Sub Code: R2321013 **R23** **Set No. 1**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURAJADA VIZINAGARAM
II B. Tech I Semester Regular/Supply Examinations, November – 2025
STRENGTH OF MATERIALS
(CE)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part A, Part B.
Part A is compulsory, Answer all questions.
In Part B, Answer any one question from each unit.

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PART-A **(20 M)**

1	a)	Define Poisson's ratio with neat sketch.	[2]
	b)	Write the relationship equations between modulus of elasticity, modulus of rigidity and bulk modulus.	[2]
	c)	Explain 'strain hardening position' when steel undergone to tensile stress.	[2]
	d)	Define the term 'factor of safety' and its importance.	[2]
	e)	What do you mean by point of inflection or contraflexure, explain in brief.	[2]
	f)	List the assumptions made in the theory of simple bending.	[2]
	g)	What is the difference between sagging and hogging.	[2]
	h)	List the assumptions made in the Lames theory in thick cylinders.	[2]
	i)	Define Mohr's theorem.	[2]
	j)	List out the limitations in Euler's theory.	[2]

PART-B **(50 M)**

Unit-1

2	a)	Three members of different cross-section carried a load of 8 tonnes. Stress in 3rd member is twice the 1st and one half of the 2nd. The 2nd rod carries 30% of the total load. Find the cross-section of each rod, if maximum stress that any member can withstand is 300 kg/cm².	[5]
	b)	A round copper rod, 560 mm long, has a diameter of 30 mm over a length of 200 mm, a diameter of 20 mm over a length of 200 mm and a diameter of 10 mm over its remaining length. Determine the stresses in each section and elongation of the rod when it is subjected to a pull of 30 kN. Take E = 100kN/mm².	[5]
		(OR)	
3	a)	A bar of 5 cm dia and 400 cm long is acted upon by a load of 10 tonnes. It is found to extend 10 cm. Find (a) stress, (b) strain, (c) Young's modulus, and (d) work done.	[5]
	b)	A member ABCD is subjected to loading system as shown in Fig. 1. Determine the net change of the length. Take E = 2×10^5 N/mm².	[5]

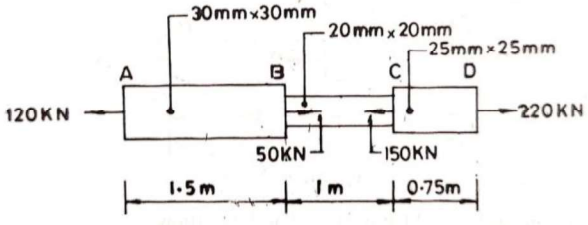

Fig. 1

Unit-2

4	a)	A cantilever ABCD, 7 m long is fixed at A, such that AB = BC = 2 m and CD = 3 m. It carries loads of 5t, 3t and 2t at B, C and D respectively in addition to U.D.L. of 1 t/m run between A and B, and 2 t/m between C and D. Draw shear force and bending moment diagrams giving all salient values.	[5]

b) A simply supported beam AB of span 8 m carrying point loads of 3 kN, 4 kN at distances 5 m and 6 m respectively from left hand support. Calculate the values of shear force and bending moment at salient points, and draw S.F. and B.M. diagrams. [5]

(OR)

5 a) A cantilever 2 m long carries an U.D.L. 2 kN/m over its entire length and two point loads 4 kN and 5 kN at distances 0.5 m and 1 m respectively from the fixed end. Draw shear force and bending moment diagrams and calculate maximum S.F. and B.M. [5]

b) An overhanging beam of length 10 m is simply supported over 6 m apart and overhang of 2 m at each side. The beam carries u.d.l. of 4 kN/m. Draw shear force and bending moment diagrams. [5]

Unit-3

6 a) A timber joist is 150 mm wide and 240 mm deep. It is used as a cantilever of length 4 m. What is the maximum concentrated load that it can carry at its free end in addition to its self weight so that the bending stress is not to exceed 7 N/mm². Take unit weight of timber = 6 kN/m^3. [5]

b) A timber beam 150 mm wide and 300 mm deep carries a uniformly distributed load of 'w' over the span of 3metres. If the safe stresses are longitudinally 20N/mm² and transverse shear 3 N/mm², calculate the maximum load that the beam can carry. [5]

(OR)

7 a) An iron pipe of internal and external diameters 200 mm and 250 mm respectively and is supported at a span 7 m apart. If unit weight of iron and water are 70 kN/m² and 10 kN/m² respectively, find the maximum fibre stress induced in the pipe when it is running full. [5]

b) A 25 cm x 7.5 cm timber beam with its longer edge vertical, spans 2 m between simple supports. What safe uniformly distributed load, the beam can carry if the permissible bending stress is 80 kg/cm². For the calculated safe U.D.L., what will be the shear stress in the section near supports. [5]

Unit-4

8 a) A simply supported steel beam, 6 m long is circular in cross-section and is of 15 cm diameter. What point load should be placed at the mid span to restrict the deflection to 1.035 cm. Take value of E = 2×10^5 N/mm². What will be the slope at the ends? [5]

b) A simply supported beam of span 3 m and cross-sectional area 100mm × 300mm carries a point load of 10 kN at a distance of 1 m from the left end. Find the slope at its two ends and deflection under the point load. Take E = 2×10^4 N/mm². (Macaulay's method) [5]

(OR)

9 a) A simply supported R.C. rectangular beam of span 3 m is carrying a U.D.L. of 8 kN/m over the entire span. If the allowable bending stress is 7 N/mm² and the allowable deflection is 10 mm, find the necessary width and depth of the section. Take E = 1×10^4 N/mm². [5]

b) A beam ABCDE is simply supported at A and D, with DE overhanging. AB = BC = CD = 2 m and DE = 1.5 m. The beam is subjected to concentrated loads of 20 kN at B, 30 kN at C and 10 kN at E. Derive the equation of the deflected shape of the beam. Find the deflection at the free end. (Macaulay's method) [5]

Unit-5

10 a) Compare the strength of solid circular column of diameter 200 mm and hollow circular column of same cross-sectional area and thickness 30 mm. The other parameters are same for both the sections. [5]

b) A thin spherical pressure vessel of diameter 1.5 m, thickness of metal 15 mm and the efficiency of longitudinal joint is 70%. If the maximum tensile stress of the plate is 80 N/mm², calculate the permissible steam pressure in the vessel. Calculate also the circumferential stress in the solid plate section and longitudinal stress in the plate section through the joint if efficiency of circumferential joint is 60%. [5]

(OR)

11 a) A column having a T section with a flange 120 mm x 16 mm and web 150 mm × 16 mm is 3 m long. Assuming the column to be hinged at both ends, find the crippling load by using Euler's formula. $E = 2 \times 10^6$ kg/cm². [5]

b) A hollow cylinder of external diameter 250 mm in shrinked over another hollow cylinder of internal diameter 150 mm so that the common diameter at junction finally comes as 200 mm. If the original difference in diameter is 10 mm, find the radial pressure at the junction. Take $E = 2 \times 10^5$ N/mm². [5]

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