

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh semester B.Tech examinations (S), September 2020

Course Code: CE463**Course Name: BRIDGE ENGINEERING**

Max. Marks: 100

Duration: 3 Hours

*(Use of IRC codes 5,6,78,83&112 , IS 456 and SP 16 are permitted in the examination hall)***PART A***Answer any two full questions, each carries 15 marks.*

- | | Marks |
|---|-------|
| 1 a) Based on structural action, explain the basic forms of bridges. | (8) |
| b) With a neat sketch describe the components of a road bridge. | (7) |
| 2 a) How the hydraulic parameters influence in the various phases of bridge design? | (8) |
| b) Why do we determine the accurate soil profile at the proposed bridge site? How the subsoil investigation is carried out? | (7) |
| 3 a) What is 'width of carriageway' and 'clearances' in a road bridge? Explain with a neat sketch. | (8) |
| b) Name the types of bridges for which the vehicle collision loads are considered for the design. Give the specifications given in IRC codes for the design of these bridges. | (7) |

PART B*Answer any two full questions, each carries 15 marks.*

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| 4 a) Describe the design principles of box culverts by incorporating the various loading combinations. | (8) |
| b) A bridge deck consists of a reinforced concrete slab continuous over longitudinal beams spaced 2.5 m apart and cross beams spaced at 5 m centres. Live load is IRC 70R tracked vehicle. The thickness of the wearing coat is 90 mm. Calculate the maximum bending moment in both directions of the deck slab due to live load using Pigeaud's curves. | (7) |
| 5 Design a solid slab bridge with the following data: | (15) |
| i) Clear span = 7 m, ii) Carriageway width = 7.5 m, iii) Live load = IRC Class AA Tracked vehicle, iv) Mix M25 concrete and steel Fe 415, v) Average thickness of wearing coat = 70 mm. vi) Kerbs provided on both sides of the bridge is having a width of 600 mm. | |
| Provide the details of reinforcements with the help of a neat sketch. | |
| 6 Design the outer longitudinal girder of a slab and beam bridge with the data given below. | (15) |
| i. Effective span of the bridge = 20 m | |
| ii. Total width of the bridge including foot path = 10 m | |
| iii. Foot path of 1.5 m width are provided on both sides of the bridge. | |

- iv. Thickness of wearing coat = 80 mm.
- v. Live load = IRC 70R Tracked vehicle.

Mix M25 and steel Fe 415 are used for the construction of the bridge. Cross girders are provided at both ends only. Checks are not required.

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) Explain the various steps involved in the design of prestressed concrete bridges? (10)
- b) Discuss the benefits resulting from the use of prestressed concrete in bridges. (5)
- c) What are the various forces to be considered for the design of abutment? Write the different types of wing wall near to the abutment. (5)
- 8 a) Design a suitable cement concrete pier to support the superstructure of a highway bridge. The various forces acting on the pier are listed below. (15)
- Dead loads from each span = 2000 kN
 Reaction due to live load on one span = 1200 kN
 Wind pressure on pier = 2.5 kN/m^2 , Breaking force = 130 kN.
 Dimensions of pier: Height of pier = 9.0 m, Width at top = 2.0 m, Width at bottom = 3.0 m, Length of pier = 8.5 m.
 Maximum water level = 8 m above base of pier.
 Girder bearings are located at 500 mm from centre of pier on either side.
 Calculate the pressure developed at the base of the pier in the following cases:
- i) Dead load and self-weight of pier
 - ii) Due to buoyancy
 - iii) Due to eccentricity of live load
 - iv) Due to longitudinal breaking force
 - v) Due to wind load
- Check the adequacy of the dimensions provided by computing the stresses.
- b) On what situations group of piles are preferred as foundations for bridges and how the load is transferred from piers to group of piles? (5)
- 9 a) Design an elastomeric pad bearing for a two lane girder and slab bridge with the following data: (15)
- i) Clear span of the bridge = 18 m
 - ii) Maximum dead load reaction per bearing = 300 kN
 - iii) Maximum live load reaction per bearing = 550 kN
 - iv) Longitudinal force per bearing = 35 kN
 - v) Vertical reaction induced by longitudinal forces per bearing = 15 kN
 - vi) Rotation at bearing of superstructure due to dead and live load = 0.0025 radian
- M25 mix is used for the construction of bridge. Assume suitably the missing data, if any.
- b) With the help of a neat sketch describe the components of well foundations. (5)
