

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), Dec.2015

B. Tech in Civil Engineering, Semester-VII

Roll No.....

COURSE CODE: DESIGN OF PRE-STRESSED
CONCRETE STRUCTURES (CE 728)

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly. Use Density of Concrete 24 KN/m³
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever required are an integral part of the answer.

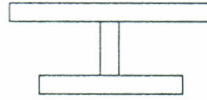
Q.1A Objective type multiple choice/fill in the blank questions (10 questions @ 1 mark) 10

- i. Diameter of HTS wires used in pre-stress (mm); (a) 2 to 8 (b) 6 to 10 (c) 10 to 20 (d) any size
- ii. Modular ratio is ; (a) E_s/E_c (b) L/d (c) M/Z (d) P/A
- iii. Expression for creep loss in prestressed concrete: _____
- iv. Bursting tension is observed at ; (a) End block (b) Anchorage zone (c) Both a & b (d) none of these
- v. Maximum shear stress in any circular section is _____ times of average stress ; (a) 1.0 (b) 1.25 (c) 1.33 (d) 1.5
- vi. Minimum strength of concrete for prestress design ; (a) M-25 (b) M-30 (c) M-35 (d) M-40
- vii. Modulus of elasticity of steel (KN/m²); (a) 150 (b) 180 (c) 200 (d) 250
- viii. Splitting and flexural tensile strength of concrete is $___ \times \sqrt{f_{ck}}$; (a) 0.5 (b) 0.6 (c) 0.7 (d) 0.8
- ix. Partial safety factor for DL+LL combination in limit state of collapse ; (a) 0.9 (b) 1.0 (c) 1.2 (d) 1.5
- x. Checking for deflection is a limit state of ; (a) Collapse (b) Serviceability (c) Both a & b (d) none of these

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

- (a) Define pre tensioning and post tensioning.
- (b) Write difference between axial and eccentric prestressing.
- (c) A rectangular beam 300x800 supports two point loads of 20 KN each at third point of span 9m. Draw a suitable cable profile and prestressing force (P) to balance effect. Neglect self wt.
- (d) Describe Guyon's method for determination of bursting tension in end blocks.

- Q.3 An unsymmetrical I-section beam of length 8m is shown below. Top flange= 300x60, bottom flange= 100x60, Web=280x80. Estimate the extreme fibre stress at centre of span section. Live load =2 KN/m and prestressing force $P= 100$ KN acting at 50mm above bottom fibre. 10



OR

- Q.3 A prestressed concrete beam 200x300 of length 6m with tendons 15-#5mm at 65 mm from bottom and 3-#5mm at 25mm from top prestressed with 840 N/mm^2 . The beam is supporting dead load and live load of 6 KN/m. Find extreme fibre stresses at mid span. 10

- Q.4A Considering load balancing concept, draw cable profiles for central point load and udl respectively. Write expression for determination of effective prestressing force. What will be the deflection at centre in these cases? 05

- Q.4B Define and illustrate end blocks. 05

- Q.5A Pretensioned beam of rectangular section 150x350 having effective cover of 50mm. Concrete M-40, $f_p = 1600 \text{ N/mm}^2$, $A_p = 461 \text{ mm}^2$. Calculate reinforcement ration and ultimate flexural strength. ($f_{pu}/0.87 f_p = 0.9$ and $X_u/d = 0.783$). 05

- Q.5B Write expression for determination of maximum and minimum principal stresses developed. How shear resistance of structural member can be improved by prestressing technique. 05

- Q.6A A concrete beam of X-sectional area $32 \times 10^3 \text{ mm}^2$ and radius of gyration of 72mm is prestressed by a parabolic cable with prestress 231 KN at $e=50\text{mm}$ at centre and $e=0$ at ends. Span of the beam is 8m. Neglect losses. Find the central deflection. 05

- Q.6B What do you understand by durability of concrete and which factors influence it? 05

OR

- Q.6B Write expressions for maximum shear stress due to torsion in flanged section and box section. 05

- Q.7 A prestressed concrete pipe of 1.6m diameter with a core thickness of 100mm is required to withstand working/hydrostatic prestress of 1 N/mm^2 . Determine the pitch of a 5mm diameter HTS wire with prestress of 1000 N/mm^2 . The permissible minimum and maximum compressive stresses in concrete are 12 N/mm^2 and zero. The loss ratio is 0.8. 10

- Q.8 Derive expression for short term deflection of prestressed member subjected to slopping tendons and eccentric anchors. 10

Q.9 A pretensioned prestressed concrete beam of rectangular section is required to support a design ultimate moment of 100 KN-m. Design the section if $f_{ck}=50$ N/mm² and $f_p=1600$ N/mm². Use average value of constant 0.15 for flexural strength and $X_u/d=0.48$. 10

Q.10 A prestressed simply supported road bridge of span 10m consist slab 380mm thick with parallel post tensioned cables, in each of which force at transfer is 360 KN. Bridge is required to support an udl of 25 KN/m². Permissible tensile stress is 0.7 N/mm². Calculate prestressing force (P), eccentricity (e), and spacing of cables. Assume losses of prestress= 20%. 10

OR

Q.10 A post tensioned PSC beam of rectangular section 250mm is to be redesigned for an imposed load of 12 KN/m on a span of 12m. Permissible stresses in concrete are 17 N/mm² in compression and 1.4 N/mm² in tension. Loss of prestress may be assumed 15%. Calculate (a) The minimum possible depth of beam; and (b) minimum prestressing force and eccentricity. 10