Hall Ticket Number:

CE413(CEEL16) (R20)

B.TECH. DEGREE EXAMINATION, DECEMBER-2024

Semester VII [Fourth Year] (Regular & Supplementary)

BRIDGE ENGINEERING

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:

(a)	Define a bridge.	CO1
(b)	List any two preliminary drawings.	CO1
(c)	Mention any two requirements of an ideal bridge.	CO1
(d)	Define linear waterway of a bridge.	CO1
(e)	What is the minimum grade of concrete to be used in the design of bridge structures for moderate exposure?	CO2
(f)	What do you mean by the effective width of slab?	CO2
(g)	In the absence of other criteria, what is the limiting value of deflection under live load for the design of bridges?	CO2
(h)	Differentiate between cut water and ease water.	CO3
(i)	What is the purpose of providing piers in bridges?	CO3
(j)	What are the sub-structures of a bridge?	CO3
(k)	What is the importance of bearings?	CO4
(l)	Differentiate between free bearing and fixed bearing.	CO4
(m)	What is the purpose of providing bed blocks in bridges?	CO4
(n)	Define rocker bearing.	CO4

UNIT – I

2. (a) What is meant by economical span? Derive the condition for an economical span, stating clearly the assumptions made in the derivation. (7M) CO1
   (b) List and discuss various classifications of bridges. (7M) CO1

(OR)

3. (a) List the preliminary data to be collected by an engineer conducting investigation for a major bridge. (7M) CO1
   (b) What are the factors influencing the choice of bridge type and its basic features? (7M) CO1

UNIT – II

4. Design the reinforced concrete deck and sketch the details of reinforcement in the longitudinal and cross section of the slab for a national highway crossing to suit the following data: Carriage way = Two lane (7.5 m wide); Foot paths = 0.8 m on either side; Clear span = 5 m; Wearing coat thickness = 75 mm; Width of bearing = 400 mm; Materials: M20 grade concrete and Fe415 HYSD bars; Loading = IRC class AA tracked vehicle. CO2

(OR)

5. Explain how Pigeaud's method and Courbon method are used for the design of slab and girder bridges. CO2

UNIT – III

6. The concrete abutment of a major bridge has the following dimensions: Width at top = 1.5 m; Width at foundation level = 3 m; Height of abutment = 4 m; The water face of the abutment is vertical and the earth side is sloping; Live loads acting at the centre of top are 25 kN; SBC of the soil = 200 kN/m^2; Density of soil at site = 16 kN/m^3; Angle of

internal friction = 30^0. Compute the stresses developed at the base and check for the stability of the abutment? CO3

(OR)

7. (a) Write a brief note on the materials of construction for the sub-structures. (6M) CO3
   (b) Describe the usual types of bridge piers with figures. (8M) CO3

UNIT – IV

8. (a) Explain elastomeric pad bearing with a neat sketch. (6M) CO4
   (b) Design a steel rocker bearing for transmitting a vertical reaction of 1000 kN and a horizontal reaction of 100 kN at the support of a bridge girder, assuming the following permissible stresses according to IRC:83-1999.
   Permissible compressive stress in concrete bed block = 4 N/mm^2
   Permissible bending stress in steel plate = 160 N/mm^2
   Permissible bearing stress in steel plate = 185 N/mm^2
   Permissible shear stress in steel = 105 N/mm^2.
   Sketch the typical details of the rocker bearing. (8M) CO4

(OR)

9. Design a well foundation for the pier of a major highway bridge to suit the following data: Internal diameter of well = 2.5 m; Type of soil strata = Clayee (K = 0.033); Depth of well = 25 m below bed level; Materials: M-20 grade concrete and Fe-415 grade HYSD bars. Sketch the reinforcement details. CO4

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Hall Ticket Number:

CE324(CEEL16) (R20)

B.TECH. DEGREE EXAMINATION, SEPTEMBER-2024

Semester VI [Third Year] (Supplementary)

BRIDGE ENGINEERING

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Write down the effect of buoyancy on piers. CO5
   (b) Write the check for total shear stress while designing elastomeric pad bearing. CO5
   (c) Calculate impact factor for IRC Class A loading, if span of bridge is 8 m. CO2
   (d) Write the use of Courbon's method. CO3
   (e) What is total load of IRC class A tracked vehicle? CO2
   (f) Identify the importance of bearings. CO1
   (g) Write the use of Pigeaud's Charts. CO1
   (h) What are the preliminary drawings to be prepared? CO1
   (i) What is meant by grip length? CO6
   (j) Express the impact load fraction in case of class A vehicle. CO2
   (k) Define shape factor. CO1
   (l) Classify the types of bridges used with navigational purpose? CO1
   (m) What is meant by linear water way? CO1
   (n) Explain any two conditions for locating piers. CO4

UNIT – I

2. Explain the components of a typical bridge CO2

(OR)

3. Explain various methods to estimate design discharge. CO1

UNIT – II

4. Design a deck slab bridge for IRC Class AA loading (Tracked vehicle only) for the following data: Clear span = 5.6 m, No. of lanes = Two, (Assume any missing data relevantly). CO3

(OR)

5. Design a RCC T-beam girder deck for a bridge using the following data: Clear width of road way = 7.5 m; Live load = IRC Class AA; Thickness of wearing coat = 80 mm; Effective span = 22 m; Width of kerbs = 600 mm; Number of main girders = 3; Spacing of cross girders = 4 m; Spacing of main girders= 3 m. Adopt M20 grade concrete and Fe415 steel. CO3

UNIT – III

6. Explain the loads that act on piers. CO4

(OR)

7. Design a pier for stability and check the stresses using the following data: The pier supports a simply supported T-beam of span 20m; Dead load from each span = 2200 kN; Live load from each span = 900 kN; Materials for pier = M20 grade concrete; Maximum mean velocity of current = 3.6 m/sec; Live load = IRC Class AA. CO4

UNIT – IV

8. Explain various checks performed while designing the elastomeric pad bearings. CO5

(OR)

9. Write down the design features of open well foundation. CO6

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Hall Ticket Number:

CE324(CEEL16) (R20)

B.TECH. DEGREE EXAMINATION, MAY-2024

Semester VI [Third Year] (Regular & Supplementary)

BRIDGE ENGINEERING

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:

(a)	What is meant by grip length?	CO6
(b)	What is total load of IRC class AA tracked vehicle?	CO2
(c)	Describe the importance of bearings.	CO1
(d)	Calculate water current load on piers?	CO1
(e)	What is a skew bridge?	CO3
(f)	Define scour.	CO4
(g)	What is meant by linear water way?	CO1
(h)	Write the advantages of elastomeric pad bearings.	CO5
(i)	Sketch the vertical clearance.	CO1
(j)	What are the types of bridges used with navigational purpose?	CO1
(k)	Express the thickness of bottom plug.	CO3
(l)	Write the use of Pigeaud's Charts.	CO3
(m)	Write any two conditions for locating piers.	CO4
(n)	Calculate impact factor for IRC Class A loading, if span of bridge is 8 m.	CO2

UNIT – I

2. Classify bridges with neat sketches. CO2

(OR)

3. What are the drawings to be prepared while planning a bridge? CO1

UNIT – II

4. Design a deck slab bridge for IRC Class AA loading (Tracked vehicle only) for the following data: Clear span = 5.4 m, No. of lanes = Two, (Assume any missing data relevantly) CO3

(OR)

5. Design a RCC T-beam girder deck for a bridge using the following data: Clear width of road way = 7.5 m, Live load = IRC Class AA, Thickness of wearing coat = 80 mm, Effective span = 20 m, Width of kerbs = 600 mm, Number of main girders = 3, Spacing of cross girders = 4 m, Spacing of main girders = 3 m. Adopt M25 grade concrete and Fe415 steel. CO3

UNIT – III

6. Design an abutment for the following data: Dead load for each span = 850 kN, Live load from each span = 800 kN, The height of the abutment is 5.2 m above the ground level, The soil is level with its top has unit weight of 18 kN/m^3 and an angle of repose is 40^0. The SBC of the soil is 240 kN/m^2. The coefficient of friction between soil and base is 0.5. CO4

(OR)

7. Design a pier for stability and check the stresses using the following data: The pier supports a simply supported T-beam of span 21.3 m. Dead load from each span = 2200 kN, Live load from each span = 950 kN, Materials for pier = M20 grade concrete, Maximum mean velocity of current = 3.6 m/sec, Live load = IRC Class AA. CO4

UNIT – IV

8. Write the salient design features of elastomeric pad bearings. CO5

(OR)

9. Design a well foundation for an abutment 10 m x 6.5 m base dimensions. The well is driven on sandy soil. Height of bearing above the maximum scour level is 30 m Permissible horizontal displacement at bearing level is 50 mm. Height of abutment is 8 m. Total vertical load including weight of the abutment and well is 22000 kN. Total lateral load at scour level is 400 kN. Submerged unit weight of soil is 9 kN/m^3. CO6

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(OR)

9. What are the types of foundations used in bridges and write design features of open well foundation? CO6

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Hall Ticket Number:

CE324(CEEL16) (R20)

B.TECH. DEGREE EXAMINATION, NOVEMBER-2023

Semester VI [Third Year] (Supplementary)

BRIDGE ENGINEERING

Time: Three hours Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Why is bridge engineering important? CO1
   (b) What are the basic parts of a bridge? CO1
   (c) Give mathematical expression for coefficient of dynamic augment (CDA). CO2
   (d) What is impact factor for IRC class A loading? CO2
   (e) Explain the gauges which are used in railways. CO2
   (f) What are the various methods that are considered in analysis of bridge? CO3
   (g) Briefly specify the advantages and limitations of using Pigeauds curves. CO3
   (h) Under what situations you would prefer to adopt reinforced concrete Tee-beam and slab bridge decks for highway crossings. CO3
   (i) How moment coefficients are calculated in Pigeauds method? CO3
   (j) Mention the types of wing walls that are adopted in bridge. CO4
   (k) List out the various forces and environmental factors acting on pier. CO4
   (l) What are the main functions of bearings used in bridge structures? CO5
   (m) Mention the different types of expansion bearings. CO5
   (n) Under what situations you would adopt shallow and deep foundations. CO6

UNIT – I

2. (a) Indicate the extent of survey to be undertaken and the relevant data to be collected for fixing site and waterway of the bridge. (7M) CO1
   (b) Explain the importance of subsoil exploration in the design of bridges and list the data to be obtained such an exploration. (7M) CO1

(OR)

3. (a) Mention the importance of investigation of site in bridge design considering sustainable development. (7M) CO1
   (b) Describe the IRC standard loadings and mention the conditions under which each should be used. (7M) CO2

UNIT – II

4. Design simply supported RCC deck slab of a road bridge for IRC class AA tracked wheel load for the following data. CO2
   Clear span = 8.0 m
   Clear road width = 6.6 m
   Thickness of pier = 1.0 m
   Kerb width = 225 mm
   Thickness of wear coat = 80 mm
   Materials: M20 concrete and Fe415 steel.

(OR)

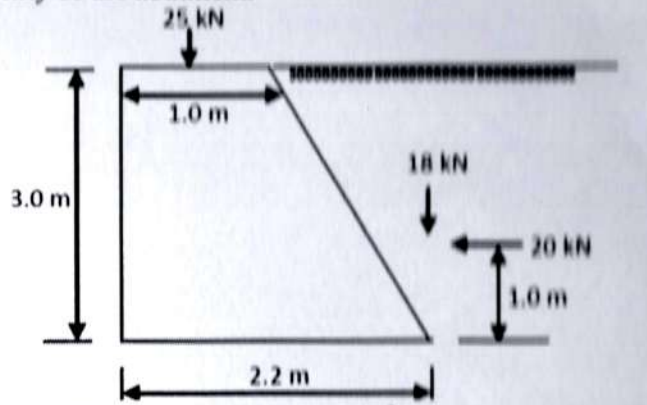
5. Use Courbon's method. Design main girder of RCC T-beam bridge with the following data:
   Clear width of road way = 7.5 m
   Width of Kerbs = 750 mm
   Effective span = 22 m
   Live load = IRC class AA tracked vehicle.
   Thickness of wearing coat = 80 mm
   Number of main girders = 4
   M20 concrete and Fe415 steel
   Spacing of main girders = 2.5 m. CO3

UNIT – III

6. (a) What are the various types of piers with neat diagrams? (7M) CO4
   (b) Specify the design principles of pier as per code. (7M) CO4

(OR)

7. Compute the stresses developed at the base and check the stability of the abutment. CO4



Note: (i) SBC of soil is = 140 kN/m^3
(ii) Coefficient of friction = 0.5
(iii) Density of masonry = 24 kN/m^3

UNIT – IV

8. Design an elastomeric pad bearing to support a tee beam girder of a major bridge using the fallowing data:
   Maximum dead load reaction/bearing = 340 kN
   Maximum load reaction/ bearing = 550 kN
   Longitudinal force due to friction for each bearing = 35 kN
   Effective span of the girder = 23 m
   Estimated rotation at bearing of the girder due to dead and live loads = 0.003 radians. M20 grade concrete is used.
   Total estimated shear strain due to creep, shrinkage and temperature = 5 x 10^{-4} units.
   Draw the details of the bearing. CO5

Hall Ticket Number:

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CE324(CEEL16) (R20)

B.TECH. DEGREE EXAMINATION, JULY-2023

Semester VI [Third Year] (Regular)

BRIDGE ENGINEERING

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) List out the components of bridges. CO1
   (b) Name the different types of IRC loads. CO2
   (c) Define the term impact factor. CO2
   (d) How much minimum straight length of approaches required for either side of the bridge as per IRC specifications? CO2
   (e) Define scour depth. CO2
   (f) Calculate the dispersion width at top of the slab for IRC class AA loading, if the wearing coat is 80 mm. CO3
   (g) What is the effective width for single concentrated load? CO3
   (h) Calculate the dispersion length for IRC class AA loading, if the deck slab over all depth is 360 mm and wearing coat is 80 mm. CO3
   (i) What is the function of piers and abutments? CO4
   (j) List out different types of pier used in highway bridge structures. CO4
   (k) What is the clearance height of a bridge? CO4
   (l) What is the necessity of using bearings in bridge? CO5
   (m) Why would you consider the fixed and expansion bearings in bridge? CO5
   (n) List out the types of foundation to be considered in bridge design. CO6

UNIT – I

2. (a) Discuss about general design requirements of bridges. (7M) CO1
   (b) Mention the importance of investigation of site in bridge design. (7M) CO1

(OR)

3. What are the different types of live loads considered in the design of RCC bridges? Explain them. CO1

UNIT – II

4. Design a reinforced concrete slab bridge using the following data: CO2
   Clear width of road way = 7.8 m
   Clear span = 11 m
   Live load = IRC class AA loading.
   Use M-25 grade concrete & Fe 415 steel.

(OR)

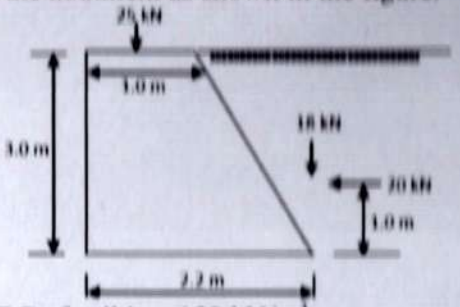
5. Design the interior slab panel of a reinforced concrete T-beam bridge using the following data: CO2
   Clear width of road way = 8.5 m
   Effective span = 20 m
   Use M20 grade concrete and Fe415 steel.

UNIT – III

6. What are the different types of piers used for bridges and explain them with neat sketches? CO4

(OR)

7. Compute the stresses developed at the base and check the stability of the abutment as shown in the figure. CO4



Note: (i) SBC of soil is = 130 kN/m^2
(ii) Coefficient of friction = 0.45
(iii) Density of masonry = 24 kN/m^3

UNIT – IV

8. Design a steel rocker bearing for transmitting a vertical reaction of 1100 kN and a horizontal reaction of 150 kN at the support of a bridge girder, assuming the following permissible stresses according to IRC: CO5
   Permissible compressive stress in concrete bed block = 5 N/mm^2
   Permissible bending stress in steel plate = 165 N/mm^2
   Permissible bearing stress in steel plate = 190 N/mm^2
   Permissible shear stress in steel = 110 N/mm^2
   Sketch the typical details of the rocker bearing.

(OR)

9. What are the types of foundations used in bridges and write design features of pile foundation? CO6

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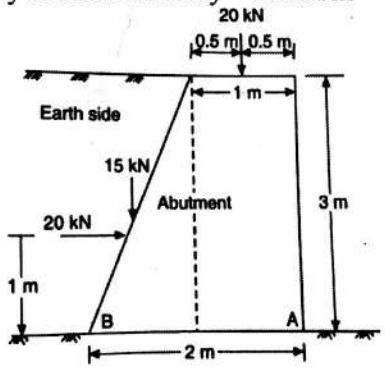
Coefficient of friction between masonry and soil = 0.5

Density of stone masonry = 25 kN/m^3



Calculate stresses developed at the base and check for the stability of the abutment. (8M) CO4

(b) Write general feature of abutments and draw structural elements of abutments. (6M) CO4

UNIT – IV

8. (a) Design an elastomeric pad bearing to support a Tee beam girder of a bridge using the following data: (8M) CO5
Maximum dead load reaction per bearing = 300 kN
Maximum live load reaction per bearing = 700 kN
Longitudinal force due to friction per bearing = 45 kN
Effective span of the girder = 16 m
Estimated rotation of the girder due to dead and live load = 0.002 radians
Concrete for Tee beam and bed rock = M-20 grade
Total estimated share strain due to creep , shrinkage and temperature = 6×10^{-4}

(b) Explain any three expansion type bearings with neat sketch. (6M) CO5

(OR)

9. What are the types of foundation used in the bridges and explain components of well foundation with neat sketch. CO6

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Hall Ticket Number:

CE314(CEEL16) (R20)

B.TECH. DEGREE EXAMINATION, JUNE-2023

Semester V [Third Year] (Supplementary)

BRIDGE ENGINEERING

Time: Three hours Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
(a) Define Bridge. CO1
(b) Define Economic Span. CO1
(c) Define vertical clearance. CO2
(d) What are the provisions of Pigeaud's method? CO3
(e) Write use of Courbon's method use. CO3
(f) What are the material used for piers and abutments? CO4
(g) What are different forces on acting on piers? CO4
(h) What are the forces on different types of abutments? CO4
(i) Explain Elastomeric bearing. CO5
(j) What are the types of bearing? CO5
(k) What are the forces acting on bearing? CO5
(l) What are the types of well foundation? CO6
(m) Define Top plug and Bottom Plug. CO6
(n) What are the components of well foundation? CO6

UNIT – I

2. (a) Explain classification and components of bridges with neat sketches. (7M) CO1

(b) Explain various methods of determination of design flood discharge. (7M) CO1

(OR)

3. What are the different types of design loads for bridges and explain in detail. CO2

UNIT – II

4. Design a reinforced concrete slab culvert for National Highway crossing to suit the following data:
   Carriage way - Two Lane (7.5 m wide)
   Foot Path - 1 m on either side
   Clear span - 6 m
   Wearing Coat = 80 mm
   Width of Bearing = 400 mm
   Material : M-25 Grade concrete and Fe 415 Grade HYDS Bars
   Loading -IRC Class AA tracked vehicle
   Design the reinforced concrete slab deck and sketch the details of reinforcement in the longitudinal and cross section of RC slab. The design should conform to the specification of IRC: 6-2014 and IRC : 112-2011 CO3

(OR)

5. Design a RCC T-beam girder bridge using the following data:
   Clear width of road way = 7.5 m
   Live load = IRC Class AA tracked vehicle
   Thickness of wearing coat = 80 mm
   Effective span = 16 m
   Width of kerbs = 600 mm
   Number of main girders = 3
   Spacing of cross girder = 4 m
   Spacing of main girders = 2.5 m
   Adopt M25 grade concrete and Fe415 HYDS reinforcement. CO3

UNIT – III

6. (a) A pier shown in figure supports the deck forming a major highway. The various forces acting on the pier are listed below:
   Dead load from each span = 2000 kN
   Reaction due to live load on one span = 1000kN
   Breaking forces = 140 kN
   Wind pressure on pier = 2.4 kN/m^2
   Material of pier = 1:3:6 cement concrete
   Density of concrete = 24 kN/m^3
   Calculate stress developed at the base of the pier due to the following cases:

   (i) Dead load amd self weight of pier
   (ii) Effect of buoyancy
   (iii) Due to eccentricity of live load
   (iv) Due to longitudinal breaking force
   (v) Due to Wind pressure
   Estimate the maximum and minimum stresses developed at the base of pier due to the critical combination of various loads (8M) CO4

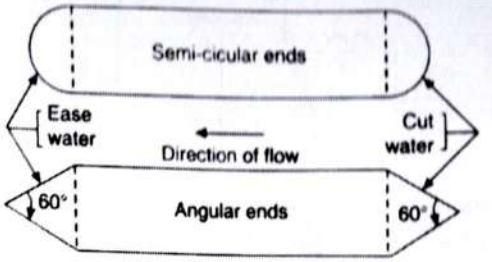


Figure. a - Pier with cut and Ease water.

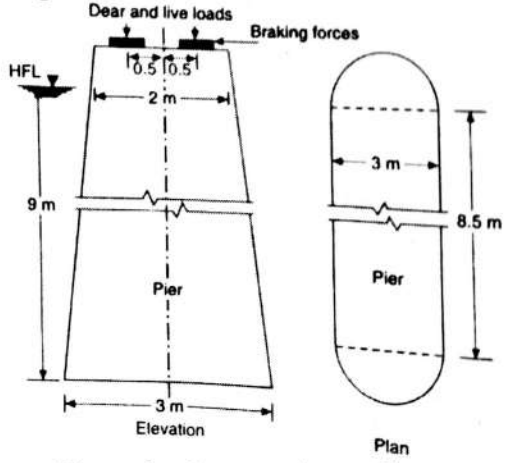


Figure. b - Forces acting on Pier

   (b) Explain any three types of abutments with neat sketch. (6M) CO4

(OR)

7. (a) A figure shows the section of stone masonry abutment used for highway bridge together with the forces acting per length of abutment
   Safe bearing capacity of soil = 150kN/m^2

Hall Ticket Number:

file-2

CE314(CEEL16) (R20)

B.TECH. DEGREE EXAMINATION, MARCH-2023

Semester V [Third Year] (Regular)

BRIDGE ENGINEERING

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) List out the components of bridges. CO1
   (b) Give mathematical expression for coefficient of dynamic augment (CDA). CO2
   (c) What is impact factor for IRC class A loading? CO2
   (d) Explain the gauges which are used in railways. CO2
   (e) Define scour depth. CO2
   (f) Calculate the dispersion width at top of the slab for IRC class AA loading, if the wearing coat is 80 mm. CO3
   (g) What are the various methods that are considered in analysis of bridge? CO3
   (h) Briefly specify the advantages and limitations of using Pigeauds curves. CO3
   (i) What are the main functions of bearings used in bridge structures? CO5
   (j) Mention the different types of expansion bearings. CO5
   (k) What is the function of piers and abutments? CO4
   (l) List out different types of pier used in Highway bridge structures. CO4
   (m) What is the clearance height of a bridge? CO4
   (n) List out the types of foundation to be considered in bridge design. CO6

UNIT – I

2. (a) Indicate the extent of survey to be undertaken and the relevant data to be collected for fixing site and waterway of the bridge. (7M) CO1

(b) Explain the importance of subsoil exploration in the design of bridges and list the data to be obtained such an exploration. (7M) CO1

(OR)

3. What are the different types of live loads considered in the design of RCC bridges? Explain them. CO2

UNIT – II

4. Design a reinforced concrete slab bridge using the following data: CO3
Clear width of road way =7.8 m
Clear span = 11 m
Live load = IRC class AA loading.
Use M-25 grade concrete & Fe 415 steel.

(OR)

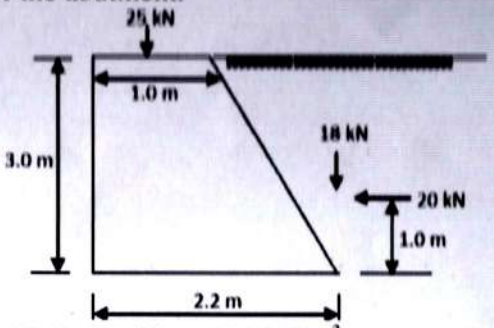
5. Using Courbon's method, design main girder of RCC T-beam bridge with the following data: CO3
Clear width of road way = 7.5 m
Width of Kerbs = 750 mm
Effective span = 22 m
Live load = IRC class AA tracked vehicle.
Thickness of wearing coat = 80 mm
Number of main girders = 4
M20concrete and Fe415 steel
Spacing of main girders = 2.5 m.

UNIT – III

6. What are the different types of piers used for bridges and explain them with neat sketches? CO4

(OR)

7. Compute the stresses developed at the base and check the stability of the abutment. CO4



Note: (i) SBC of soil is = 130 kN/m^3
(ii) Coefficient of friction = 0.45
(iii) Density of masonry = 24 kN/m^3

UNIT – IV

8. Design a steel rocker bearing for transmitting a vertical reaction of 1100 kN and a horizontal reaction of 150 kN at the support of a bridge girder, assuming the following permissible stresses according to IRC: CO5
Permissible compressive stress in concrete bed block = 5 N/mm^2
Permissible bending stress in steel plate = 165 N/mm^2
Permissible bearing stress in steel plate = 190 N/mm^2
Permissible shear stress in steel = 110 N/mm^2
Sketch the typical details of the rocker bearing.

(OR)

9. What are the types of foundations used in bridges and write design features of open well foundation? CO6

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