BE(C) VII

Theory of RCPC

Con. 3251-09.

VR-4650

(3 Hours) [Total Marks : 100

N.B.:(1) Question Nos. 1 and 7 are **compulsory.** Solve any **three** from remaining questions.
(2) **IS-456-2000** is **not permitted.**
(3) Assume **suitable data** if **required** and mention it.

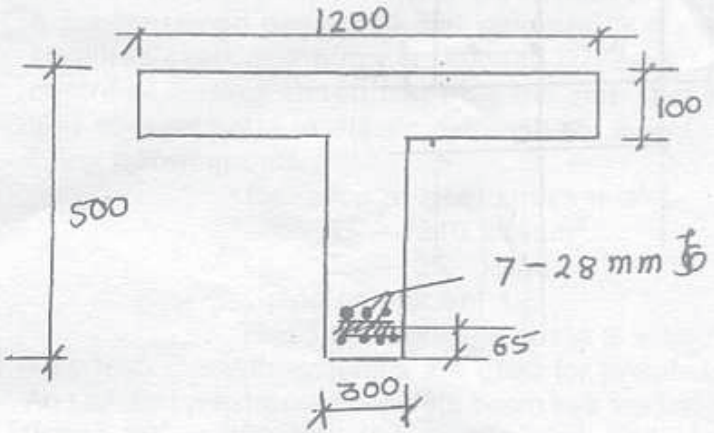
1. (a) Write any four assumptions made in Limit state of Collapse— Flexure for R.C. members and hence derive the stress block parameters. 8
(b) Define Anchorage bond, Development bond and Flexural bond. 2
(c) Draw the stress-strain curves of concrete and steel how they are modified for design as per IS-456. 5
(d) What are the advantages of helical reinforcement in place of circular links in column ? Explain condition in which it is applicable. 5

2. (a) A rectangular reinforced concrete beam is 250 x 500 (effective) and simply supported over a span of 6 m it carries a superimposed factored load of 20 kN/m (inclusive of DL). Determine the reinforced required. If the factored superimposed load is increased by 80% and the section is kept the same. Determine the reinforcement adopt M20 Fe 415. 15

d'/d	0·05	0·1	0·15	0·2
σsc	355	353	342	329

(b) Prove that the limiting values of $\frac{X_u}{d}$ are 0·53 for mild steel, 0·48 for torsteel and 0·46 for Fe500 respectively. 5

3. The cross sectional dimensions of T-beam are as shown. 12
Assuming M20 grade of concrete and Fe 415 steel.
Calculate ultimate moment of resistance of section by using LSM.



(b) A Tee-beam section has 8
b_f = 1200 mm D_f = 100 mm d = 450 mm
b_w = 250 mm
M_{ax}BM = 150 KNM. Determine area of steel. Adopt M20 Fe 415 and use WSM.

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4. (a) A Rectangular beam 250 x 450 mm effective depth is reinforced with 5 bars of 20 mm diameter out of which two bars are bent up at 45° at a section. Design the shear reinforcement. Adopt LSM M20 and Fe415. The ultimate shear force is 250 kN. 10

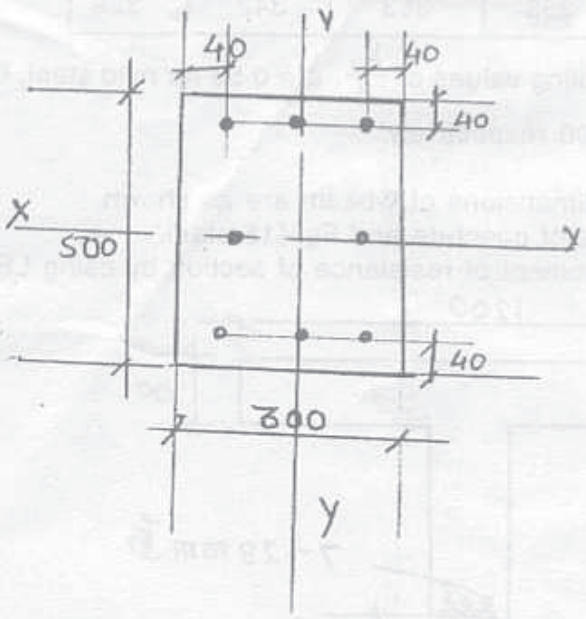
P%	0·5	0·75	1·0	1·25	1·5	1·75	2·0
J_c	0·48	0·56	0·62	0·67	0·72	0·75	0·79

(b) Design a circular column (short) subjected to an axial service load of 1000 kN. Adopt M20 and Fe415
Transverse reinforcement is helical. 10

5. (a) Design a simply supported slab to cover a room with internal dimensions 4·0 m x 5·0 m and 230 mm thick brick walls all around. Assume a live load of 3 kN/m² and finish load of 1 kN/m². Use M20 and Fe415. Assume that slab corners are prevented from lifting up 12

$\alpha_x = 0.0748$ $\alpha y = 0.056$ Use WSM

(b) A column is 300 x 500 is reinforced with 8 bars of 20 mm dia. It is subjected to a compressive force of 400 kN and M_x = 40 kNm. Check the safety of the column as uncracked section. Adopt M20 Fe 415. Use WSM 8



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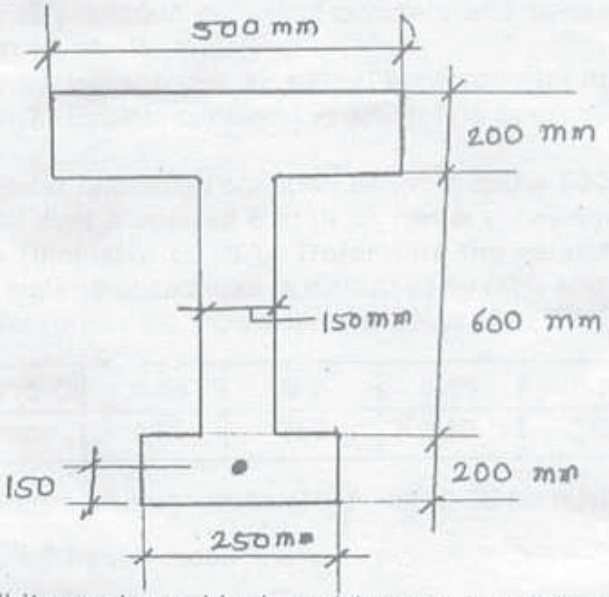
6. (a) An unsymmetrical I girder is shown in the figure. It is designed to carry a live load 15 kN/m on simply supported span of 20 m. It is prestressed with force of 1600 kN at 150 mm from soffit. Evaluate the stresses at transfer stage and at service load stage at top and bottom fibres. Assume 15% loss in prestress at service load stage. Evaluate also the limitation of the position of cable if the permissible stresses in concrete in compression and tension are limited to 16 N/mm^2 and 1 N/mm^2. 15



(b) Draw Whitney stress block and hence determine. Ultimate moment of resistance for a beam 300 × 600 mm effective. Use M20 concrete and Fe415 steel. 5

7. (a) A pre-tensioned beam 250 mm wide and 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 soft. Estimate the final percentage loss of stress due to elastic deformation, creep, shrinkage and relaxation using following data : 10

Relxation of steel stress is 5 %

E_s — 210 kN/mm^2

E_c — 35 kN/mm^2

Creep co-efficient 1·6

Residual shrinkage strain 3×10^{-4}

(b) Why high strength materials are used for prestressed concrete ? 5

(c) An I section prestressed concrete beam has top flange 1400 × 300 mm bottom flange 700 × 200 mm Web is 200 mm wide overall depth is 2400 mm. Determine the efficience of the section. 5