Con. 5472-07. (REVISED COURSE)

(3 Hours) [Total Marks : 100

N.B. (1) Question Nos. 1 and 7 are **compulsory**, attempt any **three** questions from remaining questions.
(2) Use of I.S. 456 **is not** permitted.
(3) Illustrate your answers/design with **neat** sketches wherever **required**.
(4) Assume **suitable** data if **required** and justify the **same**.

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1. (a) Write any four assumptions made in Limit State of Collapse-Flexure for R.C. members and hence derive the stress block parameters. 7
(b) Define characteristic strength and characteristic load. 2
(c) Give the partial safety factors for material strength (γ_m) as per I.S. : 456 for concrete and steel in limit state of collapse and serviceability. 4
(d) Explain, why high strength concrete and steel is required in prestressed concrete. 4
(e) Define Anchorage bond, Development bond and Flexural bond. 3

2. (a) Design a singly reinforced rectangular beam 300 × 500 mm effective depth subjected to a moment of 100 kN-m. Use WSM, M20 and Fe 415. 10
(b) If the beam in **Q. No. 2 (a)** is subjected to an ultimate moment of 300 kN-m, design the beam using LSM. Use f_{sc} = 350 N/mm^2, M20, Fe 415. Assume cover to the compression reinforcement as 40 mm. 10

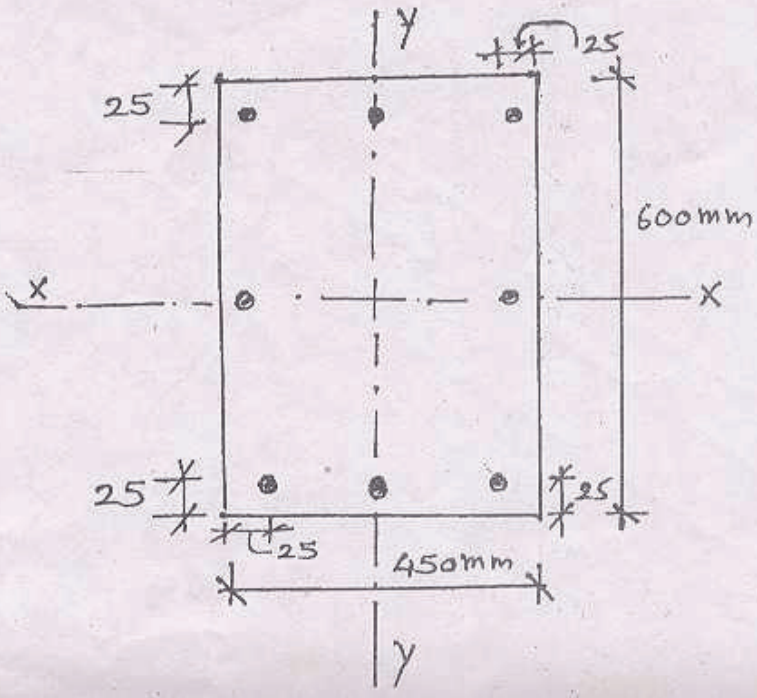
3. (a) A rectangular R.C. beam is 300 mm × 400 mm deep is reinforced with 4–16 mm dia. bars on tension side. Design the section for an ultimate torsional moment of 30 kN-m, ultimate B.M. of 45 kN-m and ultimate shear force of 38 kN. Adopt M20, Fe 415 and LSM. Assume effective cover to tension and compression reinforce as 40 mm. 12

p_t %	0·25	0·5	0·75	1·0	1·25	1·5	1·75
τ_{cu} (N/mm^2)	0·36	0·48	0·56	0·62	0·67	0·72	0·75

(b) Design a simply supported one way slab for an effective span of 2·6 m. It carries a superimposed load of 2·5 kN/m^2 including finishesh. Use M20 concrete and Fe 415 steel and WSM. Apply check for development length and sketch reinforcement details. 8

4. (a) A T–beam section has b_f = 1200 mm, D_f = 100 mm, d = 360 mm, b_w = 300 mm, A_{st} = 6 bars of 25 dia. Determine moment of resistance of the section. Use M20, Fe 415 and WSM. 10
(b) Determine ultimate moment of resistance for the beam in **Q. No. 4 (a)** using LSM, M20 and Fe 415. 10

5. (a) A rectangular column section 450 mm × 600 mm is acted upon by an axial load of 500 kN, M_X = 300 kN-m and M_Y = 20 kN-m. It is provided with 8 bars of 20 mm dia. with an effective cover of 25 mm. Check the safety of the column as uncracked section. Adopt M20, Fe 415 and WSM. Refer **figure**. 8



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(b) Design the shear reinforcement for a simply supported beam 250 mm wide, 400 mm effective depth, carrying u.d.l. of 50 kN/m including self weight. The span of the beam is 3·5 m. It is provided with 6 bars of 16 mm dia. at bottom and 2 anchor bars of 10 mm dia. at top. Use M20 concrete and Fe 415 steel and W.S.M. Sketch the reinforcement details. 12

p_t %	0·25	0·50	0·75	1·0	1·25	1·50	1·75
τ_c (N/mm^2)	0·22	0·30	0·35	0·39	0·45	0·47	0·49

6. (a) A pre-stressed concrete beam supports a live load of 4 kN/m over a simply supported span of 8 m. The beam has an I-section with an overall depth of 400 mm. The thickness of the flange and web are 60 and 80 mm respectively. The width of the flange is 200 mm. The beam is to be prestressed by an effective prestressing force of 235 kN at the suitable eccentricity such that the resultant stress at the sofit of the beam at the centre of the span is zero. 14

(i) Find eccentricity required for the force.

(ii) If the tendon is concentric, what should be the magnitude of the prestressing force for the resultant stress to be zero at the bottom fibre of the central span section ?

(b) A prestressed concrete beam of section 120 mm wide by 300 mm deep is used over an effective span of 6 m to support a u.d.l. of 4 kN/m, which includes self weight of beam. The beam is stressed by a straight cable carrying a force of 180 kN and located at an eccentricity of 50 mm. Determine the location of the thrust line in the beam and plot its position at quarter and central span sections. 6

7. (a) A pre-tensioned beam 250 mm wide × 300 mm deep is prestressed by 12 wires each of 7 mm dia. initially stressed to 1200 N/mm^2 with their centroids located at 100 mm from the sofit. Estimate the final percentage loss of stress due to elastic deformation, creep, shrinkage and relaxation using the following data :— 10

Relaxation of steel stress is 5%

E_s = 210 kN/mm^2,

E_c = 35 kN/mm^2

Creep coefficient (ϕ) = 1·6

Residual shrinkage strain = 3×10^{-4}.

(b) Draw Whitney's stress block and hence determine ultimate moment of resistance for a beam 300 × 500 mm effective. Use M20 concrete and Fe 415 steel. 6

(c) Explain the terms transmission length and end block. 4
