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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2019

DESIGN OF PRE STRESSED CONCRETE

[*Time* : 3 hours

(Maximum marks : 100)

[*Note:*— IS: 456-2000, IS: 1343-2012 are permitted.]

PART — A

(Maximum marks : 10)

Marks

I Answer *all* questions in one or two sentences. Each question carries 2 marks.

1. Define Lever arm.
2. Define Tendon.
3. What do you mean by eccentricity ?
4. Define load balancing.
5. Define creep coefficient. (5×2 = 10)

PART — B

(Maximum marks : 30)

II Answer any *five* of the following questions. Each question carries 6 marks.

1. List the assumptions in the working stress method.
2. Derive the expression for Moment of Resistance of a singly reinforced RCC sections using M25 concrete and Fe415 grade steel.
3. What are the advantages and disadvantages of pre stressed concrete over RCC ?
4. Distinguish between Pre tensioning and Post tensioning.
5. A pre-stressed concrete beam of size 350 × 550mm, with span 6m and is subjected to udl of 12KN/m including the self weight of the beam. The prestressing tendons which are located along the longitudinal centroidal axis provide an effective prestressing force of 1200 KN. Determine the extreme fibre stresses in concrete at the mid span section.

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Marks

6. List the various types of losses in prestressed concrete beams.

7. A pre tensioned concrete beam of size 110mm × 250mm is prestressed with a force of 100KN at an eccentricity of 50mm. Estimate the loss of prestress. Take modulus of elasticity of steel, Es = 210 KN/mm² and modulus of elasticity of concrete, Ec = 35 KN/mm². (5×6 = 30)

PART — C

(Maximum marks : 60)

(Answer *one* full question from each unit. Each full question carries 15 marks.)

UNIT — I

III (a) Identify the different types of sections. 6

(b) Determine (i) Depth of neutral axis (ii) Moment of Resistance (iii) Percentage of steel for a balanced singly reinforced rectangular section of 200mm × 300mm. Use M20 concrete and Fe 415 grade steel. 9

OR

IV (a) Design a reinforced cement concrete beam subjected to a Bending Moment of 30KNM. Use M20 concrete and Fe 415 grade steel. Keep the width of the beam is equal to the half the effective depth of the section. 8

(b) A simply supported singly reinforced RCC beam of 200mm × 300mm effective depth is reinforced with 3 bars of 16mm diameter. Determine the depth of Neutral axis and the maximum stress in concrete. When the steel is stressed to 140N/mm². Take m = 19. 7

UNIT — II

V (a) List the classification of Prestressed concrete. 8

(b) State the reasons for why the High grade concrete is used in prestressed concrete. 7

OR

VI (a) Explain the basic principles in pre stressed concrete. 8

(b) With the help of a neat sketch, describe the Freyssinet system of prestressing. 7

UNIT — III

VII (a) A simply supported prestressed concrete beam of rectangular cross section 400mm × 550mm, is loaded with a total uniformly distributed load of 250KN over a span of 6m. It subjected to a prestressing force of 1750KN and the tendons are in concentric. Sketch the distribution of stress at mid span. 8

(b) A prestressed concrete beam of uniform rectangular cross section and 10 meters supports a udl of 20KN/m including self weight of the section. Determine the suitable dimensions of the section. Take permissible stress of 14N/mm² for concrete. 7

OR

Marks

VIII (a) A pre stressed simply supported concrete beam 400mm × 600mm in section has a span of 6m. It is subjected to a uniformly distributed load of 18 KN/m including the self weight of the beam. The prestressing tendons are located at 200mm above the bottom fibre and provide an effective prestressing force of 1200KN. Determine the extreme stresses in concrete at the mid span. 8

(b) A rectangular prestressed concrete beam has a span of 10 meters and it carry a live load of 15KN/m excluding self weight of the beam. Take permissible stresses in concrete and steel are $16 N/mm^2$ and $1050 N/mm^2$ respectively. Design the beam using 6mm diameter tendons. Assume specific weight of concrete as $25 KN/m^3$ and width of the section is 300mm. 7

UNIT — IV

IX (a) Calculate the loss of stress in the tendons due to shrinkage of concrete in a post tensioned beam if the age of concrete at transfer is 10days. Take $Es = 2.10 \times 10^5 N/mm^2$. 6

(b) A prestressed rectangular beam of size 100mm wide and 250mm deep is pretensioned with 6 bars of 7mm diameter at an eccentricity of 90mm. Estimate the total loss of prestressing force, if the initial prestress in the wires is $1000 N/mm^2$. Take modulus of elasticity $Es = 200 KN/mm^2$, modulus of elasticity of concrete $Ec = 35 KN/mm^2$ and Creep coefficient is 1.6. 9

OR

X (a) In a pre-tensioned beam of length 15m, slip in the anchorages is estimated to be 3mm. If modulus of elasticity of steel is $2 \times 10^5 N/mm^2$, Estimate the loss of pre-stress due to slip in anchorages. 6

(b) A pre-stressed concrete beam of 8m long, 250mm × 400mm in cross section with an initial prestressing force of 500KN is applied at an eccentricity of 100mm, by tendons of area $500 mm^2$. Assuming $Es = 2 \times 10^5 N/mm^2$, $Ec = 0.333 \times 10^5 N/mm^2$, anchor slip = 1.5mm, creep coefficient in concrete $\phi = 1$, shrinkage of concrete = 0.0002 and creep loss in steel = 3%, find the total percentage loss of stress in tendons. 9