Total number of printed pages: **Programme(D)/Semester 3rd /DCE 303**

2022

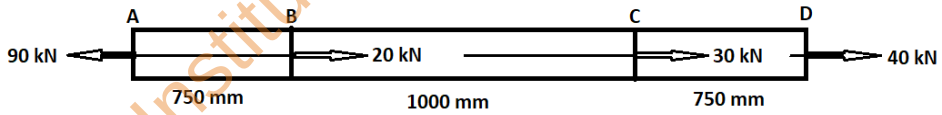
STRENGTH OF MATERIALS

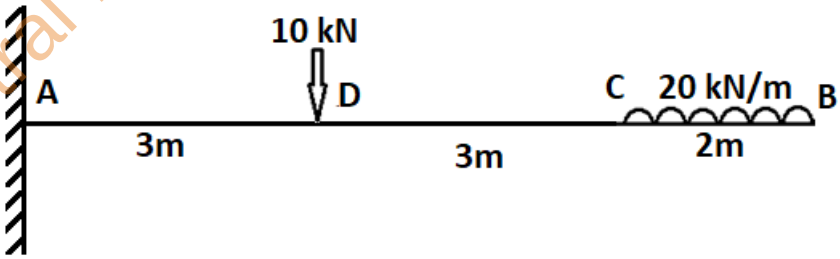
Full Marks : 100

Time : Three hours

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

*Answer **any five** questions.*

1.	a)	A copper rod 3 mm in diameter when subjected to a pull of 495 N extends by 0.07 mm over a gauge length of 100 mm. calculate the Young's modulus for copper.	8
	b)	A cylindrical bar is 20 mm 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, bulk modulus and volumetric strain. Take elastic modulus = 1 x 10^5 N/mm^2.	10
	c)	Define poisons ratio.	2
2.	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.  Fig-1	12
	b)	Define the following terms. (i) Hooke's law (ii) Elastic limit (iii) Longitudinal strain. (iv) Lateral strain	4x2=8
3.	a)	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	10

		length. Take C = 8 x 10^4 N/mm^2.	
	b)	What are the assumptions made in the theory of pure torsion?	5
	c)	Find the power that can be transmitted by a shaft 60 mm diameter at 180 rpm if the permissible shear stress is 85 N/mm^2.	5
4.	a)	The stresses at a point of a machine component are 150 MPa and 50 MPa both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of $55^0$with the axis of major tensile stress. (Use Mohr's circle)	10
	b)	The principal tensile stress at a point across two perpendicular planes are 80 N/mm^2 and 40 N/mm^2. Find the normal, tangential and resultant stress. Take its obliquity on a plane at 20^0 with the major principal plane. (use analytical method)	10
5.	a)	Define pure bending and also state the assumptions made in the theory of pure bending.	2+3=5
	b)	Derive the expression for bending stress.	5
	c)	A cast iron test beam 20 mm x 20 mm inn section and 1 m long is supported at the ends fails when a central load of 640 N is applied. What uniformly distributed load will break a cantilever of the same material 50 mm wide, 100 mm deep and 2 m long?	10
6.	a)	Derive the expression for section modulus of a circular section.	5
	b)	Calculate and draw the shear force and bending moment diagram for the beam in fig.2.  Fig.2	15
7.		Calculate and draw the Shear fore and bending moment diagrams for the beam in fig. 3.	20

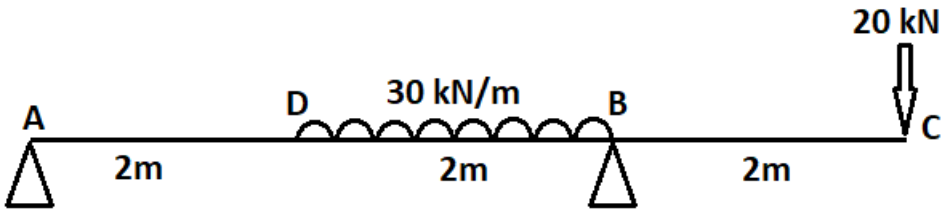


Fig-3