Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering
End Sem Examination Dec-2023
CE3ET08 Prestressed Concrete

Programme: B.Tech. Branch/Specialisation: CE

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. Minimum grade of concrete for post-tensioning method of pre-stressing is- **1**

(a) M20 (b) M30 (c) M40 (d) M50

ii. The concept used in the principles of pre-stressed concrete is- **1**

(a) Stress Concept (b) Strength Concept

(c) Load Balancing Concept (d) All of these

iii. For PSC permissible tension in small diameter wires is- **1**

(a) 1800 MPa (b) 1000 MPa

(c) 12000 MPa (d) 1400 MPa

iv. Linear pre-stressing is preferable for **1**

(a) Beams (b) Piles (c) Pipes (d) All of these

v. The length of the tendon from the free end to the point where it attains maximum stress is called _____ length. **1**

(a) Elongation (b) Transmission

(c) Extraction (d) Contraction

vi. Transmission length for crimped wired is_____ (Φ=Diameter of wire) **1**

(a) 100 Φ (b) 85 Φ (c) 65 Φ (d) 30 Φ

vii. Shrinkage strain for the pre-tensioned concrete is given by- **1**

(a) $\varepsilon_{sh}=0.0003$ (b) $\varepsilon_{sh}=0.0004$

(c) $\varepsilon_{sh}=0.0005$ (d) $\varepsilon_{sh}=0.0006$

viii. Modulus of elasticity of the pre-stressed concrete is given by- **1**

(a) $E_c=5700\sqrt{f_{ck}}$ (b) $E_c=5000\sqrt{f_{ck}}$

(c) $E_c=5300\sqrt{f_{ck}}$ (d) $E_c=4900\sqrt{f_{ck}}$

P.T.O.

ix. Among these which is not a limit state? **1**
(a) Limit state of collapse
(b) Limit state of creep
(c) Limit state of shrinkage
(d) Limit state of relaxation

x. The analysis for axial load and flexure are based on- **1**
(a) Equilibrium of internal and external forces
(b) Compatibility of strains in concrete and steel
(c) Constitutive relationships of material
(d) All of these

Q.2 Attempt any two:

i. Write down advantage and disadvantage of Pre-Stressed Concrete. **5**

ii. Distinguish between pre-tensioning and post-tensioning systems. **5**

iii. Write down various anchorage systems of pre-stressing. Explain any one of them in detail. **5**

Q.3 i. Explain types of cracks of tension member without pre-stressing. **4**

ii. Explain modes of failure for beam. **6**

OR iii. Explain the extreme fibre stresses in concrete for the following two cases: **6**
(a) Transfer of pre-stress (b) Working load condition

Q.4 i. Explain stress distribution on end block. **3**

ii. The end block of a pre-stressed beam, 200 mm wide and 300 mm deep, has tow freyssinet anchorage (100 mm diameter) with their centres at 75 mm from the top and bottom of the beam. The force transmitted by each anchorage being 200 kN, estimate the maximum tensile stress and the bursting tension developed. **7**

OR iii. A post-tensioned bridge girder with un-bonded tendon is of box section of overall dimension 1200 mm wide by 1800 mm deep with wall thickness of 150 mm. The high tensile steel has an area of 4000 mm^2 and is located at an effective depth of 1600 mm. The effective pre-stress in steel after all losses is 1000 N/mm^2 and the effective span of the girder is 24m. If f_{ck}=40 N/mm^2, f_p=1600 N/mm^2, estimate the ultimate flexural strength of the section. **7**

Q.5 i. Define principal stresses. **4**

ii. A simply supported beam 60 mm x 120 mm in section has a span of 3 m. If carries two-point loads of 2kN each at 1/3 span points in addition to its own weight. Determine the initial pre-stressing force and its eccentricity so that the tensile stress in concrete will be limited to 1.5 N/mm^2 and 1 N/mm^2 at transfer and at working load respectively. Assume the loss ratio as 80%. **6**

OR iii. A cantilever beam of span 3m is required to carry a point load of 3 kN at its free end in the addition to its own weight. The beam is 100 mm x 300 mm in section and is pre-stressed with initial pre-stressing force 120 kN which is located at 50 mm from the top. Assume the loss ratio as 80%. Determine: **6**
(a) Stress distribution at transfer of pre-stress
(b) Stress distribution at working load

Q.6 Attempt any two:

i. A post-tensioned bonded beam of unsymmetrical I-Section is required to support a design moment of 1200 kNm. Determine the overall depth and thickness of compression flange required if f_{ck}=35 MPa and f_p=1500 MPa. **5**

ii. Explain the limitations of pre-stress in long spans in design of pre-stress concrete sections for flexure. **5**

iii. Write down applications of partial pre-stressing. **5**

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Marking Scheme

CE3ET08 Prestressed Concrete

Q.1	i)	Minimum grade of concrete for post-tensioning method of pre-stressing is c)M40	**1**
	ii)	The concept used in the principles of pre-stressed concrete is d) All of the above	**1**
	iii)	For PSC permissible tension in small diameter wires is c) 12000 MPa	**1**
	iv)	Linear pre-stressing is preferable for d)All of above	**1**
	v)	The length of the tendon from the free end to the point where it attains maximum stress is called…… length b)Transmission	**1**
	vi)	Transmission length for crimped wired is…… (Φ=Diameter of wire) c)65 Φ	**1**
	vii)	Shrinkage strain for the pre-tensioned concrete is given by a) $\varepsilon_{sh}=0.0003$	**1**
	viii)	Modulus of elasticity of the pre-stressed concrete is given by a) $E_c=5700\sqrt{f_{ck}}$	**1**
	ix)	Among these which is not a limit state? a) Limit state of collapse	**1**
	x)	The analysis for axial load and flexure are based on, d) All of the above	**1**
Q.2		Attempt any two:	
	i.	Write down advantage and disadvantage of Pre-Stressed Concrete. **Provide 2.5 marks for advantages and 2.5 mark for disadvantages**	**5**
	ii.	Distinguish between pre-tensioning and post-tensioning systems. **Provide 1 marks for each correct difference**	**5**
	iii	Write down various anchorage systems of pre-stressing. Explain any one of them in detail. **Provide 2 marks for correct system names. 3 Marks for explanation**	**5**
Q.3	i.	Explain types of cracks of tension member without pre-stressing. **Provide 1 marks for each type**	**4**
	ii	Explain modes of failure for beam. **Provide 1 mark for each type**	**6**
OR	iii	Explain the extreme fibre stresses in concrete for the following two cases a)Transfer of pre-stress b) Working load condition **3 marks for each case explanation**	**6**
Q.4	i	Explain stress distribution on end block. **Full marks for correct answer**	**3**
	ii	The end block of a pre-stressed beam, 200 mm wide and 300 mm deep, has tow freyssinet anchorage (100 mm diameter) with their centres at 75 mm from the top and bottom of the beam. The force transmitted by each anchorage being 200 kN, estimate the maximum tensile stress and the bursting tension developed. **Full marks for answer Fv(max)= 4.45 N/mm² F=50 kN**	**7**
OR	iii	A post-tensioned bridge girder with un-bonded tendon is of box section of overall dimension 1200 mm wide by 1800 mm deep with wall thickness of 150 mm. The high tensile steel has an area of 4000 mm^2 and is located at an effective depth of 1600 mm. The effective pre-stress in steel after all losses is 1000 N/mm^2 and the effective span of the girder is 24m. If f_{ck}=40 N/mm^2, f_p=1600 N/mm^2, estimate the ultimate flexural strength of the section. **Full marks for f_{pu}=1310 N/mm² and Mu=8011 kNm.**	**7**
Q.5	i	Define principal stresses. **Full marks for correct definition**	**4**
	ii	A simply supported beam 60mm x 120 mm in section has a span of 3 m. If carries two point loads of 2kN each at 1/3 span points in addition to its own weight. Determine the initial pre-stressing force and its eccentricity so that the tensile stress in concrete will be limited to 1.5 N/mm^2 and 1 N/mm^2 at transfer and at working load respectively. Assume the loss ratio as 80%. **Full marks for answer Fo=53.81 kN, e=0.027 m**	**6**
OR	iii	A cantilever beam of span 3m is required to carry a point load of 3 kN at its free end in the addition to its own weight. The beam is 100 mm x 300 mm in section and is pre-stressed with initial pre-stressing force 120 kN which is located at 50 mm from the top. Assume the loss ratio as 80%. Determine a) Stress distribution at transfer of pre-stress b) Stress distribution at working load **Full marks for answer a) f=1840 kN/m²** **b) f=4960 kN/m²**	**6**

Q.6 Attempt any two:

i A post-tensioned bonded beam of unsymmetrical I-Section is required to support a design moment of 1200 kNm. Determine the overall depth and thickness of compression flange required if f_{ck}=35MPa and f_p=1500 MPa. **5**

Full marks for answer Ap=1003 mm^2

ii Explain the limitations of pre-stress in long spans in design of pre-stress concrete sections for flexure. **5**

1 mark for each correct point

iii Write down applications of partial pre-stressing. **5**

1 mark for each correct point

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