Sub Code: R2321032 **R23** **Set No. 1**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY- GURAJADA VIZIANAGARAM
II B. Tech I Semester Regular Examinations, November – 2024
MECHANICS OF SOLIDS
(ME)

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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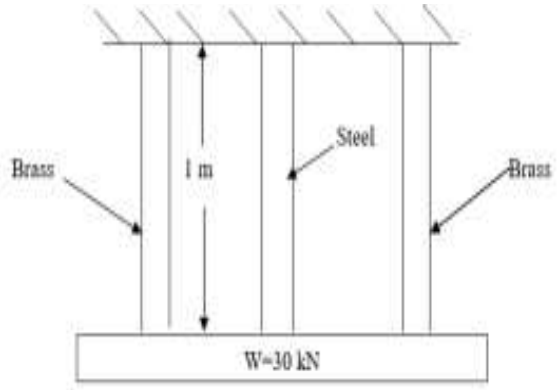
PART-A **(20 Marks)**

1	a)	What is meant by thermal stress	[2]
	b)	Illustrate the importance of strain energy	[2]
	c)	State the difference between the cantilever beam and overhanging beam	[2]
	d)	Why the shear force is needed in the analysis of beams	[2]
	e)	Draw the bending stress and shear stress profiles for a hollow rectangular beam section	[2]
	f)	Define bending stress, shear stress and neutral axis	[2]
	g)	State moment area theorem -1	[2]
	h)	Find the minimum diameter of shaft required to transmit a torque of 29820 Nm if the maximum shear stress is not to exceed 45 N/mm^2	[2]
	i)	Mention the types of stresses produced in thin cylindrical shells	[2]
	j)	What are assumptions involved in the analysis of thin cylindrical shells.	[2]

PART-B **(50 Marks)**

Unit-1

2 A weight of 30 kN is supported by two brass rods and a steel rod each 10 mm in diameter and symmetrically placed as shown in Figure. When unloaded, each rod is 1 m long. Assuming E for steel and brass as 205 kN/mm^2 and 102 kN/mm^2 respectively, find the load carried by each rod. Also determine elongation of each rod. [10]

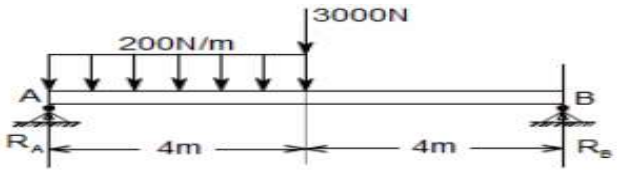


(OR)

3 A steel tube of 30 mm external diameter and 20 mm internal diameter encloses a copper rod of 15 mm diameter to which it is rigidly joined at each end. If at a temperature of 10^0C there is no longitudinal stress, calculate the stresses in the rod and tube when the temperature is raised by 200^0C.Take E for steel and copper as 2.1 x 10^5 N/mm^2 and 1 x 10^5 N/mm^2. Coefficient of thermal expansion for steel and copper are given as 11 x 10^{-6} / ^{0}C and 18 x 10^{-6} / ^{0}C. [10]

Unit-2

4 A loaded beam as shown below. Draw its S.F and B.M diagram. [10]



(OR)

5 A simply supported beam of 7m length has a load of 12KN/m uniformly distributed over 3m. It starts from 2.5 m of left support. In addition to that 8KN point load is acting 2.5m from the left-hand support. Draw the SFD and BMD. [10]

Unit-3

6 a) A rectangular timber beam 5m long has to carry a uniformly distributed load of 17.5 kN per meter run over its entire length and a concentrated load of 5 kN at the mid span. If the permissible bending stress is 10 N/mm^2 , find the section taking depth as twice the width [6]

b) A rectangular beam 150mm wide and 300mm deep is subjected to a maximum shear force of 50kN. Determine the maximum shear stress [4]

(OR)

7 A T shaped beam of flange of size 200 X 50mm and web of size 200 X 50 mm subjected to a vertical sheer force of 100KN Calculate the shear stress at the neutral axis and the junction of the web &the flange moment of inertia about the horizontal neutral axis is $1.34X10^8 mm^4$ [10]

Unit-4

8 Prove that the deflection at the center of a simply supported beam carrying a point load at the center it is given by yc $= WL^3/3EI$ [10]

(OR)

9 a) A hollow shaft, having an internal diameter 50% of its external diameter transmits 600KW at 150 r.p.m. Determine the external and internal diameter of the shaft if the shear stress is not to exceed 65 N/mm^2 and the twist in a length of 3m should not exceed 1.4 degrees. Assume maximum torque is 1.2 times of the mean torque and modulus of rigidity = $1 X 10^5 N/mm^2$. [5]

b) A beam of 4m span is carrying a point load of 40 kN at a distance of 3m from the left end. Calculate the slope at the supports and deflection under the load. Also calculate the maximum deflection. EI= $2.6x10^7$ $N-m^2$ [5]

Unit-5

10 a) A cylindrical shell 1m diameter and 3m length is subjected to an internal pressure of 2MPa.Calculate the minimum thickness if the stress should not exceed 50MPa. Find the change in diameter and volume of shell. Poisson 's ratio = 0.3 and E = $200KN/mm^2$ [5]

b) A spherical shell of 1 m diameter is subjected to an internal pressure 0.5 N/mm^2. Find the thickness if the thickness of the shell, if the allowable stress in the material of the shell is 75 N/mm^2 [5]

(OR)

11 Derive the expression for buckling load for the column with one fixed and other end free. [10]

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