Create, select, and apply appropriate techniques resources, and modern engineering and it tools including production and modeling to complex engineering activities with an understanding of the limitations.

6.THE ENGINEERING AND SOCIETY: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practices.

7. ENVIRONMENT AND SUSTAINABLITY: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for

sustainable development.

8. ETHICS: Apply ethical principles and commit to professional and responsibilities and norms of the engineering practices.

9. INDIVIDUAL AND TEAM WORK: Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary setting.

10.COMMUNICATION: Communicate effectively on complex engineering activities with the engineering community and with society at large such as being able to comprehend and write effectives reports and design documentations, make presentations, and give and receive clear instructions.

11.PROJECT MANGMENT AND FINANCE: Demonstrate knowledge and understanding of the engineering and management principals and apply these to ones own work as a member and leader in a team to manage project and in multidisciplinary environments.

12. LIFE LONG LEARNING: Recognize the need for , and have the preparations and ability to engage in independent and lifelong learning in the broadest context of technological change

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	- `	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	-	-	1	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	2	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	1	-

1 – Slight 2 –Moderate 3 – High

Bridging the Curriculum Gap (Additional Topics beyond syllabus/Seminars/Assignments)	BCG1: Indeterminate beams BCG2: Three dimensional stress system BCG3: Symmetrical & unsymmetrical bending of beams
Related Website URLs	W1: ocw.nthu.edu.tw/ocw/upload/8/259/Chapter_10-98.pdf W2:www.colorado.edu/engineering/CAS/courses.**d**/Structures.**d**/IAST...**d**/IAST.Lect01.pdf W3: https://www.scribd.com/doc/.../Symmetric-and-Unsymmetric-Bending-of-Beams
Related Video Course	V1: https://www.youtube.com/watch?v=JeIalGPTXbI

Materials (min. 3 no.s)	V2: https://www.youtube.com/watch?v=jOQx6A_nsMU V3: https://www.youtube.com/watch?v=j6n67aXNcYM

S.No	Topic Name	Book	Page no	Mode of delivery	No of hrs	Cumulative hrs
UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS						
1.	Introduction - simple stress and strain	T1	3-5	Class room teaching	1	1
2.	Elastic constants Relationship among elastic constants	T1	27-29	Class room teaching	2	3
3.	Stress Strain Diagram - Deformation of axially loaded member	Own notes	-	Class room teaching	2	5
4.	Ultimate Stress – Yield Stress	T1	7-8	Class room teaching	1	6
5.	Compound bars	T1	35-50	Class room teaching	2	8
6.	Thermal Stresses	T1	51-57	Class room teaching	1	9
7.	State of Stress in two dimensions - Stresses on inclined planes	T1	94-96	Class room teaching	1	10
8.	Principal Stresses and Principal Planes	T1	94	Class room teaching	1	11
9.	Maximum shear stress	T1	367-394	Class room teaching	1	12
10.	Mohr's circle method.	T1	97-126	Class room teaching	2	14
UNIT II SHEAR AND BENDING IN BEAMS						
1.	Introduction -Types of beams, loads, supports	T1	206-208	Class room teaching	1	15
2.	concept of shearing force and bending moment - Relationship between intensity of load, Shear Force and Bending moment	T4	239-240 & 289	Class room teaching	1	16
3.	Shear force & bending moment diagrams for cantilever beam with point load UDL,UVL and	T1	209-218	Class room teaching	2	18

	concentrated moment					
4.	Shear force & bending moment diagrams for simply supported beam with point load UDL,UVL and concentrated moment	T1	218-234	Class room teaching	2	20
5.	Shear force & bending moment diagrams for overhanging beam with point load UDL,UVL and concentrated moment	T1	235-242	Class room teaching	2	22
6.	Theory of Simple Bending – Analysis of Beams for Stresses	T1	261-329	Class room teaching	1	23
7.	Stress Distribution due to bending moment and shearing force	T4	351-376	Class room teaching	2	25
8.	Flitched Beams	T1	289-296	Class room teaching	1	26
9.	Leaf Springs.	T4	728 -740	Class room teaching	1	27
UNIT III DEFLECTION OF BEAMS						
1.	Introduction - Elastic curve – Governing differential equation - computation of slopes and deflections of determinant beams	T1	399-401	Class room teaching	2	29
2.	Problem solved by using Double integration method for determinate beams	T1	401-420	Class room teaching	2	31
3.	Problem solved by using Macaulay's methods for determinate beams	T1	420-444	Class room teaching	2	33
4.	Problem solved by using Area moment method for determinate beams	T1	444-469	Class room teaching	2	35
5.	Problem solved by using conjugate beam method	T1	469-492	Class room teaching	2	37
UNIT IV TORSION						
1.	Introduction - Theory of Torsion	T1	724-728	Class room	2	39

	Stresses and Deformations in Solid and Hollow Circular Shafts			teaching		
2.	combined bending moment and torsion of shafts	T1	761-764	Class room teaching	2	41
3.	Power transmitted by the shaft	T1	728-729	Class room teaching	1	42
4.	Shaft in series and parallel	R7	4.8-4.9	Class room teaching	2	44
5.	Open coiled helical spring in series & parallel	T1	826-837	Class room teaching	2	46
6.	Closed coiled helical spring in series & parallel	T1	813-826	Class room teaching	2	48
7.	Design of buffer springs.	R7	4.51 -4.52	Class room teaching	1	49
UNIT V COMPLEX STRESSES AND PLANE TRUSSES						
1.	Introduction - Determinate and indeterminate trusses	T1	992-999	Class room teaching	2	51
2.	Analysis of pin jointed plane determinate trusses by using method of joints	T1	998-1038	Class room teaching	2	53
3.	Analysis of pin jointed plane determinate trusses by using method of sections	T1	1038-1052	Class room teaching	2	55
4.	Analysis of pin jointed plane determinate trusses by using tension coefficient method	R8	479-486	Class room teaching	2	57
5.	Analysis of Space trusses by tension coefficient method.	R8	487-496	Class room teaching	2	59

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1. Rajput.R.K. “Strength of Materials”, S.Chand and Co, New Delhi, 2015.
2. Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain, SMTS –I Strength of materials, Laxmi publications. New Delhi, 2015
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3. Junnarkar.S.B. and Shah.H.J, “Mechanics of Structures”, Vol I, Charotar Publishing House, New Delhi 2016.
4. Singh. D.K., “ Strength of Materials”, Ane Books Pvt. Ltd., New Delhi, 2016
5. Basavarajaiah, B.S. and Mahadevappa, P., Strength of Materials, Universities Press, Hyderabad, 2010.
6. Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2009.
7. Rajendran.V, “Mechanics of solids”, SriKrishna Hitech Publishing company Private Limited.,Chennai.2017.
8. Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain, SMTS –II “Theory of structures”, Laxmi publications. New Delhi, 2005

	Prepared by	***Approved by***
Signature		
Name	Mr. S.KEERTHI PRIYAN	Mr.P.SureshKumar
Designation	Assistant Professor / CIVIL	HOD/CIVIL
Signed date		

LEGEND:

METHODOLOGY TO MAP OBJECTIVE WITH OUTCOME

Course outcomes are achieved through

- **a.** Suitable Analogies.
- **b.** Class room teaching.
- **c.** Assignments.
- **d.** Tutorials
- **e.** Weekly, monthly and model exams.
- **f.** Brain storming.
- **g.** Group discussion and role play.
- **h.** Seminars