Ref. No. : Ex/CE/5/T/506A/2025

BACHELOR OF ENGINEERING (CIVIL ENGINEERING) FIFTH YEAR, SECOND SEMESTER EXAMINATION – 2025

BRIDGE ENGINEERING

Time : three hours | Full Marks – 100

(Part – I) | (50 marks for PART – I)

Use separate Answer Script for each part

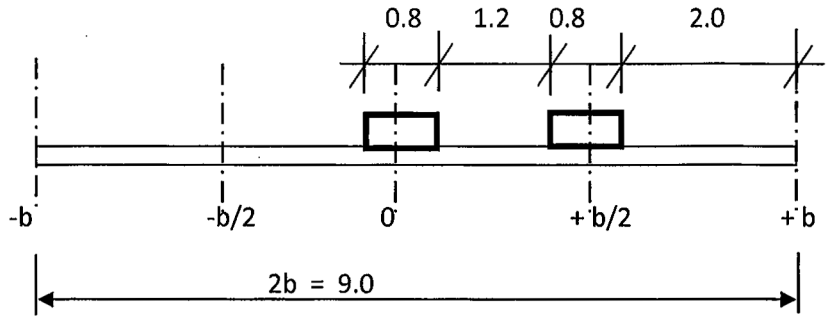
(Assume any data,if required, reasonably)

Answer any **four** from 1 to 6 and any **two** from 7 to 9. Question 10 is compulsory.

1. Name the different types of bridges depending on variation in design principle. Give an example of "Arch Bridge". ---4
2. Compare the advantages & disadvantages between Precast and cast-in-situ RCC Girder Bridge. ---4
3. Name the different types of Bearings used in bridges and indicate on their nature of transferring forces. ---4
4. Discuss on design criteria of a bridge superstructure with steel girders & concrete deck without shear connector and with shear connector. --4
5. What is the basic principle of Pre-stress concrete? Name the different 'Loss in Pre-stress' in pre-stress bridge girder. Mention the time dependent losses? ---4
6. Name two types of Expansion Joint used in bridge deck. What are the basic difference among a) a cantilever beam, b) a Bracket & c) Articulation. ---4

7. Calculate design moments of a interior slab of panel of size 3.2 m x 4.0 m for a wheel load of 12 T of contact area 300 mm (shorter) x 600 mm (longer) using Pigeaud's method. --- 10
   (Write the procedure of finding coefficients m1 & m2 and use m1 & m2 = 0.2 & 0.15 respectively)
   i) Thk. of wearing course = 75 mm.
   ii) Thk. of slab =250 mm.
   iii) Use poisson's ratio = 0.2

8. Prepare the table of "Equivalent Loads at Standard Reference Stations" as per simplified Morice & Little method" , for the deck & loading system as shown below – Consider the loading for **Tracked Vehicle.**(all dimensions are in Metre) ------ 10



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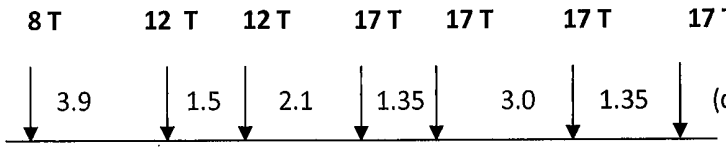
9. Calculate the effective width of deck slab acting as flange of the long girders as per following data :-
   a) Overall width of deck =12.5 m, b) Span of Long Girders (c/c of bearings) = 15 m ---- 10
   c) no. of Long Girders = 3, d) Spacing between Long Girders =4.2 m
   e) Thk. Of Web of Long Girders = 300 mm, f) Deck is symmetrically placed with the girder system

10. Calculate 'Design BM' due to vehicular load only as given below for Exterior Long Girder of a concrete bridge having the following parameters: - Use Courbon's method. ---- 14

   a) Centre to centre of bearings (span)in long. direction = 35 m.
   b) Overall width of deck slab = 11 m, c) Thickness of crash barrier = 500 mm
   a) Nos. of Long girder = 4, e) Spacing between long girders = 2.8 m
   f) Min. clear distance of any wheel from crash barrier= 1.2 m & Distance of wheel centre within any axle= 1.9 m

g) Vehicular Load



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BACHELOR OF ENGINEERING (CIVIL ENGINEERING) 5th YEAR 2nd SEM. EXAMINATION 2025
BRIDGE ENGINEERING

Time: 1 hour 30 minutes **Full Marks 50**

Use a separate Answer-Script for each part
Q1. is compulsory and answer any two from Q2. To Q4.
Part-II
(Assume any data, if required, reasonably, Use of Code is not allowed)

1. As a professional engineer and being representative of a Govt. department, it is usual that the project proposal is to be prepared before it is sent to the Competent Authority for their approval. One such Bridge Project connecting two unbridged ends across a river needs to be bridged. As a part of preparation of the Project Proposal, write down the followings:
   a) Different Stages (mainly three stages) that are to be taken care of as a project initiator.
   b) Activities under each of the above stages (only main heading).
   c) Write down the content (activities) of the Detailed Project Report (main heading only).
   d) What are the different bridge elements which are required to be designed as a part of detailed design.

   (5+5+5+5=20 marks)

2. A flyover is to be constructed to decongest a 4-legged road intersection. The superstructure is made up of simply supported RCC T beams with cast-in-situ deck slab on top of these girders. The superstructure is resting on elastomeric bearings which are, in turn, resting on RCC pedestals. The superstructure is supported by RCC pier and pier cap resting on a Pile foundation.
   The piles are arranged in a 3x3 matrix with 1.2m diameter pile spaced @ 3xdiameter of the pile in both the directions. The size of the pile cap is 8.7mx8.7m. The thickness of the pile cap is 1.5 times the diameter of the pile. Top of the pile cap is 1.0m below the existing ground level having unit weight of 2.0 t/m3. Other relevant dimensions and parameters of the bridge shall be as under:
   a) Pier size = 3m x 3m of square cross section. Pier is resting on the pile cap eccentrically w.r.t. the centre lines of the pile cap by 1.0m in both directions (both longitudinal and transverse).
   b) Height of the pier = 4.0m + penultimate digit of your roll no.
   c) Dimension of the rectangular pier cap is 8.0m(T) x 2.0m(L) x 1.0m(D). T - Transverse across traffic, L - Longitudinal along traffic and D is depth vertical.1.5m is the depth.
   d) Height of the bearing + pedestal = 0.5m.
   e) Depth of the superstructure = 2.0m
   f) Dead Load + SIDL of superstructure = 1500 tons.
   g) Braking force along longitudinal direction = 50.0 tons acting at a height of 1.2m above the Finished Road Level.
   h) Centrifugal force = 10.0tons acting at a height of 1.2m above finished road level.
   i) Unit weight of RCC = 2.5t/m^3.
   j) Unit weight of the soil = 2.0t/m^3.

   Derive the maximum and minimum pile reaction.

   (15 marks)

3. What should be the Safe Bearing Capacity (SBC) of the soil in which a Circular well foundation is to be constructed to sustain/support the following loads:
   a) Depth of well = 30m.
   b) Dia of well =10.0m.

c) Depth below max scour = 10.0m.
d) Horizontal force of 150.0t acts at 50m above the base of well under seismic load combination.
e) Weight of superstructure = 1500.0 tons.
f) Weight of pier = 250.0 tons.
g) Weight of well = 1000.0 tons.
h) Engineering properties of soil: C=0.25kg/cm^3; φ=32 degrees; ϒ(dry)=2.0t/m3.
i) FOS (Factor of Safety) is 1.6 for seismic case and 2.0 for non-seismic case.
j) Do not consider buoyancy effect.

(15 marks)

4. Calculate unfactored vertical load (V), longitudinal moment (ML) & transverse moment (MT) at the base of foundation (pile cap) using the parameters defined in Q2. Also calculate the maximum and minimum base pressure at the pile cap bottom assuming that the pile cap is basically a open foundation.
Hints: Base Pressure = $P/A \pm M_L/Z_L \pm M_T/Z_T$.
$Z_L = BxL^2/6$ and $Z_T = B^2 \times L/6$ wherein B is the transverse dimension of the pile cap (foundation) and L is the longitudinal dimension of the pile cap (foundation).

(15 marks)