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M.Tech Structural Design (2016 & Onwards) (Sem.-1)

DESIGN OF BRIDGES

Subject Code : MTSD-105

Paper ID : [74246]

Time : 3 Hrs. Max. Marks : 100

INSTRUCTION TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWENTY marks.
3. Missing data may be suitably assumed.

Q1 a) Explain classification of bridges made on the various basis. (4)

b) List out all the forces which are acting on the pipe culvert. (4)

c) State how you would determine the depth of foundation required for a pier of a bridge located near the mouth of a river. (4)

d) How would you compute the centrifugal force due to movement of vehicles on a bridge? (4)

e) What are the causes for longitudinal forces on bridges? (4)

Q2 The effective span of trough type Warren truss Highway bridge for a I.R.C. : Class A wheeled vehicles are 42 m. Warren truss consist of 7 panels @ 6 m. Design the stringer beam and cross girder with the following data :

Dead load from slab and W.C = 14 kN/m, Spacing between the stringer beam = 1.875 m Width of roadway = 7.5 m, Kerb = 600 mm on both sides.

Rolled steel section with a yield stress of 236 N/mm^2 are available to use. (20)

Q3 Design a pre stressed concrete slab for the following data:

Clear span = 4.5 m, L.L = IRC class 70R, Road = National Highway, Foot path =1 m on either side, Materials = M45 grade concrete and HYSD steel. The compressive stress permissible in concrete during transfer 16 MPa. (20)

Q4 a) Explain "Normal Depth of Scour". (4)

b) Explain with sketch the elements of plate girder bridge. (6)

c) How would you design the deck slab of a skew culvert if the angle of skew is (i) 10 degrees and (ii) 20 degrees? (6)

d) State how the dynamic effect is considered in railway bridge design. (4)

Q5 Design the top, bottom slab and vertical walls of box culvert with the following particulars:

Inside Dimensions : 3.5 m x 3.5 m for the case having D.L +L.L on the top with horizontal component due to D.L only, Density of soil : 18 kN/m^3, Angle of repose : 30°, Superimposed D.L = 12 kN/m^2, Super-imposed L.L = 45 kN/m^2, Materials: M30 concrete grade and Fe 415 grade steel, Drain is running full. (20)

Q6 Design a welded plate girder for a B.G. track using the following data :

Span of bridge = 20m, D.L of track = 7.5 kN/m

E.U.L.L. for B.M. calculation /track = 1964 kN

E.U.L.L. for shear calculation /track = 2168 kN

C.D.A = 0.458

Design a suitable section for plate girder without intermediate and end bearing stiffeners. Also sketch the details of longitudinal and cross -section. (20)

Q7 Design a suitable masonry abutment for Girder Bridge. The angle of internal friction of the retained material is 30°. The angle of friction between soil and masonry is 20°. An approached reinforced concrete slab is provided to the bridge so that the effect of surcharge may neglected. Height of the abutment below road levels 5.5 m. The positive earth pressure in front of the abutment is to be neglected. Density of masonry is 2 t/m^3, density of concrete is 2.4 t/m^3 and density of soil is1.8 t/m^3. (20)

Q8 a) Design an elastomeric pad bearing for a two - lane R.C. T-Beam bridge with clear span of 16 m with the following data :

Maximum dead load reaction per bearing = 320 kN

Maximum .live load reaction per bearing = 520 kN

Vertical reaction induced by longitudinal forces per bearing = 15 kN

Longitudinal forces per bearing = 33 kN

Concrete for bed block over pier :M-20 and A1/A2 >2

Rotation at bearing of superstructure due to D.L+ L.L = 0.0025 radian. (15)

b) Sketch and explain the details of bearing for a submersible slab bridge. (5)