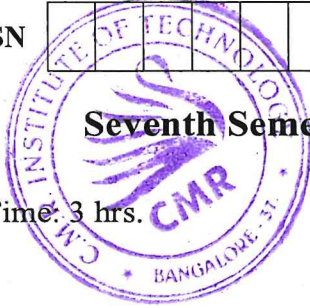


CBCS SCHEME

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15CV741



Seventh Semester B.E. Degree Examination, July/August 2021

Design of Bridges

Time: 3 hrs.

Max. Marks: 80

- Note:** 1. Answer any FIVE full questions.
2. Use of IRC-21-2000 and pigeauds curves are permitted.
3. Assume missing data, if any suitably.

- 1 a. With a neat sketch, explain term afflux. (06 Marks)
b. Derive an expression for economic span of bridge and list out the assumptions made economic span. (10 Marks)
- 2 a. Critically review the methods normally used for the estimation of the design discharge of a bridge site. (06 Marks)
b. Determine the waterway for a bridge across a stream with a flood discharge $225 \text{ m}^3/\text{s}$, velocity 1.5 m/s and width of flow at high flood level 60 m , if allowable velocity under the bridge is 1.80 m/sec . Take safe velocity is 90% of allowable velocity. (10 Marks)
- 3 Across a stream R.C.C slab culvert of single span 6 m clear length is proposed for NH for two-lane traffic following particulars are available.
Kerbs : 60 mm wide and 30 mm high.
Wearing course : 80 mm thick
Loading : IRC class AA (Tracked)
Materials : M20 concrete, Fe415 steel.
Design deck slab (check for shear is not necessary) (16 Marks)
- 4 Design a deck slab for the following particulars:
Clear span : 5.5 m
Width of footpath : 1 m on either side
Wearing coat : 100 mm
Loading : IRC class AA (Tracked)
Materials : M35 concrete and Fe415 steel.
Design the slab only for flexure. (16 Marks)
- 5 An R.C.C T-beam bridge is proposed across a stream of bed width 15 m and side slopes $1 : 1$. Following data are available.
Clear roadway : 7.5 m
Effective span : 16 m
Loading : IRC class AA (Tracked)
Materials : M20 concrete, Fe415 steel.
Spacing of three number of longitudinal beams : 2.5 m centre to centre
Spacing of five number of cross beams : 4 m centre to centre
Design:
(i) An intermediate panel of deck slab using pigeauds theory (shear need not to be checked)
(ii) An interior longitudinal beam using Kourbons theory. (16 Marks)

- 6 Design and detail the cross girder in a T-beam bridge with the following data:
 Spacing of longitudinal girders = $2.5 \text{ m}^{\text{C/C}}$;
 Spacing of cross girders = $4.0 \text{ m}^{\text{C/C}}$;
 Thickness of deck slab = 200 mm
 Thickness of wearing course = 80 mm
 Live load = Class AA (Tracked)
 Material = M₃₀ concrete and Fe415 steel. (16 Marks)
- 7 A box culvert has internal dimensions $3.00 \times 3.00 \text{ m}$ with the following data:
 Super imposed dead load = 16 kN/m^2 ;
 Live load including impact allowance = 52 kN/m^2 .
 Insitu density of soil = 18 kN/m^3 ;
 Angle of internal friction = 30 degrees ;
 Concrete grade = M30 ;
 Steel grade = Fe415
 Considering empty condition, design and detail the box culvert. (16 Marks)
- 8 Design a pipe culvert through a road embankment of height 6 m. 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 $5 \text{ m}^3/\text{sec}$. The safe velocity is 3 m/sec. Class AA tracked vehicle is to be considered as live load. Assume bell mouthed entry. Given $C_e = 1.5$, $C_s = 0.010$ and the unit weight of the soil is 20 kN/m^3 . Draw cross section of pipe showing reinforcement details. (16 Marks)
- 9 Verify the adequacy of the dimensions of the pier of a bridge with the following details :
 Top width of the pier : 1.6 m
 Height of the pier up to springing level : 10 m
 C/C of bearing on either side : 1 m
 Side batter : 1 in 12
 High flood level : 1 m below the bearing level.
 Span of the bridge : 16 m
 Loading on span : IRC class AA
 Road : Two-lane with 1 m wide footpath.
 Superstructure : Three longitudinal beams of 1.4 m depth with a deck slab of 200 mm depth.
 Rib width : 300 mm
 Material : Concrete M₁₅. (16 Marks)
- 10 a. With a neat sketch, explain rocker and roller bearing. (08 Marks)
 b. What are the requirements of expansion joint in a bridge? Explain them briefly. (08 Marks)
