JHARKHAND UNIVERSITY OF TECHNOLOGY

Diploma 3rd Semester Sample Paper (MODEL SET)

MECHANICS OF MATERIALS (MEC 301)

Time: 3 Hours **Full Marks: 70** **SET: 2**

INSTRUCTIONS:

1. Question No. 1 is Compulsory.
2. Answer any **FOUR** questions from the remaining (Q.2 to Q.7).
3. Use the provided figures for numerical problems.

Q.1. Multiple Choice Questions [2 × 7 = 14]

(i) The maximum bending moment for a Simply Supported beam with a central point load W and span L is:

(a) WL/2 (b) WL/4
(c) WL/8 (d) WL

(ii) Modulus of Rigidity is the ratio of:

(a) Linear stress to Linear strain (b) Shear stress to Shear strain
(c) Volumetric stress to strain (d) None of these

(iii) In a composite bar of steel and copper heated together, the steel will be subjected to:

(a) Tensile stress (b) Compressive stress
(c) Shear stress (d) Zero stress

(iv) The unit of Section Modulus (Z) is:

(a) mm^2 (b) mm^3
(c) mm^4 (d) mm

(v) Two shafts A and B are of same material. Diameter of A is twice that of B. The torque capacity of A is:

(a) 2 times B (b) 4 times B
(c) 8 times B (d) 16 times B

(vi) Equivalent length of a column fixed at one end and free at the other is:

(a) L (b) L/2
(c) 2L (d) $L/\sqrt{2}$

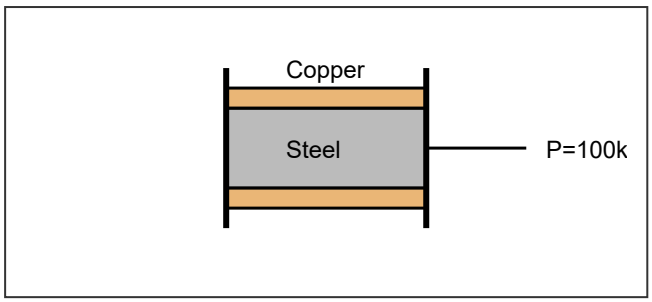
(vii) Hooke's Law holds good up to:

(a) Yield point (b) Elastic limit
(c) Plastic limit (d) Breaking point

SECTION B (Long Answer Type)

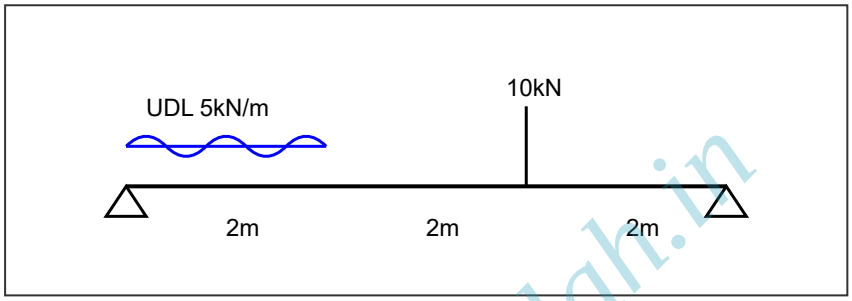
Q.2. (a) [Theory] Derive an expression for the **Total Elongation of a Uniformly Tapering Circular Rod** of diameters D_1 and D_2 and length L. **[7]**

Q.2. (b) [Numerical] Find the forces in each part of the **Composite Bar** shown below if Total Load P = 100kN. (Assume E_steel = 2 × E_copper). **[7]**



Q.3. (a) [Theory] Define **Shear Force** and **Bending Moment**. What is the relationship between Load (w), Shear Force (F), and Bending Moment (M)? **[7]**

Q.3. (b) [Numerical] Draw the **SFD and BMD** for the Simply Supported Beam shown below. **[7]**



Q.4. (a) [Theory] Explain the concept of **Composite Bars**. How do you calculate stresses in a composite bar due to temperature change? **[7]**

Q.4. (b) [Numerical] A rectangular timber beam 200 mm wide and 300 mm deep is simply supported over a span of 5 m. Determine the **Maximum UDL** the beam can carry if bending stress is not to exceed 120 N/mm². **[7]**

Q.5. (a) [Theory] Derive the expression for **Power Transmitted by a Shaft** ($P = 2\pi NT/60$). Explain the meaning of each term. **[7]**

Q.5. (b) [Numerical] A solid steel shaft has to transmit 75 kW at 200 rpm. Taking allowable shear stress as 70 N/mm², find the suitable **Diameter of the shaft**. **[7]**

Q.6. (a) [Theory] Explain **Euler's Theory of Buckling**. Write the formula for Euler's Crippling Load for a column with **Both Ends Hinged**. **[7]**

Q.6. (b) [Numerical] A hollow cast iron column of external diameter 200 mm and internal diameter 150 mm is 6 m long with both ends fixed. Find the **Safe Load** using Euler's formula. Take Factor of Safety = 4 and E = 100 GPa. **[7]**

Q.7. Write Short Notes on (Any FOUR): [3.5 × 4 = 14]

a. Moment of Resistance

b. Modular Ratio

c. Strength of a Shaft

d. Radius of Gyration

e. Bulk Modulus
