Code: 20A01301 **R20**

B.Tech II Year I Semester (R20) Supplementary Examinations April/May 2024

ADVANCED STRENGTH OF MATERIALS

(Civil Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Write the expression for slope and deflection of a simply supported beam carrying a point load at the centre. 2M

(b) A cantilever 3 m length is carrying a point load of 30 kN at the free end. If I = 10^8 mm^4 and E = $2.1x10^5$ N/mm^2, find the slope at the free end of the beam. 2M

(c) Define a spring? Mention the different types of springs. 2M

(d) Define polar section modulus. 2M

(e) Differentiate between column and a strut. 2M

(f) Mention the limitations of Euler's theory. 2M

(g) What are helical springs? 2M

(h) Define strain energy. 2M

(i) Define Lame's Equation. 2M

(j) Differentiate between Hoop stress and longitudinal stress. 2M

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

2 A cantilever of length 2 m carries a point load of 35 kN at the free end and another load of 35 kN at its centre. If E = $1x10^5$ N/mm^2 and I = $1x10^8$ mm^4 for the cantilever then determine the slope and deflection at the free end of the beam using moment area method. 10M

OR

3 (a) Derive the expression for slope and deflection for a cantilever beam carrying uniformly distributed load over its entire length using moment area method. 5M

(b) A cantilever of length 4 m carries a uniformly distributed load of 2 kN/m run over the whole length. The cantilever is propped rigidly at the free end. If the value of E = $2x10^5$ N/mm^2 and I=$1x10^8$ mm^4, then determine the (i) Reaction at the rigid prop, and (ii) The deflection at the centre of the cantilever. 5M

4 (a) A closely coiled helical steel spring of 10 mm diameter has 15 coils of 100 mm mean diameter. The spring is subjected to an axial load of 150 N. Find the (i) Maximum shear stress induced, (ii) The deflection, and (iii) Stiffness of the spring, Take rigidity modulus as $8.16x10^4$ N/mm^2. 5M

(b) Determine the expression for strain energy stored in a body due to torsion. 5M

OR

5 (a) Mention the assumptions made while deriving shear stress value produced in a circular shaft subjected to torsion. 5M

(b) For a hallow circular shaft with 200 mm and 100 mm outer and inner diameters respectively, Find the maximum torque which the shaft can safely transmit if the shear stress is limited to 40 N/mm^2. 5M

6 (a) Mention the assumptions made in the Euler's theory. 5M

(b) Derive the expression for Euler's buckling load for a long column of length L with both ends fixed, from first principles. 5M

OR

Contd. in Page 2

7	(a)	Using Euler's formula, calculate the critical stresses for a strut having slenderness ratio of 80 and 120 under the following conditions: (i) Both ends fixed, (ii) One end fixed other end hinged.	5M
	(b)	A hollow mild steel tube of 7 m long and 5 cm internal diameter and 5 mm thick is used a strut with both ends hinged. Find the crippling load and safe load taking factor of safety as 3. Take $E=2x10^5$ N/mm^2.	5M
8		A closely coiled helical spring is to carry a load of 1 kN. Its mean coil diameter is to be 10 times that of wire diameter. Calculate these diameters if the maximum shear stress in the material of the spring is to be limited to 90 N/mm^2.	10M
		OR	
9		A laminated spring 0.9 m long is made up of plates each 5 cm wide and 1 cm thick. If the bending stress in the plate is limited to 120 N/mm^2, how many plates would be required to enable the spring to carry a central point load of 2.65 kN? If E = $2x10^5$ N/mm^2, what is the deflection under the load?	10M
10		Derive the expression for circumferential stress and longitudinal stress for a thin shell subjected to an internal pressure.	10M
		OR	
11		What do you mean by a thick compound cylinder? How do you determine the hoop stresses in a thick compound cylinder?	10M

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B.Tech II Year I Semester (R20) Supplementary Examinations August/September 2023

ADVANCED STRENGTH OF MATERIALS

(Civil Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a)	State the condition for the use of Macaulay's method.	2M
(b)	Write the expression for the radius of curvature of the deflected beam.	2M
(c)	Explain the Polar Section Modulus.	2M
(d)	Define torsional stiffness.	2M
(e)	Define Slenderness ratio.	2M
(f)	What is Equivalent length of a column? Explain with various end conditions.	2M
(g)	What is meant by Spring Constant?	2M
(h)	Explain about compound springs.	2M
(i)	List the assumption madein Lame's equations.	2M
(j)	Define radial pressure in thin cylinder.	2M

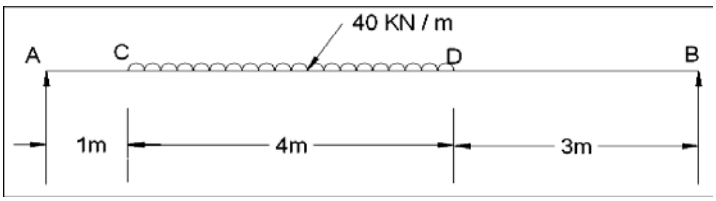
PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

2 A simply supported beam of span L is subjected to two equal loads W/2 at each of 1/3rd span points. Find the expressions for deflection under the loads and at the mid span. Use Moment Area Method. 10M

OR

3 Determine the deflection of the beam at its mid span and also the position of maximum deflection. Take E = 2 x 10^5 N/mm^2 and I = 4.3 x 10^8 mm^4. Use Macaulay's method. The beam is shown in fig below. 10M



4 A shaft is to be fitted with a flanged coupling having 8 bolts on a circle of diameter 150 mm. The shaft may be subjected to either a direct tensile load of 400 kN or a twisting moment of 18 kNm. If the maximum direct and shearing stresses permissible in the bolt material are 125 N/mm^2 and 55 N/mm^2 respectively, find the minimum diameter of the bolt required. Assume that each bolt takes an equal share of the load or torque. 10M

OR

5 The stiffness of a close coiled helical spring is 15 N/mm of compression under a maximum load of 60 N. The maximum shearing stress produced in the wire of spring is125 N/mm^2. The solid length (when the coils are touching) of the spring is given as 5 cm.Find, 10M
(i) diameter of wire,
(ii) mean diameter of the coil sand,
(iii) number of coils required. Take modulus of rigidity = 4.5 x10^4 N/mm^2.

Contd. In Page 2

6	(a)	Write down the assumptions made in the Euler's column theory.	5M
	(b)	A solid round bar 3 m long and 5 cm diameter is used as a strut with both ends hinged. Determine the crippling load. E = 200 GPa.	5M
		OR	
7		A column of timber section 15 cm x 20 cm is 6m long both ends being fixed. If the Youngs modulus is 1.75 kN/mm^2, determine the crippling load and safe load if the factor of safety is 3.	10M
8		A leaf spring carries a central load of 3000 N. The leaf spring is to be made of 10 steel plates 5 cm wide and 6 mm thick. If the bending stress is limited to 150 N/mm^2 determine: (i) length of the spring and (ii) deflection at the centre of the spring. Take 2 x 10^5 N/mm^2.	10M
		OR	
9		Determine the bending stress, shear stress and total work done on an open coiled helical spring subjected to axial force having mean radius of each coil as 'r' and 'n' numbers of turns.	10M
10	(a)	In case of cylindrical shells, what is done to enhance their pressure-bearing capacity? Explain how the shell behaves when such steps are taken.	5M
	(b)	A thick spherical shell, of 250 mm internal diameter is subjected to an internal pressure of 8 N/mm^2. If the maximum permissible tensile stress is 10MPa, find the minimum thickness required. Find the stresses in the interior and exterior of the shell.	5M
		OR	
11		A thin cylinder is 3.5 m long, 90 cm in diameter and the thickness of metal is 12 mm. It is subjected to an internal pressure of 2.8 N/mm^2. Calculate the change in dimensions of cylinder and the maximum intensity of stress induced. Given E = 200 GPa and Poisson's ratio = 0.3.	10M

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