



P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Eighth Semester, B.E. - Civil Engineering

Semester End Examination; May / June - 2019

Design of Bridges

Time: 3 hrs

Max. Marks: 100

Note: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.

ii) Use of IS456, SP16 & IRC21 permitted. iii) Write free hand sketches wherever necessary.

UNIT - I

- 1 a. What is the basis for classification of bridges? List three varieties of classification of bridges. 8
- b. Bring out the sequence of panning of bridge for particular site and also determine economic span of the bridge from the following data :

Span (m)	4	8	12	16	20
Superstructure cost (Rs lakhs)	2	5	8	12	18
substructure cost (Rs lakhs)	6	15	18	24	30

12

- 2 a. Explain Afflux and Scour phenomenon at a bridge site. Mention how the same are estimated and also mention the design limits. 10
- b. Determine the waterway for a bridge over a trapezoidal channel having side slope of 1 : 1 with a discharge of 25 m³/s, a bed fall of 1 : 1000 and a bed width to depth ratio of 6 : 1. The bed material is sand with a safe velocity of 2.5 m/s. The afflux should not be more than 8 cm. Take Manning's constant $n = 0.25$. 10

UNIT - II

- 3 a. Reproduce with neat dimensional sketches IRC Class AA tracked and A loading considered in Bridge design. 8
- b. Explain the following :
- | | | | |
|------------------------------------|--------------------------|--|----|
| i) Collision forces | ii) Water current forces | | 12 |
| iii) Impact effect on bridge decks | iv) Erection stresses | | |
- 4 a. Reproduce with neat dimensional sketches IRC Class AA wheeled loading on the bridge. 8
- b. Explain the following :
- | | | | |
|---|--------------------------|--|----|
| i) Wind load | ii) Buoyance force | | 12 |
| iii) Longitudinal forces due to vehicle and temperature | iv) Deformation stresses | | |

UNIT - III

5. Design a slab culvert for both BM and SF having a span of 5 m with the following data, road width 7.5 m, Live load - class AA tracked vehicle, crash barrier 400 mm either side, kerb 400 mm x 200 mm, WC = 80 mm, M25 grade concrete and Fe500 steel. 20
6. Design a slab culvert for both BM and SF having a span of 6.5 m with the following data, road width 7.5 m, Live load - class AA wheeled vehicle, crash barrier 500 mm either side, kerb 400 mm x 200 mm, WC = 100 mm, M30 grade concrete and Fe500 steel. 20

UNIT - IV

7. It is proposed to design a box culvert for effective dimensions of 4.5 m x 4.5 m for a highway with geometric properties such as, road width 7.5 m, LL IRC class A loading vehicle, parapet 500 mm either side, kerb 200 mm, WC = 100 mm. The soil properties obtained from the lab report are, angle of repose $\phi = 30^\circ$, unit weight of soil 18 kN/m^3 . The concrete and steel grades to be provided are M40 and Fe415 for the box culvert. Design the box culvert for full flow condition. 20
8. IRC Class AA wheeled vehicle passes over a box culvert with effective dimensions of 3.5 m x 3.5m under no flow condition. The geometric properties of highway are as follows, road width 7.5 m, parapet 500 mm either side, kerb 200 mm, WC = 80mm, $\phi = 30^\circ$, unit weight of soil 18 kN/m^3 , design for an empty condition of box culvert using M30 concrete and Fe415 steel. 20

UNIT - V

9. Design an interior slab of a T beam bridge measuring 3 m x 5 m for IRC class AA Tracked vehicle with M-40 grade concrete and Fe-500 steel. 20
10. Design the main girder of a RCC T – Beam bridge central girder of flexure only using the following data for a road bridge :
 Clear width of road way = 7 m, effective span = 15 m
 Spacing of main girders = 3 m (3 Nos)
 Spacing of cross girders = 4 m (5 Nos) 20
 Width of main and cross girder = 300 mm
 Depth of main girder = Depth of cross girder
 Thickness of wearing cost = 100 mm
 Live load - IRC Class AA Tracked Vehicle
 M-40 grade concrete : Fe-500 grade steel

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