CBCS SCHEME

USN | | | | | | | | | | |

15CV741

Seventh Semester B.E. Degree Examination, June/July 2019

Design of Bridges

Time: 3 hrs. Max. Marks: 80

Note: **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Use of IRC:21-2000 allowed.***
3. ***Assume any missing data suitably.***

Module-1

1 a. Explain linear waterway, afflux and scour. **(06 Marks)**

b. Determine the water way for a bridge across a stream with a flood discharge of 225 m^3/s, velocity 1.5 m/s and width of flow at high flood level 60 m, if allowable velocity under the bridge is 1.8 m/s. Use Molesworth formula. **(10 Marks)**

OR

2 a. Derive an expression for economic span of a bridge. **(08 Marks)**

b. Briefly explain class AA wheeled vehicle with a neat sketch. **(08 Marks)**

Module-2

3 Design a slab bridge for the following details.
Loading = class AA tracked vehicle
Clear span = 4.5 m
Road width = 7.5 m
Foot path on either side = 600 mm
Thickness of wearing course = 80 mm
For M25 concrete and Fe415 steel
$k_d = 0.318$ d, $j_d = 0.89$d
Constant $\alpha = 2.85$
Density of concrete = 24 kN/m^3
Density of wearing course = 22 kN/m^3
Check for shear not required and no need to design the footpath. Show reinforcement details in a cross section. **(16 Marks)**

OR

4 Design a slab bridge for the following details:
Carriage way width = 12 m
Kerb width = 550 mm
Exposure condition = moderate
M25 concrete and Fe 415 steel
Loading = class AA wheeled vehicle
Clear span = 5.0m; $\alpha = 3.0$
Wearing course = 60 mm
Check for shear not required. No need to design Kerb. Show reinforcement details.
(16 Marks)

Module-3

5 A T-Beam bridge has to be provided across a channel having following data. Design the slab deck and show reinforcement details.

Food discharge = 30 m^3/s
Bed width = 12 m
Side slope = 1:1
Depth of flow = 1.25 m
Maximum allowable afflux= 1.50 cm
Number of longitudinal girders = 3
Load = IRC class AA tracked vehicle on a two lane highway of 7.5 m
M25 concrete and Fe415 steel, $k_d = 0.318$ d, $j_d = 0.89$ d.
Thickness of wearing course = 80 mm
Take $m_1 = 0.043$ and $m_2 = 0.028$ for self weight of slab and surface finish. Take $m_1 = 0.077$ and $m_2 = 0.058$ for live load. No need to check for shear. **(16 Marks)**

OR

6 A T-beam bridge has to be provided across a channel having following data. Design the T-beam and show reinforcement details.

Clear span = 14 m
Number of longitudinal girders = 3
Spacing of girders = 3 m
Width of main girder = 0.30 m
Spacing of cross girders = 3.5 m
Width of cross girder = 0.25 m
M25 concrete and Fe415 steel = $k_d = 0.318$ d, $j_d = 0.89$ d
Load = IRC class AA tracked vehicle on a two lane highway of 7.5 m
Footpath = 1 m wide footpath on either side
Thickness of wearing course = 80 mm
Take impact = 10%
Overall depth = 1450 mm
Reaction coefficient for the critical girder due to live load = 0.517 **(16 Marks)**

Module-4

7 An RCC pipe culvert is proposed for a drain carrying a design discharge of 1.40 m^3/s. Permissible velocity of flow is 1.50 m/s. Bed level of drain 100.00 m, road formation level 103.00 m, road width is 7.50 m. Embankment slope is 1.5:1. Table below gives the details of NP3 pipe and its strength.

Pipe diameter		Reinforcement		Three edge bearing strength
Internal	External	Longitudinal	Spiral	
800 mm	990 mm	26.60 N/m	130.40 N/m	57.48 kN/m

Embankment load is 60 kN/m. Value of $C_s = 0.025$ for IRC class AA wheel load of 62.50 kN. Impact factor is 1.50. Coefficient of head loss at entry is 0.51. Coefficient of head loss due to friction is $0.0033\ L/(R)^{1.3}$. Design the pipe culvert. Draw the cross section of pipe showing reinforcement and bedding details. **(16 Marks)**

OR

8 Design a box culvert having inside dimensions of 3.5m × 3.5 m. The culvert is subjected to a super imposed dead load of 12 kN/m^2 and a live load of 35.7 kN/m^2 including impact. Unit weight of soil = 18 kN/m^3. The coefficient of active earth pressure, $k_a = 1/3$. k = 0.318 and j = 0.89 for M25 concrete and Fe415 steel. The design condition is the top of the slab carries the dead and live loads and the culvert is empty. Take road width equal to 7.5 m. **(16 Marks)**

Module-5

9

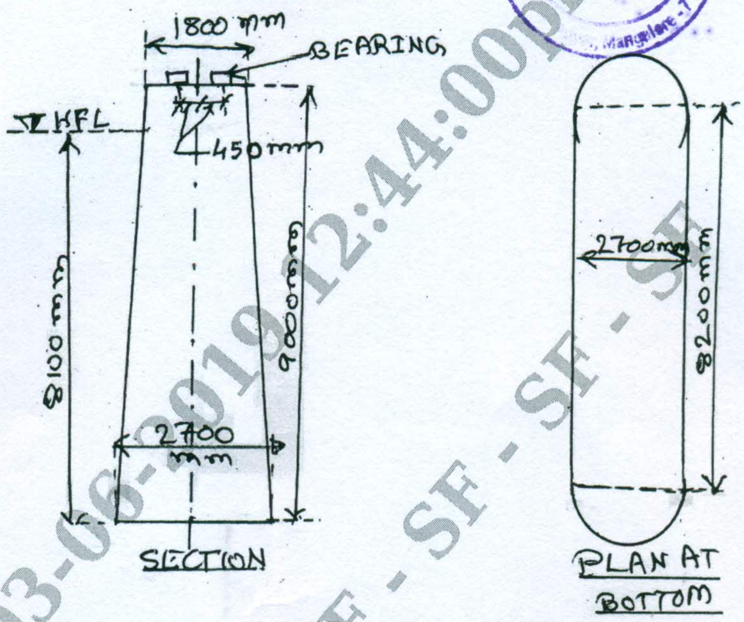

Fig.Q9

Check the adequacy of dimensions of the pier shown in Fig.Q9 for the following details.
Super structure = simply supported T-beam of 21.30 m span
Foundation = well foundation
Dead load from each span = 2250 kN
Reaction due to live load on one span = 900 kN
Maximum mean velocity of current = 3.6 m/s
Materials for pier : M20 grade concrete
Live load = IRC class AA tracked vehicle **(16 Marks)**

OR

10 a. Explain with a neat sketch the following two types of bearings:
i) Fixed bearing
ii) Expansion bearing **(08 Marks)**

b. What are the functions of an expansion joint? Explain it briefly with any two neat sketches. **(08 Marks)**

* * * * *