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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: III**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 19CV3PCSOM **Max Marks: 100**
Course: Strength of Materials **Date: 15.09.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1	a)	With usual notations derive an expression for the axial deformation of a bar of tapering circular cross section	**06**
	b)	A bar at 30 mm diameter is subjected to a pull of 60 kN. The measured elongation on a gauge length of 200mm is 0.09mm and the change in diameter is 0.0039mm. Calculate the Elastic constants.	**10**
	c)	Establish the relationship between stress and strain for a unidirectional stress system.	**04**

OR

2	a)	A specimen of steel 30mm in diameter with a gauge length of 250mm is tested to destruction. It has an extension of 0.18 mm under the load of 90kN and load at the elastic limit is 180kN and the maximum load is 200kN.The total extension at fracture is 60 mm and diameter at the necking is 20mm.Determine (i)The stress at elastic limit. (ii) Young's modulus. (iii) Percentage elongation (iv) Percentage reduction in area(v) Ultimate tensile stress.	**08**
	b)	Explain the construction of Mohr's circle of stresses for finding the normal, tangential, and resultant stresses on an inclined plane, when the two mutually perpendicular stresses are like and are unequal in magnitude	**08**
	c)	Define Principal Plane and Principal Stress.	**04**

UNIT - II

3	a)	Draw the shear force and bending moment diagram for a simply supported beam of span 5m subjected to a load uniformly varying from 0 kN/m at one end to 30 kN/m at the other end.	**08**
	b)	Derive the relationship between load, shear force and bending moment.	**04**

c) Draw the shear force and bending moment diagram for the beam shown in Fig.Q.3c. **08**

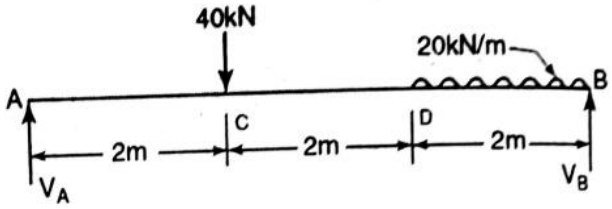

Fig.Q.3c.

UNIT - III

4 a) A simply supported beam has a span of 4 m and rectangular in cross section 100 mm x 200 mm. Find the uniformly distributed load it can carry, if the maximum bending stress and the maximum shear stress are not to exceed 10 N/mm^2 and 0.6 N/mm^2 respectively. **05**

b) An I section has flanges of size 180 mm x 10 mm and its overall depth is 500 mm. Thickness of the web is 8 mm. It is strengthened with a plate of size 240 mm x 12 mm on compression side. Find the moment of resistance of the section if permissible stress is 150 N/mm^2. How much uniformly distributed load it can carry if it is used as a cantilever beam of span 3 m? **10**

c) Explain Neutral axis, section modulus and moment of resistance as applied to beams. **05**

OR

5 a) A T shaped cross section of a beam of Flange 200mmx50mm and web 200mmx50mm is subjected to a bending moment of 15kNm and a shear force of 10kN at a particular section. Draw the bending stress and shearing stress distribution diagrams across the section. Indicate the values at salient points. Flange is at the top. **10**

b) Derive the simple bending equation with usual notations **10**

UNIT - IV

6 a) Derive an expression for Euler's formula for a column when one end is fixed, and the other end is hinged **06**

b) A hollow cast iron column has an outer diameter of 180 mm and thickness of 20 mm. It is 8 m long with one end fixed and the other end hinged. Calculate the ratio of Rankine's critical load to Euler's critical load. Take E= 80 GPa, $\alpha = 1/1600$, fc =550 MPa and factor of safety of 3. **10**

c) Define slenderness ratio. Explain its engineering significance in designing the column **04**

UNIT - V

7 a) A solid cylindrical shaft is to transmit 300 kW of power at 100 rpm. If the shear stress is not to exceed 80 N/mm^2, find the diameter of the shaft. Also what percentage saving in weight would be obtained if this shaft is replaced by a hollow shaft whose internal diameter is 0.6 times the external diameter. The length, material and maximum stress being the same **08**

b) Derive the Torsion equation with usual notations **04**

c) A thick cylinder of 250 mm internal diameter and 350 mm outer diameter contains a fluid at a pressure of 125 N/mm^2 . Determine the hoop stress and radial stresses and draw a neat sketch showing stress distribution across the wall thickness. **08**

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