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17CV741

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Design of Bridges

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of codes, IRC-6, IRC-21, IRC-112, IS-456 IS-458, Pigeaud's curves
***   are permitted.***
3. Assume any missing data suitably.

Module-1

1 a. Define a bridge. How the bridges are classified? Explain briefly. **(10 Marks)**
   b. Mention the various methods of estimating the maximum discharge in the stream and explain any three methods. **(10 Marks)**

OR

2 a. What is meant by economical span of a bridge? Derive the equation of a economical span by stating the assumptions made. **(10 Marks)**
   b. A bridge needs to be constructed across an alluvial stream having a discharge of 500 cumecs. Calculate the depth of maximum scour when the bridge consists of:
   (i) Three spans of 15m each
   (ii) Two spans of 30m each
   (iii) Four spans of 30m each
   Take silt factor as 1.1. **(10 Marks)**

Module-2

3 Design a reinforced concrete deck slab bridge for a National Highway to suit the following data:
   Width of the carriage way = 7.5 m (two lane traffic)
   Foot path on either side = 1.0 m
   Clear span = 6.0 m
   Wearing coat = 80 mm
   Width of bearing = 400 mm
   Materials = M30 grade concrete and steel Fe-415 HYSD bars
   Loading: IRC class-A.
   The design should confirm to the new code specifications using limit state method. Check for shear and design of foot path is not necessary. **(20 Marks)**

OR

4 Design a reinforced skew deck slab for a National Highway crossing of a stream to suit the following data:
   Width of carriage way = 7.5 m; Foot path on either side = 1.0 m; Clear span = 6.0 m; Wearing coat = 80 mm; Width of bearing = 370 mm; Skew angle = 30°; Materials: concrete: M-25 grade and steel Fe-415 grade HYSD bars; Depth of the slab = 540 mm ; Loading IRC – Class AA loading tracked vehicle. The design should confirm to the new code specifications using limit state method. Check for shear and design of foot path is not necessary. **(20 Marks)**

Module-3

5 Design the deck slab only for the T-beam bridge for the following data:
Effective span = 16m,
Loading: IRC class AA tracked vehicle
Materials: M-25 grade concrete and steel Fe-415
Spacing of the cross girders = 4m c/c
Width of carriage way = two lane 7.5 m
Thickness of the wearing coat = 80 mm
Kerbs on either side = 600 mm × 300 mm deep
Width of the main girder = 300 mm
Width of the cross girder = 300 mm
Spacing of main girder = 2.5 m c/c
Width of cross girder = 300 mm **(20 Marks)**

OR

6 Design a T-beam bridge 'main girder' for the same data given in Q5. **(20 Marks)**

Module-4

7 Design a pipe culvert through a road embankment of height 6m, the width of the road is 7.5 m and the formation width is 10 m, the side slope of the embankment is 1.5:1. The maximum discharge is 5 m^3/sec. The safe velocity is 3 m/sec Class A-A, tracked vehicle is to be considered as a live load. Assume Bell mouthed entry. Given $K_e = 0.08$, $C_e = 1.5$, $C_s = 0.010$ and density of soil is 20 kN/m^3. Internal diameter of the pipe is 1000 mm and external diameter of the pipe is 1230 mm. Three edge bearing strength is 71.85 kN/m. Spiral reinforcement is 21.52 kg/m. Longitudinal reinforcement is 2.66 kg/m. Draw the reinforcement details of the pipe and type of foundation bed. **(20 Marks)**

OR

8 Explain in detail the design principles of box culvert. **(20 Marks)**

Module-5

9 a. Mention the various forces acting on the pier. **(05 Marks)**
   b. Explain the different types of abutment with sketches. **(08 Marks)**
   c. Compute the stresses developed at the base and check for the stability of the abutment as shown in Fig.Q9(c). SBC of soil is 150 kN/m^2. Coefficient of friction between masonry and soil is 0.5, density of stone masonry is 25 kN/m^3.
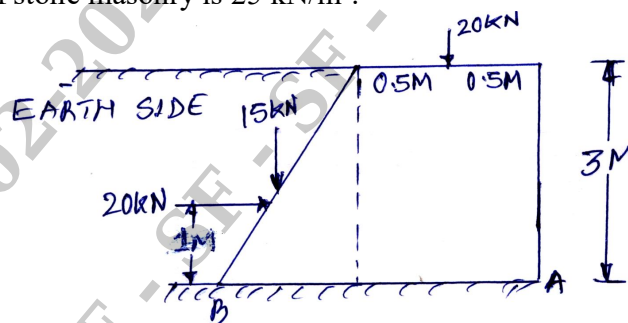

Fig.Q9(c) **(07 Marks)**

OR

10 a. Mention the different types of bearings. Explain with neat sketches for any two types of bearings used in bridge. **(08 Marks)**
   b. What are the points to be considered in the selection of suitable bridge bearings? **(04 Marks)**
   c. What are the functions of an expansion joint? Explain any two types with sketches. **(08 Marks)**

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