STRENGTH OF MATERIALS-II (CE404PC)
COURSE PLANNER

I. COURSE OVERVIEW: The aim of this course is to introduce basic principles of fluid mechanics and it is further extended to cove r the application of fluid mechanics by the inclusion of fluid machinery. Now a days the principles of flui d mechanics find wide applications in many situations. The course deals with the fluid machinery, like tu rbines, pumps in general and in power stations. This course also deals with the large variety of fluids suchas air, water, steam, etc; however the major emphasis is given for the study of water.

II. PREREQUISITE(S):

Level	Credits	Periods	Prerequisite
UG	4	5	Strength of Materials - I

III. COURSE OBJECTIVES: At the end of this course, a student will be able to

1. Determine stresses in the member subjected to Torsion
2. Analyze columns and struts
3. Understand the concept of direct and bending stresses
4. Analyze and design springs, thin and thick cylinders
5. Understand the concept of unsymmetrical bending.

IV. COURSE OUTCOMES:

After completing this course the student must demonstrate the knowledge and ability to:

S.NO	COURSE OUTCOMES(CO)	Knowledge Level (Blooms level)
CO 1	Able to understand the stresses developed in the shafts subjected to torque, bending moment and thrust and understand the design considerations to prevent the failure. ii)Able to apply the formulae for the design of springs.	Knowledge, Understanding & apply (L1, L2, L3)
CO 2	Understand the failure phenomenon of columns and struts and finding the stresses developed in them & Able to calculate the stresses induced in beam columns.	Knowledge, Understanding & apply (L1, L2, L3)
CO 3	Able to apply the design principles for the design of dam, chimneys, retaining walls which are subjected to both direct and bending stresses &Able to apply the design principles for the design of beams curved in plan.	Knowledge, Understanding & apply (L1, L2, L3)
CO 4	Able to calculate the stresses induced in thin cylinders and thick cylinders and obtain safe dimensions.	Understanding L2
CO 5	Able to calculate the stresses developed in a beam subjected to unsymmetrical bending and also find shear centre.	Understanding L2

V. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program outcomes		Level	Proficiency assessed by
PO1	Engineering knowledge: To Apply the knowledge of mathematics, science, engineering fundamentals/principals, and civil engineering to the solution of complex engineering problems encountered in modern engineering practice.	3	Assignments
PO2	Problem analysis: Ability to Identify, formulate, review research literature, and analyze complex engineering problems related to Civil Engineering and reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2.8	Exercise, Exams
PO3	Design/development of solutions: Design solutions for complex engineering problems related to Civil Engineering and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3	Exercise
PO4	Conduct investigations of 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.	-	-
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	-	-
PO6	The engineer 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 Civil Engineering professional engineering practice.	1.75	Disssions
PO7	Environment and sustainability: Understand the impact of the Civil Engineering professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.		
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	-	----
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	2.25	Mock Test
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	-	------

PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	-	-----
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2.25	Prototype, Discussions

VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program outcomes		Level	Proficiency assessed by
PSO 1	**ENGINEERING KNOWLEDGE:** Graduates will be able to apply technical knowledge in drawing, analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good basics in mathematics, basic sciences and technical communication	2.50	Lectures and Assignments
PSO 2	**BROADNESS AND DIVERSITY:** Graduates will be able to summarize and can demonstrate about societal, economical, environmental, health and safety factors involved in infrastructural development, and shall work within multidisciplinary teams with competence in modern tool usage.	2.50	Assignments & Seminars
PSO 3	**SELF-LEARNING AND SERVICE:** Graduates will be able to pursue lifelong learning and professional development to face the challenging and emerging needs of our society, ethically and responsibly.	2.50	--

VII. SYLLABUS:

JNTUH SYLLABUS

UNIT – I

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations : T/J = q/r = Gθ/L – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

Springs: Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple – springs in series and parallel – Carriage or leaf springs.

UNIT II

Columns and Struts: Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns- assumptions- derivation of Euler's critical load formulae for various end conditions –

Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Straight line formula – Prof. Perry's formula.

Beam Columns: Laterally loaded struts – subjected to uniformly distributed and concentrated loads – Maximum B.M. and stress due to transverse and lateral loading.

UNIT – III:

Direct and Bending Stresses: Stresses under the combined action of direct loading and bending moment, core of a section – determination of stresses in the case of chimneys, retaining walls and dams – conditions for stability – stresses due to direct loading and bending moment about both axis.

UNIT –IV

Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders – Thin spherical shells.

Thick Cylinders: Introduction - Lame's theory for thick cylinders – Derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders – Necessary difference of radii for shrinkage – Thick spherical shells.

UNIT – V

Unsymmetrical Bending: Introduction – Centroidal principal axes of section – Graphical method for locating principal axes – Moments of inertia referred to any set of rectangular axes – Stresses in beams subjected to unsymmetrical bending – Principal axes – Resolution of bending moment into two rectangular axes through the centroid – Location of neutral axis - Deflection of beams under unsymmetrical bending.

Shear Centre: Introduction - Shear centre for symmetrical and unsymmetrical (channel, I, Tand L) sections

SUGGESTED BOOKS:

TEXT BOOKS:

1. Mechanics of Materials Ferdinand P. Beer et al., Tata McGraw Hill Education Pvt.Ltd 5^{th} edition 2009.
2. Strength of Materials R. Subramanian, Oxford University Press 2010
3. Strength of Materials by B.S. Basavarajaiah, B.S. Mahadevappa, University Press3^{rd} Edition 2015.

REFERENCE BOOKS:

1. Fundamentals of Solid Mechanics by M. L. Gambhir, PHI Learning Pvt. Ltd
2. Introduction to Strength of Materials by U. C. Jindal, Galgotia Publications Pvt. Ltd.
3. Mechanics of Materials by R. C. Hibbeler, Pearson Education

4. Strength of Materials by S. S. Rattan, Tata McGraw Hill Education Pvt. Ltd.

5. Strength of Materials by R.K Rajput, S. Chand & Company Ltd.

6. Strength of Materials by S.S Bhavikatti, Vikas Publishing House Pvt. Ltd.

MOOC'S- SWAYAM/ NPTEL:
https://nptel.ac.in/courses/105105108/

GATE SYLLABUS:

Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Theories of failures; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, buckling of column, combined and direct bending stresses.

IES SYLLABUS:

Elastic constants, Stress, plane stress, Strains, plane strain, Mohr's circle of stress and strain, Elastic theories of failure, Principal Stresses, Bending, Shear and Torsion.

VIII. COURSE PLAN:

Lecture No.	Unit No.	Topics to be covered	Link for PPT	Link for PDF	Course learning outcomes	Teaching Methodology	Reference
1		Introduction to strength of materials-2	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	An ability to identify, formulate, and solve engineering problems	Digital writing pad	
2	**1**	**TORSION OF CIRCULAR SHAFTS**: Introduction	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** Torsion equation , Polar moment if Inertia	Digital writing pad	**T1,T2,T3**
3		Assumptions made in the theory of pure torsion, Polar section modulus – Power transmitted by shafts, Theory of pure torsion – Derivation of Torsion equation -	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** Bending stresses and torsional stresses.	Digital writing pad	

4	Combined bending and torsion	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad	
5	Design of shafts according to theories of failure.	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** Maximum stress theory, strain theory, vonmises theory	Digital writing pad	
6	SPRINGS: Introduction – Types of springs	https://drive.google.com/drive/folders/1UoU9_N3xklYHvEebuzLBqXc07ySmbjoS	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand**: Stiffness of spring, combined compression and torsional shear stress analysis, deflection in springs arranged in parallel and series	Digital writing pad	
7	deflection of close and open coiled helical springs under axial pull and axial couple	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand**: Stiffness of spring, combined compression and torsional shear stress analysis, deflection in springs arranged in parallel and series	Digital writing pad	
8	springs in series and parallel.	- https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand**:deflection in springs arranged in parallel and series	Digital writing pad	
9	springs in series and parallel.	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand**:deflection in springs arranged in parallel and series	Digital writing pad	

10		**UNIT-2 COLUMNS AND STRUTS**: Introduction – Types of columns	https://drive.google.com/drive/folders/1UoU9_N3xklYHvEebuzLBqXc07ySmbjoS	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** Types of equilibrium conditions, neutral, stable, unstable.	Digital writing pad	
11		Axially loaded compression members – Crushing load	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** Euler's theorem for long columns, equivalent length of columns.	Digital writing pad	
12		Euler's theorem for long columns- assumptions- derivation of Euler's critical load formulae for various end conditions	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** Euler's theorem for long columns, equivalent length of columns.	Digital writing pad	
13							
14	**2**	Equivalent length of a column – slenderness ratio	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** Euler's theorem for long columns, equivalent length of columns.	Digital writing pad	
15		Euler's critical stress – Limitations of Euler's theory–	- https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** Euler's theorem for long columns, equivalent length of columns.	Digital writing pad	
16		Long columns subjected to eccentric loading	- https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** To study Euler's, Rankine's and other theories of columns	Digital writing pad	
17		Secant formula –	-	https://drive.g	To understand: To	Digital	

		Empirical formulae — Rankine	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	oogle.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	study Euler's, Rankine's and other theories of columns	writing pad	
18		Gordon formula-Straight line formula – Prof. Perry's formula.	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	To understand: To study Euler's, Rankine's and other theories of columns	Digital writing pad	
19		**BEAM COLUMNS**: Introduction	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** Transverse and lateral loading conditions	Digital writing pad	**T1,T2,T3**
20		Laterally loaded struts subjected to uniformly distributed loads	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad	
21							
22		Laterally loaded struts subjected to concentrated loads	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad	
23	**3**	**UNIT-3 DIRECT AND BENDING STRESSES**: Stresses under the combined action of direct loading and bending moment	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** Stresses in beam columns under concentrated and distributed load	Digital writing pad	
24		Stresses under the combined action of direct loading and bending moment	- https://drive.google.com/drive/folders/13H10	https://drive.google.com/drive/folders/13H10SfisBpzZ		Digital writing pad	

			SfisBpzZy1JrqQPe4jVqKlSOFYHk	y1JrqQPe4jVqKlSOFYHk			
25		Determination of stresses in retaining walls, chimneys and dams	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad	
26		Determination of stresses in retaining walls, chimneys and dams	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** Stresses in real time conditions on dams, chimneys, walls	Digital writing pad	
27		Determination of stresses in retaining walls, chimneys and dams	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad	
28		Conditions for stability-overturning and sliding Stresses due to direct loading Stresses due to bending moment about axis	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** Stability for - overturning, direct bending	Digital writing pad	
29							
30	**3**	Conditions for stability-overturning and sliding Stresses due to direct loading Stresses due to bending moment about axis	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** Stability for - overturning ,direct bending	Digital writing pad	**T1,T2,T3**
31		Conditions for stability-overturning and sliding Stresses due to direct loading Stresses due to bending	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSO	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jV		Digital writing pad	

		moment about axis	FYHk	qKlSOFYHk			
32		Conditions for stability-overturning and sliding Stresses due to direct loading Stresses due to bending moment about axis	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad	
33		Conditions for stability-overturning and sliding Stresses due to direct loading Stresses due to bending moment about axis	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad	
34							
35	4	**UNIT-4** Thin seamless cylindrical shells	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:**Concept of thin seamless cylindrical shells	Digital writing pad	
36		Thin seamless cylindrical shells	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad	
37		Derive the formula for longitudinal and circumferential stresses, hoop, longitudinal and volumetric strains.	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	Understand the formula	Digital writing pad	
38		Derive the formula for longitudinal and circumferential stresses, hoop, longitudinal and volumetric strains.	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad	

39	Analyze Lames theory for thick cylinders	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** Lames theory for thick cylinders, derivation of lames formulae	Digital writing pad
40	Analyze Lames theory for thick cylinders	- https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad
41					
42	Analyze Lames theory for thick cylinders	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad
43		https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad
44	Derive the derivation of lames formulae and distribution of hoop and radial stresses across thickness, evaluate thick cylinders and compound cylinders for necessary difference of radii under shrinkage	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	**To understand:** Distribution of hoop and radial stresses across thickness, Design of thick cylinders, compound cylinders, necessary difference of radii for shrinkage, thick spherical shells.	Digital writing pad
45		- https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad
46		https://drive.go	https://drive.g		Digital

			ogle.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	oogle.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		writing pad
47		Thin seamless cylindrical shells	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	Understand the concept of thin seamless cylindrical shells	Digital writing pad
48		Thin seamless cylindrical shells	- https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	Understand the concept of thin seamless cylindrical shells	Digital writing pad
49		**UNIT-5 UNSYMMETRICAL BENDING-** Introduction	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	Difference between symmetrical and unsymmetrical bending	Digital writing pad
50	**5**	Centroidal principal axes of section	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	Difference between symmetrical and unsymmetrical bending	Digital writing pad
51		Moment of inertia to any set of rectangular axes, stresses in beam subjected to unsymmetrical bending	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	Moment of inertia about two principle axis and product moment of inertia to calculate bending stresses in different sections	Digital writing pad
52		Moment of inertia to any set of rectangular axes, stresses in beam	- https://drive.google.com/drive/	https://drive.google.com/drive/folders/13		Digital writing pad

	subjected to unsymmetrical bending	folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		
53	Moment of inertia to any set of rectangular axes, stresses in beam subjected to unsymmetrical bending	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad
54	Bending moment due to application of load with some inclination	- https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad
55	Shear centre for symmetrical section	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	Centre where the section will bend instead of twisting for both symmetrical and unsymmetrical sections	Digital writing pad
56	Shear centre for unsymmetrical section	- https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk	https://drive.google.com/drive/folders/13H10SfisBpzZy1JrqQPe4jVqKlSOFYHk		Digital writing pad
57					
58					

IX. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

CO’S	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	2	-	-	2	2	-	2	3	2	2
CO2	3	2	3	-	-	2	-	-	2	3	-	3	2	3	3
CO3	3	3	3	-	-	2	-	-	3	2	-	2	2	2	3
CO4	3	3	3	-	-	2	-	-	2	2	-	2	3	3	2
CO5	3	3	3	-	-	1	-	-	2	2	-	2	2	2	2
AVG	3	2.8	3	-	-	1.75	-	-	2.25	2.25	-	2.25	2.50	2.50	2.50

N=None S=Supportive H=Highly related

X. QUESTION BANK:

SHORT ANSWER QUESTIONS-

UNIT-I

S.NO	Question	Blooms Taxonomy Level	Programme Out come
1.	Define pure torsion	Understanding	1
2.	Define Torsional moment of resistance	Understanding	1
3.	Define Polar section modulus	Understanding	1
4.	Define shafts	Understanding	1
5.	Define Combined bending	Understanding	1
6.	Define end thrust	Understanding	1
7.	Define springs	Understanding	1
8.	Define leaf springs.	Understanding & remembering	1
9.	What are the limitations of Euler’s theory?	Understanding	1
10.	What is the middle quarter rule for circular section?	Understanding	1

LONG ANSWER QUESTIONS-

S.No	Question	Blooms Taxonomy Level	Programme Out come
1.	Discuss in brief various prominent theories of failure.	Understanding & remembering	9
2.	Explain Power transmitted by shafts	Analyze	9
3.	Derive equation for deflection of close coiled helical springs under axial pull	Analyze	9
4.	Derive equation for deflection of open coiled helical springs under axial pull	Analyze & Apply	9
5.	Explain springs in series	Analyze & Apply	9
6.	Explain springs in parallel	Analyze & Apply	9
7.	Explain Carriage or leaf springs.	Analyze & Apply	9
8.	Derive the expression for the maximum bending stress developed in the leaf spring and also the central deflection of a leaf spring.	Analyze & Apply	9
9.	Explain Types of springs	Analyze & Apply	9
10.	Derive an expression for a member subjected to direct stress in one plane.	Analyze & Apply	9

UNIT-2

SHORT ANSWER QUESTIONS-

S.N	Question	Blooms Taxonomy Level	Programme Out come
1.	Define short column	Understanding	9
2.	Define Struts	Understanding	9
3.	Define Crushing load	Understanding & remembering	9
4.	Define long columns	Understanding & remembering	9
5.	Define various end conditions	Understanding & remembering	9
6.	Define eccentric loading	Understanding & remembering	9
7.	Define slenderness ratio	Understanding & remembering	9
8.	Explain Euler's critical load	Understanding	9
9.	What are Laterally loaded struts	Understanding	9
10.	What is eccentric loading	Understanding	9

LONG ANSWER QUESTIONS-

S.No	Question	Blooms Taxonomy Level	Programme Out come
1.	Explain Euler's theorem for long columns	Understanding	12
2.	Explain Equivalent length of a column	Understanding	12
3.	Explain Straight line formula – Prof. Perry's formula	Understanding	12
4.	Explain Laterally loaded struts – subjected to uniformly distributed load	Analyze & Apply	12
5.	Explain Laterally loaded struts – subjected to concentrated load	Analyze & Apply	12
6.	Explain the concept of Beam -Columns	Analyze & Apply	12
7.	Explain Secant formula	Analyze & Apply	12
8.	Explain Euler's critical stress	Analyze & Apply	12
9.	Explain Rankine – Gordon formula	Analyze & Apply	12
10.	Explain Limitations of Euler's theory	Analyze & Apply	12

UNIT-3

SHORT ANSWER QUESTIONS-

S.No	Question	Blooms Taxonomy Level	Programme Out come
1.	Define circular beams	understanding	10
2.	Define stability	understanding	10
3.	What is the middle quarter rule for circular section?	understanding	10
4.	Differentiate between symmetrical and unsymmetrical bending	understanding	10
5.	What is moment of inertia?	Understanding	10
6.	Write the stresses in dams?	understanding	10
7.	What is the difference between dam and a retaining wall?	Remembering	10
8.	Define chimney	Understanding & evaluate	10
9.	What are the stresses due to direct loading?	Understanding & evaluate	10
10.	Write the condition for stability of dams.	Understanding & evaluate	10

LONG ANSWER QUESTIONS-

S.No	Question	Blooms Taxonomy Level	Programme Out come
1.	Explain conditions for stability	Understanding	9
2.	Explain determination of stresses in the case of chimney.	Analyze & Apply	9
3.	Explain determination of stresses in the case of retaining wall.	Analyze & Apply	9
4.	Explain determination of stresses in the case of dams.	Analyze & Apply	9
5.	Explain stresses due to direct loading	Analyze & Apply	9
6.	Explain stresses due to bending moment about both axis.	Analyze & Apply	9
7.	Why is it necessary to use the minimum radius of gyration of section to calculate the crippling load? Explain briefly.	Analyze & Apply	9
8.	Explain the conditions for stability of dam.	Analyze & Apply	9
9.	Discuss briefly the stresses in beams subjected to unsymmetrical bending.	Analyze & Apply	9
10.	What do you mean by direct stress and bending stress?	Analyze & Apply	9

UNIT-4

SHORT ANSWER QUESTIONS-

S.No	Question	Blooms Taxonomy Level	Programme Out come
1.	Define Thin Cylinders	understanding	1
2.	Define Thick Cylinders	understanding	1
3.	What are hoop stresses	remembering	1
4.	Define radial stresses	remembering	1
5.	What are compound cylinders	understanding	1
6.	What are Thin spherical shells.	remembering	1
7.	Define radii for shrinkage	understanding	1
8.	Define Thick spherical shells.	Understanding & remembering	1
9.	Write Lame's formulae	Understanding & remembering	1
10.	What are Volumetric strains	Understanding	1

LONG ANSWER QUESTIONS-

S.No	Question	Blooms Taxonomy Level	Programme Out come
1.	Explain Lame's theory for thick cylinders	Analyze & Apply	10
2.	Explain design of thick cylinders	Analyze & Apply	10
3.	Explain design of compound cylinders	Analyze & Apply	10
4.	Define and explain maximum strain energy theory.	Analyze & Apply	10

5.	A hollow rectangular column is having external and internal dimensions as 140cm deep x 100 cm wide and 100 cm deep x 60cm wide respectively. A vertical load of 220kN is transmitted in the vertical plane bisecting 140 cm side at an eccentricity of 10cm from the geometric axis of the section. Calculate the maximum and minimum stresses in the section.	Analyze & Apply	10
6.	Determine the stresses and deflection at the midpoint of a channel section by unsymmetrical method. Also identify the position of the neutral axis.	Understanding	10
7.	Explain briefly how stresses in beams due to un symmetric bending is considered. b) Explain briefly the method of locating shear centre.	Understanding	10
8.	The external diameters of a steel collar are 200mm, and the internal diameter decreases by 0.125mm when shrunk on to a solid steel shaft of 125mm diameter. Find the reduction in diameter of the shaft, the radial pressure between the collar and the shaft and hoop stress at the inner surface of the tube. Take E = $210GN/m^2$ and 1/m=0.3.	Evaluate	10
9.	A column is rectangular in cross section 300 x 400 mm The column carries an eccentric loading of 360kN on one diagonal at a distance of quarter diagonal length from a corner. Calculate the stresses at all four corners. Also draw stress distribution diagram for any side.	Evaluate	10
10.	Write the differences between hoop and radial stresses .	Understanding	10

UNIT-5

SHORT ANSWER QUESTIONS-

S.No	Question	Blooms Taxonomy Level	Programme Out come
1.	Define Centroidal principal axis.	Understanding	6
2.	Define Moments of inertia	Remembering	6
3.	What is Unsymmetrical Bending	Remembering & Understanding	6
4.	Define Shear centre	Remembering & Understanding	6
5.	What are Principal axes	Understanding	6
6.	Define neutral axis	Understanding	6

7.	What is moment of inertia?	Understanding & remembering	6
8.	Write a note on Mohr's circle of stresses.	Understanding	6
9.	Define Mohr's circle	Remembering & Understanding	6
10.	Differences between major and minor principal axis	Understanding	6

LONG ANSWER QUESTIONS-

S.No	Question	Blooms Taxonomy Level	Programme Out come
1.	Derive the normal stress, tangential stress and resultant stress of two mutually perpendicular principal stresses of unequal intensities by Mohr's method.	Analyze & Apply	10
2.	Define and explain maximum strain energy theory.	Analyze & Apply	10
3.	A column is rectangular in cross section 300 x 400 mm .The column carries an eccentric loading of 360kN on one diagonal at a distance of quarter diagonal length from a corner. Calculate the stresses at all four corners. Also draw stress distribution diagram for any side.	Analyze & Apply	10
4.	At a point in a material, the stresses on two mutually perpendicular planes are 50N/mm^2 (tensile) and 30 N/mm^2 tensile). The shear stress across these planes is12N/mm^2. Using Mohr circle, find agnitude and direction of the resultant stress on a plane making an angle of 35 degrees with the plane of the first stress. Find also, the normal and tangential stresses on this plane	Analyze & Apply	10
5.	Determine the stresses and deflection at the midpoint of a channel section by unsymmetrical method. Also identify the position of the neutral axis.	Apply	10
6.	Explain briefly the method of locating shear centre.	Analyze &	10
7.	Explain briefly how stresses in beams due to un symmetric bending is considered	Analyze & Apply	10
8.	Explain Shear centre for symmetrical sections (channel, I, T and L)	Analyze & Apply	10
9.	Explain Shear centre for unsymmetrical sections (channel, I, Tand L)	Analyze & Apply	10
10.	Explain 1Deflection of beams under unsymmetrical bending.	Analyze & Apply	10

XI. OBJECTIVE QUESTIONS: JNTUH

UNIT-1

1) Shear stress energy theory is called as _______
   a. distortion theory b. Von Mises theory c. both a. and b. d. none of the above
2) For designing ductile materials, which of the following theories is/are used?
   a. Maximum shear stress theory b. Shear strain energy theory
   c. Both a. and b. d. None of the above
3) A circular bar is subjected to an axial force and shear force, the difference between two principle stresses is 120 Mpa. Based on maximum shear stress theory what is the factor of safety, if elastic limit of the bar is 300 Mpa**?**
   a. .5 b. 2 c. 2.5 d. 3
4) Principal stress of 30 Mpa and -70 Mpa acts on a material which has elastic limit stress in simple tension and compression as 60 Mpa and 200 Mpa respectively. Specify the reason for failure of the material assuming maximum principle stress theory.
   a. Compression b. Tension c. Unpredictable
5) According to maximum strain energy theory, failure of material due to complex stresses occurs when total stored energy per unit volume at a point ____________
   a. reaches the value of yield point
   b. reaches the value of strain energy stored per unit volume at yield point
   c. reaches the value of strain energy stored per unit volume at elastic limit
   d. exceeds total strain energy caused by uniaxial stress at elastic point
6) Minor principal stress has minimum _________
   a. value of shear stress acting on the plane b. intensity of direct stress
   c. both a. and b. d. none of the above
7) The angle between normal stress and tangential stress is known as angle of _______
   a. declination b. orientation c. obliquity d. rotation
8) The maximum tangential stress $\sigma_t = (\sigma_x \sin 2\theta)/2$ is maximum if, θ is equal to _________
   a. 45^o b. 90^o c. 270^o d. all of the above
9) What is the value of shear stress acting on a plane of circular bar which is subjected to axial tensile load of 100 kN? (Diameter of bar = 40 mm , $\theta = 42.3^o$
   a. 58.73 Mpa b. 40.23 Mpa c. 39.60 Mpa d. insufficient data

10) Stress in the cross section of a shaft at the centre _________
    a. is zero b. decreases linearly to the maximum value of at outer surface
    c. both a. and b. d. none of the above

UNIT-2

1) What is the value of Rankine's constant for cast iron?
   a. 1 / 750 b. 1 / 1600 c. 1 / 7500 d. 1 / 9000
2) If the effective length of a column is twice the actual length, then the column is _________
   a. fixed at both the ends b.hinged at both the ends
   b. fixed at one end and free at the other end d. fixed at one end and hinged at the other end
3) What is the safe load acting on a long column of 2 m having diameter of 40 mm. The column is fixed at both the ends and modulus of elasticity is 2×10^5 N/mm^2? (F.O.S = 2)
   a. 120 Kn b. 124 kN c. 130 kN d. 150 kN
4) Rankine-Gordon's empirical formula is applicable for ______

a. long column b. short column c. both a. and b. d. none of the above

5) While determining crippling load, the effective length of solid circular bar is 1/ √2 of actual length if, ________

a. both ends of solid circular bar are fixed b. both ends of solid circular bar arehinged

b. c. one end is fixed and one is free d. one end is fixed and other end is hinged

6) Which of the following assumptions are made in torsion theory?

a. Shaft is perfectly straight b. Material of the shaft is heterogeneous

b. Twist cannot be uniform along the length of the shaft d. All of the above

7) Torque and bending moment of 100 kN.m and 200 kN.m acts on a shaft which has external diameter twice of internal diameter. What is the external diameter of the shaft which is subjected to a maximum shear stress of 90 N/mm^2?

a. 116.5 mm b. 233.025 mm c. 587.1 mm d. 900 mm

8) What is the maximum shear stress induced in a solid shaft of 50 mm diameter which is subjected to both bending moment and torque of 300 kN.mm and 200 kN.mm respectively?

a. 9.11 N/mm^2 b. 14.69 N/mm^2

c. 16.22 N/mm^2 d. 20.98 N/mm^2

9) What is the shear stress acting on the outer surface of a hollow shaft subjected to a torque of 100 Nm?(The inner and outer diameter of the shaft is 15 mm and 30 mm respectively.)

a. 50.26 N/mm^2 b. 40.24 N/mm^2 c. 20.120 N/mm^2 d. 8.74 N/mm^2

10) What is the S.I. unit of torsional rigidity?

a. Nm b. $N.m^2$ c. Nm/ radian d. None of the above

UNIT-3

1) What is the maximum principle stress induced in a solid shaft of 40 mm diameter which is subjected to both bending moment and torque of 300 kN.mm and 150 kN.mm respectively?

a. 21.69 N/mm^2 b. 28.1 N/mm^2 c. 50.57 N/mm^2

d. 52.32 N/mm^2

2) A member subjected to couple produces rotational motion about its longitudinal axis called as ___

a. torsion b. twisting moment c. both a. and b. d. none of the above

3) Energy stored in a body within an elastic limit is called as ______

a. resilience b. strain energy c. both a. and b d. none of the above

4) What is the strain energy stored in a cube of 50 mm, when it is subjected to shear stress of 200 Mpa. (G = 100 Gpa) a. 25 Nm b. 75 Nm c. 125 Nm d. 150 Nm

5) Modulus of resilience is the ratio of _______

a. minimum strain energy and unit volume b. maximum stress energy and unit volume

c. proof resilience and unit volume d. resilience and unit area

6)

Strain energy stored in a uniform bar is given as _______

a. (σ E/ 2A) b. (σ L/ 2AE) c. ($σ^2$ AL/ 4E) d. ($σ^2$ AL/ 2E)

7) Macaulay's method is used to determine _______

a. deflection b. strength c. toughness d. all of the above

8) Which of the following is a differential equation for deflection?

a. $dy / dx = (M/EI)$ b. $dy / dx = (MI/E)$ c. $d^2y / dx^2 = (M/EI)$ d. $d^2y / dx^2 = (ME/I)$

9) The vertical distance between the axis of the beam before and after loading at a point is called as ________

a. deformation b. deflection c. slope d. none of the above

10) The design of a beam is based on strength criteria, if the beam is sufficiently strong to resist

a. shear force b. deflection c. both a. and b. d. none of the above

11) A simply supported beam carries uniformly distributed load of 20 kN/m over the length of 5 m. If flexural rigidity is 30000 kN.m^2, what is the maximum deflection in the beam?

a. 5.4 mm b. 1.08 mm c. 6.2 mm d. 8.6 mm

UNIT -4

1) Why are shear connectors used?

a. Interconnect planks b. To avoid sliding between planks
c. Both a. and b. d. None of the above

2) What is the average shear stress acting on a rectangular beam, if 50 N/mm^2 is the maximum shear stress acting on it?

a. 31.5 N/mm^2 b. 33.33 N/mm^2 c. 37.5 N/mm^2 d. 42.5 N/mm^2

3) The ratio of maximum shear stress to average shear stress is 4/3 in ________

a. circular cross-section b. rectangular cross-section
c. square cross-section d. all of the above

4) What is the shear stress acting along the neutral axis of triangular beam section, with base 60 mm and height 150 mm, when shear force of 30 kN acts?

a. 15.36 N/mm^2 b. 10.6 N/mm^2 c. 8.88 N/mm^2 d. Insufficient data

5) A circular pipe is subjected to maximum shear force of 60 kN. What is the diameter of the pipe if maximum allowable shear stress is 5 Mpa?

a. 27.311 mm b. 75.56 mm c. 142.72 mm d. 692.10 mm

6) Which of the following laminas have same moment of inertia ($I_{xx} = I_{yy}$), when passed through the centroid along x-x and y-y axes?

a. Circle b. Semi-circle c. Right angle triangle d. Isosceles triangle

7) The bending formula is given as ______

a. $(M/E) = (\sigma/y) = (R/I)$ b. $(M/y) = (\sigma/I) = (E/R)$
c. $(M/I) = (\sigma/y) = (E/R)$ d. none of the above

8) A uniformly distributed load of 20 kN/m acts on a simply supported beam of rectangular cross section of width 20 mm and depth 60 mm. What is the maximum bending stress acting on the beam of 5m?

a. 5030 Mpa b. 5208 Mpa

c. 6600 Mpa d. Insufficient data

9) What is the product of sectional modulus and allowable bending stress called as?
a. Moment of inertia b. Moment of rigidity c. Moment of resistance d. Radius of gyration

10) Moment of inertia acting on a semi-circle about symmetrical axes is given as ________
a. $1.57\ r^4$ b. $0.055\ r^4$ c. $0.392\ r^4$ d. $0.11\ r^4$

UNIT -5

1) When a rectangular bar is uniaxially loaded, the volumetric strain (e_v) is given as ______
a. $\sigma_x / E(1-\mu)$ b. $\sigma_x / E(1+\mu)$ c. $\sigma_x / E(1-2\mu)$
d. $\sigma_x / E(1+2\mu)$

2) What is the bulk modulus of a material, if a cube of 100 mm changes its volume to 4000 $mm^3$when subjected to compressive force of 2.5×10^6 N?
a. 62.5 Gpa b. 65 Gpa c. 67.5 Gpa d. 70Gpa

3) The relation between modulus of elasticity (E), modulus of rigidity (G) and bulk modulus (K) is given as _________
a. K+G / (3K+ G) b. 3 KG / (3K+ G) c. 3 KG / (9K+ G) d. 9 KG / (3K+ G)

4) Modulus of rigidity is the ratio of _______
a. Lateral strain and linear strain b. Linear stress andlateral strain
c. Shear stress and shear strain d. Shear strainand shear stress

5) In maximum principle strain theory, maximum principal strain for no failure condition is
a. $e = (\sigma_x - \sigma_y)/ E + \tau^2$ b. $e = q_{max} \geq q_{yp}$
c. $e = \sigma_{yp} / E$ d. none of the above

6) Which theory gives satisfactory results for brittle materials?
a. Maximum shear stress theory b. Maximum principle stresstheory
c. Shear strain energy theory d. None of the above

7) In simple tensile test, when maximum principle stress reaches the value of yield point, the material subjected to complex stresses fail. This theory is called as_________.
a. Coulumb's theory b. Rankine's theory c. Venant's theory d. Von Mises theory

8) According to Coulomb's theory, material subjected to complex stresses fails, if _________ shear stress induced in the material exceeds________shear stress at the yield point.
a. minimum, maximum b. maximum,minimum c. maximum, maximum d. minimum, minimum

9) St. Venant's theory is also known as maximum __________
a. principle stress theory b. shear stress theory
c. principle strain theory d. strain energy theory

XII. GATE QUESTIONS:

1) In Mohr's circle method, compressive direct stress is represented on _____
a. positive x-axis b. positive y-axis c. negative x-axis d. negative y-axis

2) The graphical method of Mohr's circle represents shear stress (τ) on _______

a. X-axis b. Y-axis c. Z-axis d. None of the above

3) Which of the following stresses can be determined using Mohr's circle method?

a. Torsional stress b. Bending stress c. Principal stress d. Allof the above

4) Principal stress is the magnitude of_________stress acting on the principal plane.

a. Normal stress b. Shear stress c. Both a. and b. d. None of theabove

5) What is the relation between actual length and effective length while determining crippling load for a hollow rectangular cast iron column having both ends fixed?
(where L= actual length and L_e =effective length)

a. $L_e = L$ b. $L_e = L/2$ c. $L_e = 2L$ d. $L_e = 4L$

6) Slenderness ratio is the ratio of effective length of column and _________

a. lateral dimension of a column

b. least radius of gyration of a column

c. maximum radius of gyration of a column d. none of the above

7) Euler's formula is applicable only __________

1. for short columns 2. for long columns 3. if slenderness ratio is greater than $\sqrt{(\pi^2 E / \sigma_c)}$
4. if crushing stress < buckling stress 5. if crushing stress ≥ buckling stress

a. 1, 2 and 3 b. 2, 3 and 5 c. 3 and 4 d. all of the above

8) In Euler's theory, long columns having the ratio of (L_e /LLD) ≥ 12 fail due to ________

a. crushing b. buckling c. both a. and b. d. none of the above

9) Which of the following relation represents torsional flexibility?

a. GJ b. GL c. GJ / L d. L / GJ

10) When a rectangular bar is uniaxially loaded, the volumetric strain (e_v) is given as ______

a. $\sigma_x / E(1- \mu)$ b. $\sigma_x / E(1+ \mu)$ c. $\sigma_x / E(1- 2\mu)$

d. $\sigma_x / E(1+2\mu)$

IES QUESTIONS:

1) The ratio of effective length and least lateral dimension for short column is ________

a. > 12 b. < 12 c. ≥ 12 d. none of the above

2) Stress in the cross section of a shaft at the centre _________

a. is zero b. decreases linearly to the maximum value of at outer surface

c. both a. and b. d. none of the above

3) What is the shear stress acting on the outer surface of a hollow shaft subjected to a torque of 100 Nm? (The inner and outer diameter of the shaft is 15 mm and 30 mm respectively.)

a. 50.26 N/mm^2 b. 40.24 N/mm^2 c. 20.120 N/mm^2 d. 8.74 N/mm^2

4) What is the S.I. unit of torsional rigidity?

a. Nm b. N.m^2 c. Nm/ radian

d. None of the above

5) Which of the following relation represents torsional flexibility?

a. GJ b. GL c. GJ / L d. L / GJ

6) In the relation (T/J = Gθ/L = τ/ R), the letter G denotes modulus of _______
a. elasticity b. plasticity c. rigidity d. resilience

7) What is the proof resilience of a square bar of 2500 mm^2 and 200 mm long, when a load of 150 kN is induced gradually? (Take E = 150 x 10^3 Mpa)
a. 45 J b. 8 J c. 5.3 J d. 6 J

8) What is the maximum stress induced in a bar 2500 mm^2, when a load of 2000 kN is applied suddenly?
a. 400 N/mm^2 b. 800 N/mm^2 c. 1600 N/mm^2 d. Insufficient data

9) What is the strain energy stored in a simply supported beam due to bending moment?
a. $\int (M^2/EI)$ b. $\int (M^2/2EI)$ c. $\int (M/2EI)$ d. $\int(2M/EI)$

10) Stress on an object due to sudden load is__________the stress induced when the load is applied gradually.
a. equal to b. half c. twice d. thrice

11) What is the strain energy caused due to self weight in a cylindrical bar?
a. $(W^2 L) / (6 AE)$ b. $(W L) / (8 AE)$ c. $(\tau^2/ 2G)V$ d. $(\tau^2/ G)V$

XIII. WEBSITES:

1. http://www.asce.org
2. http://www.icivilengineer.com
3. http://www.construction-guide.in
4. http://nptel.ac.in/courses/112105171/1

EXPERT DETAILS:

1. Vinayak Eswaran, Professor & Head of the Department, IIT Hyderabad
2. Dr.Raja Banerjee, Associate Professor, IIT Hyderabad
3. Dr.YVD Rao. Faculty In charge, Engineering Services Division, BITS Pilani, Hyderabad Campus
4. Dr. Jeevan Jaidi, Associate Professor, Dept. of Mechanical Engineering, BITS-Pilani, Hyderabad Campus
5. Dr P. Laxminarayana, Head, Dept. of Mechanical Engineering, Osmania University College of Engineering, Hyderabad
6. Dr. T.I. Eldho. Department of Civil Engineering, IIT Bombay

XV. JOURNALS:

1 Thesis Digest on civil Engineering
2 International Engineering and Technology Journal of Civil and Structure
3 International journal of civil engineering
4 Journal of information knowledge and research in civil engineering
5 International journal of civil engineering and technology
6 International Journal of Civil Engineering and Applications
7 Recent Trends in Civil Engineering and Technology
8 World Research Journal of Civil Engineering
9 International Journal of Structural and Civil Engineering
10 International Journal of Civil Engineering (IJCE)
11 International Journal of Structural and Civil Engineering Research

12 International Journal of Advanced Research in Civil, Structural, Environmental and Infrastructure Engineering and Developing

XVI. LIST OF TOPICS FOR STUDENT SEMINARS:

1. Stress
2. Strain
3. Shear centre
4. Neutral axis
5. Symmetrical bending
6. Bending moment
7. Lames theory
8. Cylindrical shells
9. Thick cylinders
10. Thin cylinders
11. Curved beams
12. Springs