B.E Civil Engineering Fourth Year First Semester- 2018

Ref Ex/CE/T/412/2018

Design of structures –III

Time 3 hours

Full Marks 100

Use separate answer script for each part

Part – I (60 Marks)

Answer Q1 and any one from Q2 and Q3

Assume reasonable values of any data if required
IS 1893, IS1343 and IRC-6 are allowed in the examination hall
Notations have their usual meaning

Q 1 (a) A rectangular post tensioned beam 300 mm wide and 600mm deep is simply supported on a span of 10 m. A straight cable of area 600 mm^2 is placed at 200mm above the soffit of the beam. The initial pre-stress on the cable is 1500 MPa. Calculate the maximum Live Load can be applied as UDL on the beam based on the stresses at central span only. Loss of Pre-stress =15% Grade of concrete = M45 (assume Zone-I as per IS1343) **15**

(b) A G+7 storey RCC Hospital building (20m x 20m in plan) is to be constructed at Kolkata. Columns are placed 5m c/c along both direction. Floor to floor height is 3.4m except ground floor which is 3.0 m for parking. The building is located on a site with Soft soil. The service block is separated structurally from the main building by expansion joint. The lumped weights due to **dead load** per floor are as follows - 2700 KN (roof level), 3700KN (typical floor level) 2800KN (1st floor level) and 600KN (pile cap level). Determine the seismic load at each floor level and calculate the bending moment (with diagram) of the frame at 5^{th} floor level only by portal method. Take the plinth level is 100 mm above ground level and top of the pile cap is 500mm below Ground level. **25**

Q 2 (a) What are the differences between Pretension and post-tension system in Pre-stressed Concrete structures? What are the different types of losses in pre-stressing ?

(b) " To find out the reaction factor for the central girder of a typical three girder R C C bridges, the live loads are positioned nearer to the kerb" – Explain

(c) What is load balancing concept in pre-stressed concrete ?

(d) Draw the long section and cross-section of a column at a typical floor of size 600 mm X 600 mm with 12 nos 20 mm dia HYSD Bars .The spacing of ties is 8 mm dia @100 c/c (near Junction and 200c/c for the rest part. The detailing should be as per IS 13920 and IS456 .Cross-section of the connecting beams is 350mm X 500mm.Floor to floor height = 3.4m. **5X4 =20**

Q3. A RCC tee beam (simply supported) bridge is to be constructed over a river . The following data is given:

- Clear width of roadways = 7.5 m
- Span of the bridge = 22 m
- Average thickness of wearing coat = 80 mm
- Thickness of deck slab = 250 mm
- Number of main girders = 3
- Number of cross girders = 6
- Spacing of the main girders = 2.8 m
- Size of kerb = 300mm (depth) X 600 mm (width)

Determine the maximum bending moment for the central girder due to Class AA tracked loading only. **20**

Bachelor of Civil Engineering examination , 2018

(BCE - 4th year - 1st semester)

Design of Structures III

Time: 3 hours | Full marks : 100

The figures in the margin indicate full marks

PART - II (40 marks)

Assume reasonable value of any data if required

IS 456, SP 16 and IS3370 are allowed in the examination hall

Answer any one question

30+10=40

1. (a) Design a Cantilever T-type retaining wall to retain a soil of full height 6.5 m and anuniformly distributed surcharged load of 20 KN/m^2 at top surface level. Safe bearing capacity of cohesionless soil = 250 KN/m^2. γ_S= 18 KN/m^2, ϕ= 30^0 .Gradeof concrete M25.Grade of steel Fe 415. Show detail of reinforcements through neat sketches.

   (b) Design the long wall of an underground water tank of dimension 7mx3mx2.5m high. Grade of concrete M20 and Grade of steel Fe 415. Surrounding soil is cohesionless of bearing capacity =250 KN/m^2. γ_S= 16 KN/m^2 , ϕ= 30^0 . Water table may be considered at GL.

30+10=40

2. (a) Design a short RCC column with a suitable Pile cap against an axial compressive force of P=1600 KN and biaxial moments M_x=155 KN-m and M_y= 135 KN-m. Use 500 dia. RCC piles of capacity 350 KN. Grade of concrete M25. Grade of steel Fe 415. Apply Limit State Method of design as per IS 456. Partial safety factor against load and moments may be considered 1.5. Show detail of reinforcements through neat sketches.

   (b) Design the long wall of an underground water tank of dimension 7mx3mx2.5m high. Grade of concrete M20 and Grade of steel Fe 415. Surrounding soil is cohesionless of bearing capacity =250 KN/m^2. γ_S= 16 KN/m^2 , ϕ= 30^0 . Water table may be considered at GL.