CSM : 22

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. What is moment-area method? Where is it conveniently used? Find the slope and deflection of a simply supported beam carrying a (a) point load at the centre and (b) uniformly distributed load over the entire length using moment-area method. **(3+3+7+7=20)**

2. The homogeneous rectangular block of mass m, width b, and height H is placed on the horizontal surface and subject to a horizontal force P which moves the block along the surface with a constant velocity. The coefficient of kinetic friction between the block and the surface is μ_k. Determine **(10+10=20)**

(a) The greatest value that h may have so that the block will slide without tipping over and

(b) The location of a point C on the bottom face of the block through which the resultant of the friction and normal force acts if h = H/2.

3. A prismatic beam of I section ABC is simply supported at A and B, where AB = 20 m and BC = 1 m, C is free end. A uniformly distributed load of 10 kN/m is acting on the beam. The cross section I beam particulars are

Flanges width	=	150 mm
Thickness	=	10 mm
Web thickness	=	10 mm
Overall depth of beam	=	300 mm

Determine the maximum value and the location of principal stress occurring anywhere in the beam. **(12+8=20)**

4. In a truss girder of a bridge, a diagonal consists of a 16 mm thick flat carries a pull of 750 kN and is connected to a gusset plate by double cover butt joint. The thickness of each cover plate is 8 mm. Determine the number of rivets necessary and the width of the flat required. What is the efficiency of the joint? Sketch the joint. Given **(12+8=20)**

Working stress in shear in rivet	=	100 N/mm^2
Working stress in bearing in rivet	=	300 N/mm^2
Working stress in tension in plate	=	0.6 x 260 MPa

PART - B

5. Discuss the types of problems in pipeline designs. A liquid of specific gravity 0.88 and absolute viscosity 6.533×10^{-4} N.s./m^2 flows through a pipe of diameter 0.15m at the rate of 60 lit/s. If the loss of head in 100m length of pipe is 4.56m, determine whether the pipe is rough or smooth. **(20)**

6. The pressure difference in pipe of diameter D and length L due to turbulent flow depends upon the velocity V, viscosity μ, density ρ, and roughness k. Using Buckingham's pi theorem obtain an expression for pressure difference. **(20)**

7. (a) Differentiate between specific energy and specific force in open channel flow. **(5)**

(b) A 3.6 m wide rectangular channel carries water to a depth of 1.8 m. In order to measure the discharge, the channel width is reduced to 2.4 m and a hump of 0.3 m height is provided at the bottom. Calculate the discharge if water surface in the contracted section drops by 0.15 m. (Assume no losses) **(15)**

8. (a) Explain negative skin friction. **(5)**

(b) A footing 2 m square rest on a soft clay with its base at a depth at of 1.5 m from ground surface. The clay stratum is 3.5 m thick and underlain by firm sand stratum. The clay soil has the following properties:

Liquid limit (W_L) = 30%, Natural moisture content (W_n) = 40%,
Specific gravity (G_s) = 2.7 and $\phi = 0°$ and $C_u = 0.5$ kg/cm^2

The clay stratum is normally consolidated. Natural water table is close to the surface. Using Skemton's equation determine the net safe bearing capacity of the footing. **(15)**

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