PVP 20

Code: 20CE3404

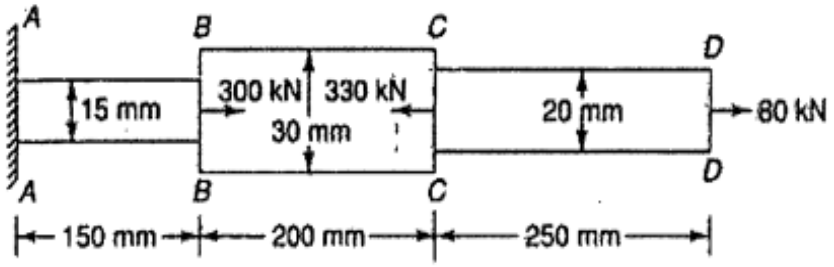
II B.Tech - II Semester – Regular / Supplementary Examinations
MAY - 2023

MECHANICS OF SOLIDS
(CIVIL ENGINEERING)

Duration: 3 hours Max. Marks: 70

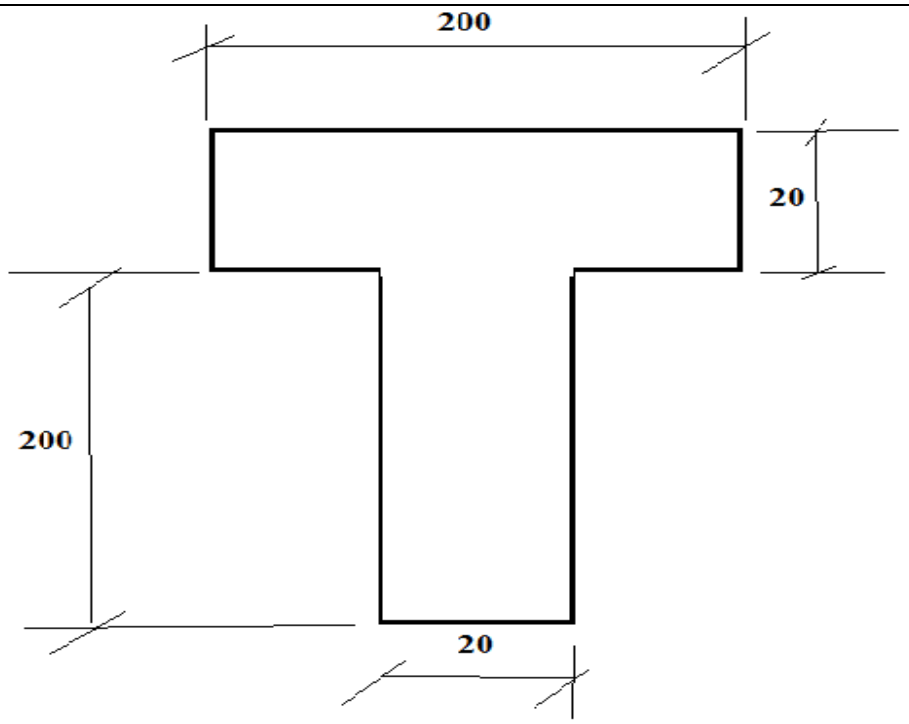
Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level CO – Course Outcome

			BL	CO	Max. Marks
		UNIT-I			
1	a)	Define Thermal stress and discuss the thermal stresses in composite bar in series.	L1	CO1	7 M
	b)	A steel circular bar has three segments as shown in Fig.1. Determine i) the total elongation of the bar. ii) The length of the middle segment to have zero elongation. Take E= 200 GPa.  Fig.1	L3	CO1	7 M
		OR			
2	a)	Define Bulk modulus and develop the expression for the relation between Bulk and Young's moduli.	L1	CO1	7 M
	b)	A steel bar 35 mm x 35 mm in section and 100	L3	CO1	7 M

		mm long is acted upon by a tensile load of 180 kN along it's longitudinal axis and 400 kN and 300 kN along the axes of the lateral surfaces. Determine i) Change in the dimensions of the bar and ii) Change in volume. Take E = 2 X 10^5 N/mm^2			
UNIT-II					
3	a)	A 8 m simply supported beam is carrying a central point load of 1 kN. Sketch the bending moment diagram.	L3	CO2	7 M
	b)	Draw SF and BM diagrams for a cantilever beam of length L, carrying uniformly varying load zero at free end and *w* per unit length at fixed support.	L4	CO2	7 M
OR					
4	a)	Define point of inflection. Is there point of inflection in a cantilever beam subjected to point load at center?	L1	CO2	7 M
	b)	A beam of 10 m length is simply-supported at its ends. It carries uniformly distributed load of 20 kN/m run over the length of left half of its span, together with concentrated load of 20 kN situated at center. Draw shear force and bending moment diagrams for this beam indicating values at the salient points.	L3	CO2	7 M
UNIT-III					
5	a)	In a piece of material, a tensile stress, σ and shearing stress q act on a given plane. Show that the principal stresses are always of opposite sign.	L4	CO3	7 M
	b)	At a point in a material, there are normal stresses of 30 N/mm^2 and 60 N/mm^2 both tensile together	L3	CO3	7 M

		with a shearing stress of 22·5 N/mm^2. Find the values of principal stresses and inclination of principal planes to the direction of the 60 N/mm^2 stress.			
OR					
6	a)	Derive an expression for normal and tangential stresses on a diagonal plane of a material subjected to pure shear.	L4	CO3	7 M
	b)	A straight bar of uniform cross-section is loaded in axial tension. Determine the normal and shearing stress on a plane inclined at an angle θ° to the axis of the bar. Also, determine the magnitude and direction of the maximum shearing stress in the bar.	L3	CO3	7 M
UNIT-IV					
7		A beam is having a T-shaped cross section with flange width 125 mm, flange thickness 25 mm, depth of web 175 mm and thickness of web 25 mm. If a bending moment of 2.5 kN-m is acting at the section, draw the bending stress distribution.	L3	CO4	14 M
OR					
8		A symmetrical T section (Fig.2) made with two rectangular planks of size 200 mm x 20 mm is subjected to a vertical shear force of 100 kN. Calculate shear stress at important points and draw shear stress distribution diagram. (All dimensions in mm)	L5	CO4	14 M

	 Fig.2			
	UNIT-V			
9	A hollow circular shaft of 200 mm internal diameter and thickness 50 mm transmits power at 200 rpm. The angle of twist over a length of 1 m is found to be 0·5 degree. Calculate the maximum shear stress developed and the power transmitted. Take G = 0·8 x 10^5 N/mm^2.	L3	CO5	14 M
	OR			
10	A close coiled helical spring, made out of 8 mm diameter wire, has 18 coils. Each coil is of 80 mm mean diameter. If the maximum allowable shear stress in the spring is 140 MPa, determine the maximum allowable load on the spring and elongation of the spring. Also, determine the stiffness of the spring. Take G = 82 GPa.	L3	CO5	14 M