1. How will you effective width of slab for a single concentrated load?
2. What are the forces acting on bridges?
3. How will you find reaction factor for guider using Courbon’s Theory?
4. Classify the types of bridges.
5. Explain the IRC Specifications for live load for IRC class AA loading?
6. Explain the loading standards of bridges
7. Explain the IRC Specifications for live load for IRC class A loading?
8. What are the span range for solid and Tee beam bridges?
9. Explain the IRC Specifications for live load for IRC class B loading?
10. Draw the loading standard for IRC class AA loading.
11. Explain the IRC Specifications for live load for IRC class 70R loading?
12. State the various loads and forces to be considered in the design of bridge members.
13. Explain the procedure for shear stress calculation in Solid slab bridges

PART – B

1. Explain IRC loading standards for Highway bridges
2. Explain how Impact factor is calculated for Highway bridges
3. Classify the bridges on the basis of materials of construction and forms of
4. Explain with neat sketches various types of Bridges bearings
5. Explain Curbon’s theory of determining load carried by longitudinal Girder
6. Explain with neat sketches different types of Highwaybridges Superstructure.

7. Design a deck slab bridge for the following data:

   Clear distance between abutments: 7m

   Road : NH (Two Lane)
   Foot path : 1m on either side
   Width of bearing : 400 mm
   Wearing coat : 80mm average
   Loading : IRC Class AA (Tracked)
   Materials : M30 concrete and Fe 415 Steel
8. Design a RCC Tee beam girder bridge for the following data:
   - Clear width of road way : 7.5 m
   - Span (Centre to centre of bearing) : 16 m
   - Live load : IRC class AA Tracked vehicle
   - Average thickness of wearing coat : 80 mm
   - No. of main girders : 4
   - Spacing of cross girders : 4m
   - Materials : M30 concrete and Fe 415 Steel

9. Design a solid slab bridge for the following data:
   - Clear distance between abutments: 9m
   - Road : NH (Two Lane)
   - Foot path : 1m on either side
   - Width of bearing : 400 mm
   - Wearing coat : 80mm average
   - Loading : IRC Class A (Tracked)
   - Materials : M30 concrete and Fe 415 Steel

10. Design a solid slab bridge for the following data:
    - Clear distance between abutments: 6m
    - Road : NH (Two Lane)
    - Foot path : 1m on either side
    - Width of bearing : 400 mm
    - Wearing coat : 80mm average
    - Loading : IRC 70R (wheeled)
    - Materials : M30 concrete and Fe 415 Steel

11. Design a RCC Tee beam girder bridge for the following data:
    - Clear width of road way : 8.5 m
    - Span (Centre to centre of bearing) : 20 m
    - Live load : IRC class A Tracked vehicle
    - Average thickness of wearing coat : 80 mm
    - No. of main girders : 4
    - Spacing of cross girders : 4m
    - Materials : M30 concrete and Fe 415 Steel

12. A reinforced concrete simply supported slab is required for the deck of a road bridge having the data given below:
    - Width of carriageway - 7.5 m
    - Width of kerb – 600 mm
    - Clear span – 5m
    - Width of bearing – 400 mm
    - Type of loading I.R.C. class AA or A whichever gives the worst effect.
Materials : M30 concrete and Fe 415 Steel

13. A reinforced concrete simply supported slab is required for the deck of a road bridge having the data given below:
Width of carriageway - 9.5 m
Width of kerb – 600 mm
Clear span – 5m
Width of bearing – 400 mm
Type of loading I.R.C Class A.

UNIT II DESIGN PRINCIPLES OF LONGSPAN RC BRIDGES

PART – A

1. What are the advantages of continuous bridges?
2. How will you find the radius and thickness of arch bridges?
3. What is called Articulation?
4. How will you find Bending Moment in slabs spanning in two directions.
5. How will you find reaction factor for guider using Courbon’s Theory?
6. How the concentrated load is calculated in Box culvert.
7. State the types of loading considered in box culverts.
8. Draw the neat sketch of balanced cantilever bridges.
9. In what situations balanced cantilever bridges are considered.

PART B

1. Write the step by step procedure of design of long span continuous bridge.
2. Sketch the typical cross section of Balanced Cantilever Bridge. What are the advantages of this construction?
3. Explain the neat procedure of design of Arch Bridges.
4. Explain in detail about the design of Box Culvert.
5. Write the step by step procedure of design of box girder bridges.
6. Explain in detail about the types of loading considered in Box culvert.
7. Explain the method of designing a slab deck in integrated with longitudinal and cross section girder using Pigeauds method to support live loads due to IRC Class AA tracked vehicle

UNIT III PRESTRESSED CONCRETE BRIDGES

PART-A

1. What are the span range for solid and Tee beam bridges?
2. What are the advantages of Prestressed concrete bridges?
3. Draw any two cross sections for the pre- tensioned concrete bridges?
4. Draw any two cross sections for the post-tensioned concrete bridges?
5. What is meant by maximum and minimum prestressing forces?
6. How will you find the eccentricity of cables in prestressed concrete bridges?
7. Define short term and long term deflection.
8. Explain the procedure for end block design.

**PART – B**

1. Design an Interior panel and Cantilever of R.C.C T-Beam deck slab bridge for Two lane highway with following data
   1) Span of the Bridge-25 m
   2) Foot path on either side-1.5 m wide
   3) Width of carriage way-7.5 m
   4) Spacing of longitudinal Girders-3.3 m (3 No’s)
   5) Spacing of cross Girders- 3.0 m
   6) Thickness of wearing coat-75 mm
   7) Loading-IRC Class AA Tracked vehicle
   8) Material-M30 and Fe 500
   9) Use m1=0.055 and m2=0.021
   10) Sketch the details of reinforcement

2. Using the design data of Question No (1) Design the intermediate Post tensioned Pre stressed girder using M 45 grade of concrete and high tension strands of 7 ply 15.2 mm dia. Having Ultimate strength 1800 N/mm2, use Fe 415 as supplementary reinforcement take loss ratio=0.85

3. A reinforced concrete simply supported slab is required for the deck of a road bridge having the following data:-
   (i) Clear span = 5.5 m.
   (ii) Width of carriage way = 7.5 m.
   (iii) Foot path on either side = 1m. Wide.
   (iv) Materials = M20 grade concrete and Fe 415 steel.
   (v) Type of loading IRC class AA. Design the deck slab. Show the reinforcement details.

4. Briefly discuss the economic span for bridges.

5. Design a box culvert having inside dimensions 4m × 4m for the following data.
   Dead load = 12 kN/m²
   Live load = 46 kN/m²
   Density of soil = 18 kN/m³
   Use M20 concrete and Fe 415 steel.

6. Explain the various components of a bridge.
7. Design a post tensioned prestressed concrete slab bridge deck to suit the following data:
   - Clear span: 12m
   - Width of bearing: 400 mm
   - Clear width of road way: 7.5m
   - Foot path: 1m on either side
   - Kerb: 600 mm wide
   - Thickness of wearing coat: 80 mm
   - Loading: IRC Class AA tracked vehicle
   - Compressive strength at Transfer: 35 N/mm²
   - Materials: M40 grade concrete and 7 mm diameter high tensile wires with an ultimate strength of 1500 N/mm². For supplementary reinforcement adopt Fe415 grade steel bars.

8. Design a post tensioned prestressed concrete T-beam and slab bridge deck to suit the following data:
   - Effective span: 24 m
   - Width of carriage way: 7.5 m
   - Kerbs 600 mm wide on either side of the road
   - Spacing of main girders: 2m
   - Spacing of cross girders: 4m
   - Loading is IRC Class AA tracked vehicle
   - Adopt M-45 Grade concrete and High tensile steel strands conforming to IS: 6006 and supplementary reinforcement comprising Fe 415 Grade HYSD bars.
   - Permissible stresses are as specified in IRC: 18-2000. Loss ratio = 0.85

9. Design a post tensioned prestressed concrete T-beam and slab bridge deck to suit the following data:
   - Effective span: 30 m
   - Width of carriage way: 7.5 m
   - Kerbs 600 mm wide on either side of the road
   - Spacing of main girders: 2m
   - Spacing of cross girders: 4m
   - Loading is IRC Class AA tracked vehicle
   - Adopt M-45 Grade concrete and High tensile steel strands conforming to IS: 6006 and supplementary reinforcement comprising Fe 415 Grade HYSD bars.
   - Permissible stresses are as specified in IRC: 18-2000. Loss ratio = 0.85

10. Design a post tensioned prestressed concrete slab bridge deck to suit the following data:
    - Clear span: 10m
    - Width of bearing: 400 mm
    - Clear width of road way: 7.5m
    - Foot path: 1m on either side
    - Kerb: 600 mm wide
    - Thickness of wearing coat: 80 mm
Loading : IRC Class A tracked vehicle
Compressive strength at Transfer : 35 N/mm²
Materials: M40 grade concrete and 7 mm diameter high tensile wires with an ultimate strength of 1500 N/mm². For supplementary reinforcement adopt Fe415 grade steel bars.

11. Design a post tensioned prestressed concrete T-beam and slab bridge deck to suit the following data:
   Effective span : 25 m
   Width of carriage way : 7.5 m
   Kerbs 600 mm wide on either side of the road
   Spacing of main girders : 2m
   Spacing of cross girders : 4m
   Loading is IRC Class A tracked vehicle
   Adopt M-45 Grade concrete and High tensile steel strands conforming to IS: 6006 and supplementary reinforcement comprising Fe 415 Grade HYSD bars.
   Permissible stresses are as specified in IRC: 18-2000. Loss ratio = 0.85

UNIT IV STEEL BRIDGES
   PART – A

1. What are the span range for solid and Tee beam bridges?
2. What are the advantages of plate girder bridges?
3. How will you find the economical depth of the plate Girder?
4. Explain the loads considered in Railway bridges.
5. Draw the neat sketches of truss bridges
6. What is meant by maximum and minimum prestressing forces?
7. What is a purpose of providing Lateral Bracings in plate girder bridges?

PART – B

1. Design a deck type welded plate girder bridge to suit the following data:
   Effective span of the girder – 30 m
   Dead load – 7.5 kN/m
   Equivalent total live load for bending moment calculation/track – 2727 kN
   Equivalent total live load for shear calculation/track – 2927 kN
2. Design a deck type welded plate girder bridge to suit the following data:
   Effective span of the girder – 30 m
   Dead load – 7.5 kN/m
3. Design a plate girder to carry a super imposed load of 180 kN/m on an effective span of 15 m.

4. Design a steel trussed bridges to suit the following data:
   
   Effective span – 30m
   
   Roadway -7.5m (two lane)
   
   Kerbs -600mm
   
   Loading : IRC class AA tracked vehicle
   
   Materials: M25 Grade concrete and Fe415 HYSD bars for deck slab. Rolled steel sections with an yield stress of 236 N/mm².

5. Design the longitudinal girder of a T-beam and slab bridge for the following data.
   Effective span 18m, Carriage way width 7.5m, Kerb 600 mm on either side. Provide three longitudinal beams and five cross beams. Loading IRC class AA tracked vehicle. Adopt M25 Fe415 bars. Also provide the reinforcement details. Use Courbon’s method for the calculation of reaction coefficients.


7. Design a deck type welded plate girder bridge to suit the following data:
   
   Effective span of the girder – 30 m
   
   Dead load – 7.5 kN/m
   
   Equivalent total live load for bending moment calculation/track – 2727 kN
   
   Equivalent total live load for shear calculation/track – 2927 kN

8. Design a deck type welded plate girder bridge to suit the following data:
   
   Effective span of the girder – 30 m
   
   Dead load – 7.5 kN/m

9. Design a plate girder to carry a super imposed load of 180 kN/m on an effective span of 15 m.

10. Design a steel trussed bridges to suit the following data:
    
    Effective span – 30m
    
    Roadway -7.5m (two lane)
    
    Kerbs -600mm
    
    Loading : IRC class AA tracked vehicle
    
    Materials : M25 Grade concrete and Fe415 HYSD bars for deck slab. Rolled steel sections with an yield stress of 236 N/mm².

11. Design a steel trussed bridges to suit the following data:
    
    Effective span – 33m
    
    Roadway -7.5m (two lane)
    
    Kerbs -600mm
    
    Loading : IRC class AA tracked vehicle
    
    Materials : M25 Grade concrete and Fe415 HYSD bars for deck slab. Rolled steel sections with an yield stress of 236 N/mm².
UNIT V BEARING AND SUBSTRUCTURES
PART – A

1. Under what situation shall engineers use jacking at one end only and from both ends in prestressing work?

2. What is “preset” during installation of bridge bearings?

3. In incremental launching method of bridge construction, what are the measures adopted to enhance sufficient resistance of the superstructure during the launching process?

4. In bridge widening projects, the method of stitching is normally employed for connecting existing deck to the new deck. What are the problems associated with this method in terms of shrinkage of concrete?

5. What are the advantages of assigning the central pier and the abutment as fixed piers?

6. In prestressing work, if more than one wire or strand is included in the same duct, why should all wires/strands be stressed at the same time?

7. In the design of elastomeric bearings, why are steel plates inserted inside the bearings?

8. What are the advantages of piers constructed monolithically with the bridge deck over usage of bearings?

9. What are the three major types of reinforcement used in prestressing?

10. Why is the span length ratio of end span/approach span to its neighboring inner spans usually about 0.75?

11. What is the consideration in selecting the orientation of wing walls in the design of bridge abutments?

12. What are the shortcomings of grillage analysis which is commonly used in structural analysis of bridges?

PART – B

1. What is the function of bearings in bridges?

2. Design an elastomeric bearing at the sliding end of a bridge for the following data.
   - Maximum Normal load 1000 kN, Minimum-normal load 200 kN, Transverse lateral load 40 kN, Longitudinal load 60 kN, Total longitudinal translation 15 mm, Rotation at support 0.0025 radians. Shear modulus of elastomeric bearing = 1.2 N/mm². Allowable
compressive stress for concrete = 7 N/mm². Allowable compressive stress for elastomer = 10 N/mm².

3. Design a reinforced concrete abutment using following data

   Dimensions: shown in Figure.

   Superstructure: T-beam two –Lane Bridge of effective span 16.1m

   Overall length: 17.26

   Loading: As for National Highway

   Back fill: Gravel with angle of repose $\phi = 35^\circ$

   Unit weight of back fill $w = 18$ kN/m²

Figure.

4. Explain the functions of expansion joints and contraction joints.

5. (a) Why is bridge inspection important?

   (b) Discuss in detail the inspection and maintenance of bridges.

6. Discuss in detail the major cause of bridge failures. Indicate how these failures could be avoided.