a cross-section at 500 mm×300 mm and is prestressed with 9 cables, each cable consisting at 12 wires at 5 mm diameter. Take $E_3 = 2.1\times10^5$ N/mm$^2$ and $E_6 = 3.5\times10^4$ N/mm$^2$. One cable is tensioned at a time. [14]

(c) What are the merits and demerits of prestressed concrete? The Figure-1 shows the mid-span cross-section of a prestressed post-tensioned beam at span 24 m. There are 6 cables each of 12 wires at 5 mm diameter and one stressed with initial prestress at 1150 N/mm$^2$. Assuming an effective prestress at 1000 N/mm$^2$ after all losses have taken place, compute the extreme fiber stresses in concrete. The profile at the cable is parabolic with zero eccentricity at the ends. It carries a live load at 9 kN/m in addition to its own weight. Take unit weight of concrete as 24 kN/m$^2$ [14]



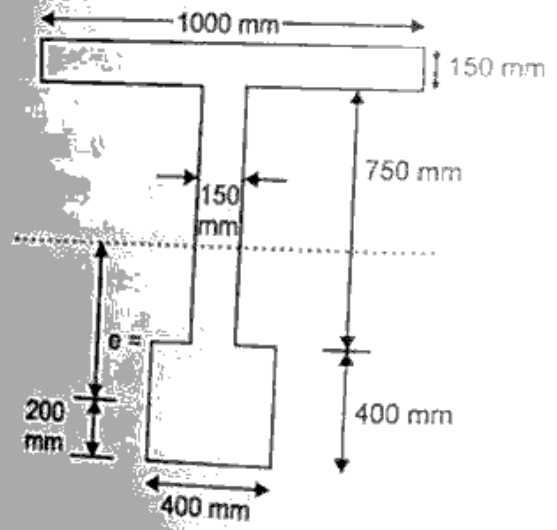


Figure-1





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# 320831(20)

BE (8th Semester)

Examination, April - May, 2017

[New Scheme]

## Structural Engineering Design-IV

*Time Allowed* : 4 hours *Maximum Marks* : 80

*Minimum Pass Marks* : 28

*Note* : (*i*) Part (*a*) of each question is compulsory and attempt any one part from rest two parts (*b*) and (*c*) in each question.

(*ii*) The figures in the right-hand margin indicate marks.



### UNIT-I

1. (*a*) Define raft foundation. Why raft foundation is provided? [2]

(*b*) Design a combined rectangular footing for two columns 600×600 mm each and 5 m apart and carrying a load of 1800 kN each. The available width is restricted to 2.40 m. The safe bearing capacity of soil may be taken as 200 kN/m$^2$. Use M-20 concrete and Fe-415 steel. Use limit state method. [14]

(*c*) Design a strap footing for two columns *A* and *B*, spaced 5 m c/c. Column *A* is 300×300 mm in size carries a load of 600 kN and is on the property line. Column *B* is 400×400 mm in size, carries a

load at 900 kN. The bearing capacity of soil is 120 kN/m$^2$. Use M-20 mix and Fe-415 steel and limit state method. [14]

## UNIT - II

2. (*a*) Name different types of retaining walls [2]

(*b*) Design a cantilever retaining wall for a road for the following requirements by using limit state method of design

(*i*) Height wall from the bottom of base to the top of stem = 6.0 m

(*ii*) Superimposed load due to road traffic = 18 kN/m$^2$

(*iii*) Unit weight of fill = 18 kN/m$^3$

(*iv*) Angle of internal friction for fill material = 30°

(*v*) Allowable bearing pressure on ground = 160 kN/m$^2$

(*vi*) Coefficient of friction between concrete and ground = .4

(*vii*) Parapet wall 1.0 m high on the top of stem

Use M-20 concrete and Fe-415 steel [14]

(*c*) Describe design principles of counterfort retaining wall with neat sketches and by giving formulae to be used [14]

## UNIT - III

3. (*a*) What are the advantages of dome of water tanks? [2]



(*b*) Design a circular water tank with flexible base for capacity to 400000 liters. The depth at tank is to be 4 m, including a free board of 200 mm. Use M-20 concrete and Fe-415 steel. Redesign the tank assuming that the joint between the wall and base is rigid. [14]



 

(*c*) Design an Intze tank, tank part only up to bottom dome of 900000 liters capacity. Use M-20 concrete and Fe-415 steel. [14]

## UNIT - IV

4. (*a*) Name various types of bridges. [2]

(*b*) Design a solid slab bridge for class A loading for following data :

(*i*) Clear span = 5.0 m

(*ii*) Clear width of roadway = 7.5 m

(*iii*) Thickness of wearing coat = 7.5 cm

Use M-20 mix and Fe-415 steel.



(*c*) Design a cantilever slab and inner panels of a T beam bridge for Class AA (tracked) vehicle loading only for following data : [14]

(*i*) Clear width of roadway = 7 m

(*ii*) Span Centre to Centre of bearing = 16 m

(*iii*) Live load one lane Class AA loading tracked vehicle only.

(*iv*) Average thickness of bearing coat = 8 cm

Use M-20 concrete and Fe-415 steel.

## UNIT - V

5. (*a*) Define pretensioning and post-tensioning system. [2]

(*b*) List different types of losses induced in prestress concrete. Explain in brief each. A post-tensioned prestress concrete beam of 30 m span is subjected to a transfer prestress force of 2500 kN at 28 days' strength. The profile of the cable is parabolic with maximum eccentricity at 200 mm at midspan. Determine the loss of prestress and the jacking force required if jacking is done from both ends at the beam. It has

  