CSM : 14

CIVIL ENGINEERING

PAPER - I

Time Allowed : 3 hours Full Marks : 100

Marks for each question is indicated against it.

Attempt <u>any 5 (five)</u> questions taking not more than 3 (three) questions from each Part.

PART A

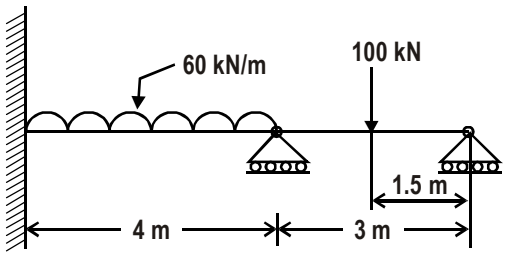
1. (a) A motorist travelling at a speed of 86.4 km/h suddenly sees a man 100m ahead. He instantly slows the engine and applies the brake, so as to stop the car 10m ahead of the man. Calculate the time required by the motorist to stop the car. **(10)**

(b) A 10º wedge is used to raise a body weighing 1000N. Determine the minimum force P required to raise the body if the coefficient of friction μ=0.35 between all the surfaces. **(10)**

2. (a) Derive the expression of Eulers Crippling Load for long column when both ends are hinged. **(10)**

(b) Determine the Poission's ration (μ) and bulk modulus (K) if the bar has a modulus of elasticity (E) equal to 1.98×10^5 N/mm^2 and modulus of rigidity (G) is 0.85×10^5 N/mm^2 **(10)**

3. (a) Analyse the continuous beam shown in the figure below by flexibility matrix method.



(10)

(b) A simply supported beam of uniform section and of length *l* carries a uniformly distributed load over the whole span. Determine the length of the plastic hinge at collapse condition of the beam. **(10)**

4. (a) Design a short axially loaded square column of 500mm × 500mm for a service load of 2000kN. Use M25 grade of concrete and Fe 500 grade of steel. **(10)**

(b) A simply supported prestressed concrete beam of rectangular cross-section 400mm × 600mm is loaded with a uniformly distributed load of 40kN/m over a span of 6m.
Sketch the distribution of stresses at the mid span and end sections if the prestressing force is 1920kN and the tendon is located at 200mm above the bottom fiber. **(10)**

PART B

5. (a) Define Reynold's number, Froude's number and Mach number and derive expression for any two of them. **(10)**

(b) A vertical rectangular gate 2.0m wide and 2.5m high is subjected to a water pressure on one side, the water surface being at the top of the gate. The gate is hinged at the bottom and is held by a horizontal chain at the top. Calculate the tension in the chain. **(10)**

6. (a) Derive the expression for velocity distribution of laminar flow through a circular pipe**.(10)**

(b) Derive the expression for hydraulic jump in horizontal rectangular channel. **(10)**

7. (a) What is specific speed of turbine? Derive the expression for it. Discuss the significance of specific speed. **(10)**

(b) An inward flow reaction turbine has runner of outer diameter 1.2m and inner diameter 0.6m. The blades occupy 5% of the peripheral area and widths of the blades are 25cm and 30cm at the inlet and outlet respectively. If a discharge of 3.0 m^3/sec enters radially, determine the flow velocities at the inlet and outlet of the runner. **(10)**

8. (a) Discuss standard penetration test. What are the various corrections? What is the importance of the test in geotechnical engineering? **(10)**

(b) What are the assumptions that are generally made in the analysis of the stability of slopes? Discuss briefly their validity. **(10)**

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