Total number of printed pages: 4

D/3rd Semester/DCE 303

2024

STRENGTH OF MATERIALS

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **question 1** and **any four** from the rest questions.*

1.	a)	Choose the correct answer:	15
		(i) The stress which acts in a direction perpendicular to the area is called _____ a) Shear stress b) Normal stress c) Thermal stress d) None of the mentioned (ii) The bending moment on a section is maximum where shear force is a) Minimum b) Maximum c) Changing sign d) Zero (iii)The property by which a body returns to its original shape after removal of the force is called _____ a) Plasticity b) Elasticity c) Ductility d) Malleability (iv)The polar moment of inertia of a circular shaft of diameter (d) is a) $\pi d^4/8$ b) $\pi d^4/16$ c) $\pi d^4/32$ d) $\pi d^4/64$	

(v) The bending moment at the free end of a cantilever beam is

a) Zero

b) Maximum

c) Increasing

d) Decreasing

(vi) A point of contraflexure is a point where

a) Shear force is zero

b) Shear force is maximum

c) Bending moment is zero

d) Bending moment is maximum

(vii) The resistance per unit area to deformation is called

a) Strain

b) Stress

c) Pressure

d) Modulus of elasticity

(viii) The unit of stress is

a) Nmm

b) N/mm^2

c) Mm

d) no unit

(ix) Hook's law holds good up to

a) Yield point

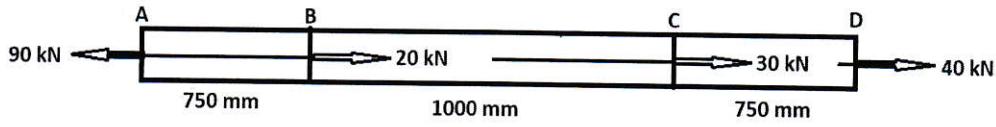
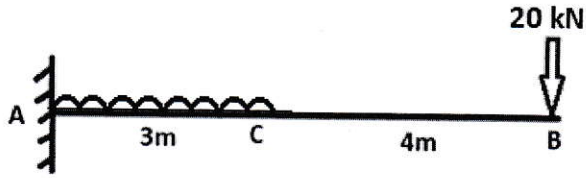
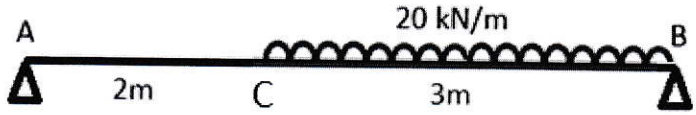
b) Elastic limit

c) Plastic limit

d) Breaking point

(x) Whenever a material is loaded within elastic limit stress is

		a) Equal to strain b) Directly proportional to strain c) Inversely proportional to strain	
	b)	Write TRUE or FALSE against each	5
		(a) A continuous beam has only two supports at the ends. (b) The unit of Young's modulus is same as that of stress. (c) The maximum bending moment of a simply supported beam of length l with a central point load W is Wl/8. (d) A beam supported at its both ends is not a simply supported beam. (e) A load which acts at a point on a beam is called uniformly distributed load.	
2.	a)	A cylindrical bar is 20mm diameter and 1000 mm long. During a tensile test it is found that the longitudinal strain is 4 times the lateral strain. Calculate the modulus of rigidity and bulk modulus. Given $E=1x10^5$ N/mm^2.	10
	b)	A steel rod 5 m long and 30 mm in diameter is subjected to an axial tensile load of 50 kN. Determine, (i) Longitudinal strain, (ii) Lateral strain, (iii)Change in length of the rod, (iv)Change in diameter of the rod, (v) Change in volume of the rod. Given, $E = 2 \times 10^5$ N/mm^2 and Poisson's ratio = 0.25	10
3.	a)	What are the assumptions made in the theory of pure torsion?	4
	b)	Derive the relationship to find the maximum torque which a shaft of radius R can transmit.	6
	c)	Find the angle of twist per meter length of a hollow shaft of 100mm external diameter and 60 mm internal diameter, if the shear stress is not to exceed 40 MPa. Given C = 85 GPa.	10
4.	a)	In case of simple bending, derive $M/I = \sigma/Y = E/R$.	5
	b)	Describe the theory of simple bending with respect to neutral layer.	5

	c)	Determine the diameter of a solid shaft which will transmit 90 kW at 160 rpm if the shear stress in the shaft is limited to 60 n/mm^2. Also find the length of the shaft if the twist must not exceed 1 degree over the entire length. Take C = 8 x 10^4 N/mm^2	10
5.	a)	A steel bar of 600 mm^2 cross sectional area is carrying loads as shown in the fig-1. Determine the elongation of the bar. Take E=200 GPa. 	12
	b)	Define the following terms. (i) Hooke's law (ii) Elastic limit (iii) Longitudinal strain. (iv) Lateral strain	8
6.		Calculate and draw the shear force and bending moment diagram for the cantilever beam. 	20
7.		Calculate and draw the shear force and bending moment diagram for the simply supported beam. 	20

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