

M.E DEGREE EXAMINATIONS: NOV/DEC 2012

Third Semester

STRUCTURAL ENGINEERING

SEE554: Design of Bridges

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

1. What is meant by economic span of bridges?
2. What are the factors to be considered while selecting the type of bridge?
3. What is the difference between a bridge and a culvert?
4. Draw the neat sketch of a T- beam bridge showing its various components
5. List out the methods available for distribution of live loads among longitudinal girders
6. What is meant by net effective width of dispersion?
7. What are the advantages of prestressed concrete bridges?
8. Draw the sketch showing different types of pretensioned prestressed concrete deck bridge.
9. What are the functions of bearing used in bridges?
10. What is meant by abutment?

PART B (5 x 16 = 80 Marks)

11. a) Write short notes on the following
- (i) Design forces for bridges. (8)
 - (ii) Classification of bridges (8)

(OR)

- b) Explain :
- (i) Longitudinal and centrifugal forces in road bridges (8)
 - (ii) Secondary stresses in members of bridge structures (8)

12. a) (i) Write short notes on Courbon's Theory (6)
- (ii) Obtain the values of short span and long span bending moments in case of an interior panel of a T-beam bridge having the following details:
- Dimensions of the panel : 3m x 3.5m
- Loading : IRC Class A
- Loading pattern : two wheels (each of 75 KN) adjusted symmetrically with respect to centre of the panel. (10)

(OR)

- b) Design the deck slab for the following particulars:
Clear distance between abutments : 6.7m
Road : National highway (two lane)
Footpath : 1m on either side
Wearing coat : 80mm (average)
Loading : IRC Class AA (tracked)
Materials : M30 concrete , Fe 415 grade steel

13. a) A reinforced box culvert of rectangular water way 3.75m wide by 2.5m deep is required for a road crossing. The box culvert has to support a superimposed load of 10kN/m^2 and a live load of 40kN/m^2 . The density of soil at site is 16kN/m^3 and the angle of repose of soil is 30° . Use M25 grade concrete and Fe415 grade HYSD bars, design the box culvert and sketch the reinforcements.

(OR)

- b) Design the deck slab of a double cantilever bridge to suit the following data:
Road width : 7.5m between kerbs
Footpaths : 1.8m on either side
Spacing of the Tee beams : 1.8m
Loading : IRC class AA tracked vehicle
Materials : M25 grade concrete, Fe415 grade HYSD bars.

14. a) Design a posttensioned concrete slab bridge deck for national highway crossing to suit the following data :
Total design shear : 150 KN
Maximum bending moment due to live load = 187 KN-m
Dead load bending moment = 190 KN-m
Clear span 10m
Width of bearing : 400mm
Clear width of roadway = 7.5m
Foot path on either side : 1m
Kerbs 600mm wide
Live load: IRC class AA tracked vehicles
Materials : M-40 grade concrete and 7mm diameter high-tensile wires with an ultimate tensile strength of 1500 N/mm^2 housed in cables with 12 wires and anchored by Freyssinet anchorages of 150 mm diameter.
Compressive strength at transfer = 35 N/mm^2
Loss ratio : 0.8.

(OR)

- b) Design the interior slab panel of a post tensioned prestressed concrete T-beam slab bridge-deck for a national highway crossing to suit the following data:
Data:
Effective span : 30m

Width of road = 7.5m
Kerbs = 600mm on each side
Foot path = 1.5m wide on each side
Thickness of wearing coat = 80mm
Live load : IRC class AA tracked vehicle
Spacing of cross girders = 5m
Assume necessary data and grade of materials.

15. a) Design an elastomeric unreinforced neoprene pad bearing to be placed beneath a girder of a bridge to suit the data given below:
- Span of the girder : 12m
 - Dimensions : 300mm x 1400mm
 - No of girders : 3
 - Slab thickness : 300mm
 - No. of lanes : 2
 - Live load : IRC class AA
 - Horizontal force : 100KN
 - Shear modulus of elastomer : 1 N/mm^2
 - Coefficient of friction : 0.35

(OR)

- b) Verify the stability of the abutment of a bridge with the following details :
- Top width : 1.5m
 - Height : 4m
 - Back water : 1 in 6
 - Front face of abutment is vertical
 - Material : Stone masonry
 - Unit weight of soil : 18 KN/m^3
 - Angle of repose : 30°
 - Superstructure : T-beam bridge of span 15m
 - Loading : IRC Class AA

Assume suitable dimensions for the components of the superstructure.
