Ref No. – Ex/CE/5/T/506A/2019

BACHELOR OF ENGINEERING (CIVIL ENGINEERING) 5th YEAR 2nd SEM. EXAMINATION 2019

BRIDGE ENGINEERING

Full Marks 100

Time: Three hours (Part I: 50 marks)

Use a separate Answer-Script for each part

Part-I

Question no. 2, 3 and 6 are compulsory

Answer any two from Question no. 1, 4 and 5

(Assume any data, if required, reasonably, Use of Code is not allowed)

1. Consider a Pile foundation with 12 nos. of piles as shown in the figure-1a & 1b for a four lane bridge. Design forces at pile cap top are Vertical load (P) = 1800 T; Moment in longitudinal direction (ML) = 350 Tm and Moment in Transverse direction (MT) = 200 Tm. Derive the maximum and minimum pile reaction for the above mentioned load case. Also specify the pile ID subjected to maximum and minimum loads. Consider a shift of 150mm in pier position along longitudinal direction.

(15 marks)

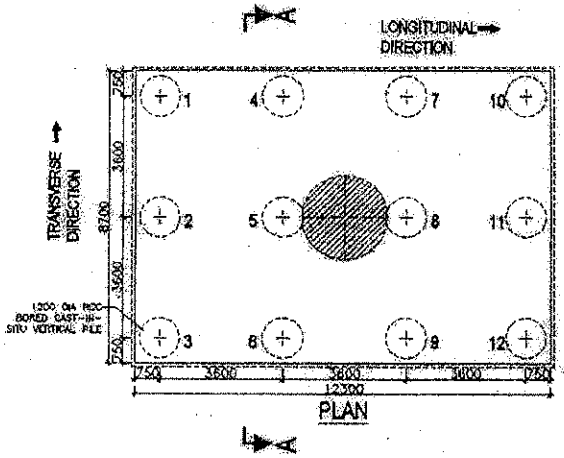

Figure -1a

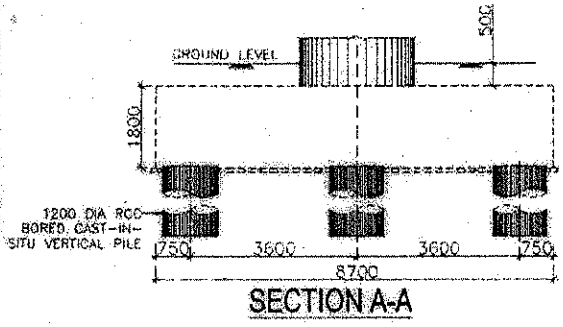

Figure -1b

2. Government has decided to construct a flyover in Kolkata near Jadavpur locality to provide signal free movement. Designer has proposed 3-span continuous superstructure for the flyover. A typical arrangement of the superstructure is shown in the figure 2a & 2b. Propose a suitable bearing configuration (Fix, Free, Longitudinally guided and Transversely guided) for the superstructure in order to avoid development of internal stresses due to creep, shrinkage and thermal loads.

(5 marks)

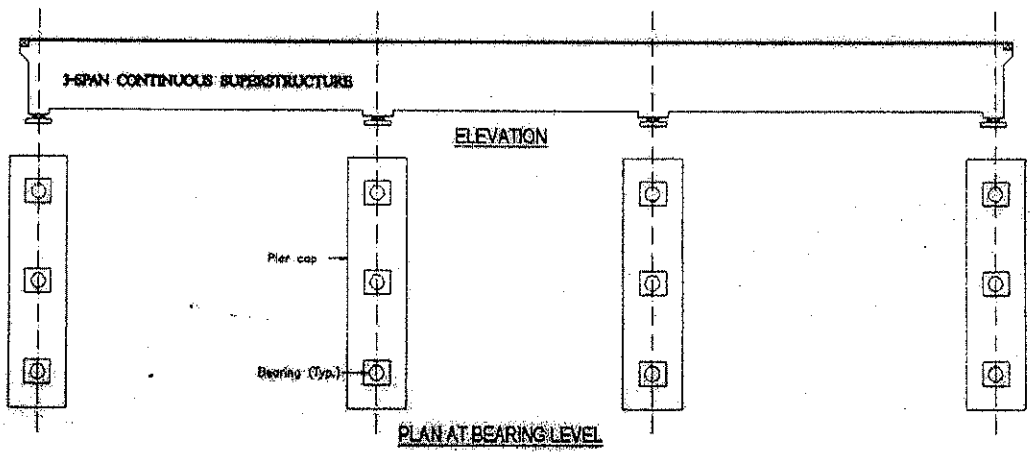

Figure -2a

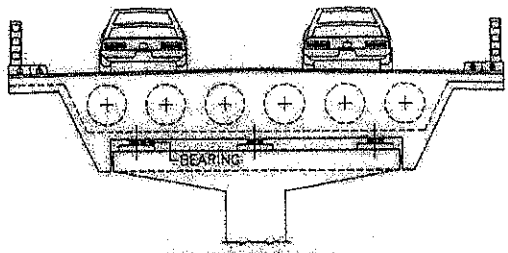

Figure -2b

3. Write a short note on function of bearings in bridge structures. Explain the types of bearings and their applicability depending upon span/superstructure type.

(5 marks)

4. Determine the following parameters for the bed profile shown in the figure 3.
   i. Mean scour depth;
   ii. Design scour depth;
   iii. Proposed founding level of the structure.

   (S=1:500, Rugosity co-efficient=0.035, Sandy soil, mean particle size 0.725mm, Silt factor=1.5)

(15 marks)

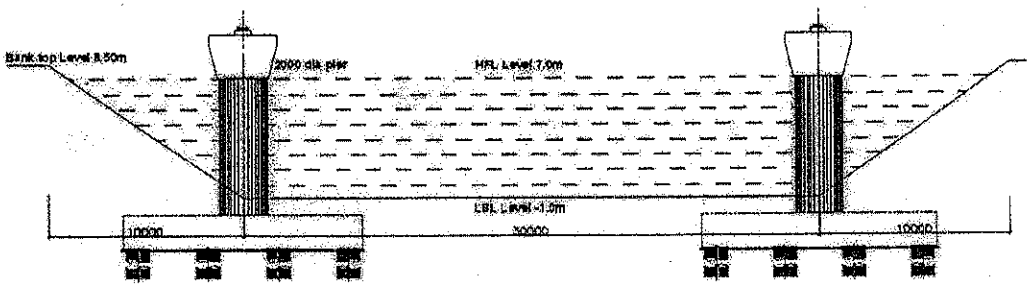

Figure -3

5. Calculate the foundation pressures at the base of the circular well with the following particulars:
   a) Depth of well = 32m;
   b) Dia of well =7.0m;
   c) Depth below max scour = 23.0m;
   d) Q = 150 t acting at 40m above the base of well under seismic condition;
   e) W1 – Weight of Superstructure = 1000 t;
   f) W2 = Weight of Pier = 200 t;
   g) W3 = Weight of well = 1100 t;
   h) Soil around the well is mixed type having C=0.2kg/cm^2; φ=30 degrees; Y(dry)=1800kg/m3.
   i) Permissible bearing capacity of soil is 50 tonnes/m^2 and no tension. FOS is 1.6 for seismic case and 2.0 for non-seismic case.

(do not consider buoyancy effect)

(15 marks)

6. Discuss about the various loads and forces acting on following elements of a bridge
   (i) Abutment
   (ii) Pier

(10 marks)

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BACHELOR OF ENGINEERING (CIVIL ENGINEERING) FIFTH YEAR, SECONDSEMESTER EXAMINATION – 2019

BRIDGE ENGINEERING
(Part – II)

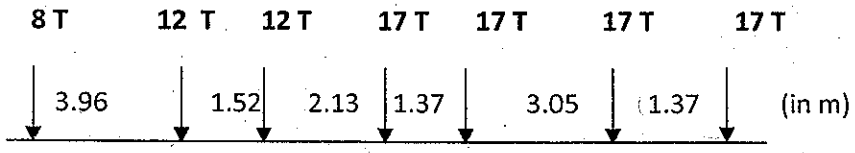
Time : three hours

Full Marks – 100
(50 marks for PART – II)

Use separate Answer Script for each part
(Assume any data,if reuired, reasonably)

Answer any five from 1 to 6 and any two from 7 to 9.

1. Name the different types of bridges. Which type of bridge 'The Howrah Bridge' is? ---5
2. Compare the advantages & disadvantages between Precast and cast-in-situ RCC Girder Bridge. ---5
3. Name the different types of Bearings used in bridges and discuss on their nature of transferring forces. ---5
4. Discuss on design criteria of a bridge superstructure with steel girders & concrete deck without shear connector and with shear connector. ---5
5. What is the basic principal of Pre-stress concrete? What are the advantages of using pre-stressed concrete girder in bridges? ---5
6. Why two stage pre-stressing is more conventional than pre-stressing in one stage in a concrete bridge? Name the different 'Loss in Pre-stress' in pre-stress bridge girder. ---5
7. Design for a interior slab panel of size 3.2 m x 4.0 m for a wheel load of 17 T of contact area 350mm(shorter) x 840 mm (longer) using Pigeaud's method. Design for moment due to Dead & wheel load.
   (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) Use poisson's ratio = 0.2 --12.5
8. Calculate 'Design BM' due to vehicular load as given below for Exterior Long Girder of a concrete bridge having the following parameters: - Use Courbon' method. ---- 12.5
   a) Centre to centre of bearings 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 & Wheel base = 1.9 m
   g) Vehicular Load



9. Calculate the final bending stress in the i)Top of Conc. Deck, ii) Top of top flange & iii) Bot. of bottom flange in a composite bridge girder for the data as below:- (consider modular ratio =7.5 & Creep factor=0.5) --- 12.5
   a) Thickness & Eff. Width of conc. Deck = 200 mm & 2.5 m respectively.
   b) Size of Steel Girder : Top flange- 500mmx 25mm, Bot. flange – 800 mm x 40 mm, Web – 2000mm x16mm
   c) Design BM: i) For DL1 = 350 TM , ii) For SDL = 280 TM , iii) For vehicular load = 230 TM