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M.Tech. 3rd Semester (Structural Engineering)

Examination, December-2024

DESIGN OF ADVANCED CONCRETE STRUCTURES

Paper-22MTSE23C1

Time allowed : 3 hours]

[Maximum marks : 100

Note : (i) *Question No. 1 is compulsory.*

(ii) *Each question carries equal marks (20 marks.)*

(iii) *Students have to attempt five questions in total, at least one question from each section.*

(iv) *Assume suitable data if missing.*

(v) *Use of IS 456 : 2000 and interaction curves are permitted.*

1. (a) Write a brief note on fire resistance of structural members. 4×5=20
- (b) Explain the curvature of a member at section with reference to a figure. Draw moment (M) and curvature (ϕ) for a singly reinforced beam section.
- (c) Explain about the Limit State analysis of concrete beams.
- (d) What are the conditions to be checked while fixing beams and columns in buildings ?

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Section-A

2. What are the design philosophies in RCC ? What are the characteristics of structural design ? What is load modeling and its characteristics ? 20
3. Why is the PM interaction curve important in column design ? What is the formula for moment curvature relationship ? Also define moment-curvature (M- ϕ) diagrams. 20

Section-B

4. A beam 3500mm deep and 250mm wide is continuous over two span of length 4.5m each carries a uniformly distributed load of 160kN/m. Design the beam using M20 concrete and Fe 415 steel. 20
5. What is Corbel in structural design ? What is the design of Corbel as per ACT ? Write down design procedure for Corbels ? 20

Section-C

6. Define shear wall. Classify different types of shear walls with sketches. Explain the design principles of rectangular and flanged shear walls. 20

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7. Explain in detail moment curvature or moment rotation relationship of a flexural member. Also explain redistribution of moments. What are the IS code provisions for the limit analysis of RC structures. 20

Section-D

8. Explain strengthening of RC structures using various beam column joints. Also Draw the ductile of Beam-Column joint. 20
9. What are the design rules to be applied to concrete members under fire test under ISO834 with respect to the following : 20
 - (i) cover to steel
 - (ii) size of members (minimum thickness for a given fire rating)
 - (iii) other factors like detailing practice

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M.Tech. (Structural Engineering) 3rd Semester
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DESIGN OF PRESTRESSED CONCRETE STRUCTURES

Paper-22MTSE23C2

Time allowed : 3 hours] [Maximum marks : 100

- Note : • Question No. 1 is compulsory.
- Each question carries equal marks (20 marks)
 - Students have to attempt **five** questions in total at least **one** question from each section.
 - Assume suitable data if missing.
 - Use of Code IS 1343 is permitted.

1. (a) Write a short note on need of high strength concrete and steel.
- (b) Define Load Balancing.
- (c) Mention the limitations of prestressing.
- (d) List the advantages of prestressed concrete poles.
- 4×5=20

Section-A

2. What are the different ways of improving the shear resistance of structural concrete members by prestressing techniques ? 20

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3. A post-tensioned beam AB of span 25 m is prestressed with an initial prestressing force of 400 kN at the jacking end A of the beam. The cable is having zero eccentricity at the supports A and B and an eccentricity of 400 mm towards the soffit at mid-span. The coefficient of friction $\mu = 0.30$ and the coefficient of wave effect $K = 0.0043/\text{m}$. Determine :

- (i) The loss of prestressing force in the cable due to friction.
- (ii) The effective prestressing force in the cable at the farther end B of the beam. 20

Section-B

4. Sketch the layout of tendons of a PSC continuous beam:

- (i) Straight
- (ii) Curved in elevation 20

5. How will you improve shear resistance of a P.S.C. beam? What are the steps involved in design of continuous concrete beam? 20

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Section-C

6. What is the necessity of providing reinforcements in the anchorage zone of a prestressed concrete beam? Give the supporting figures. 20
7. A non-cylinder prestressed concrete pipe of internal diameter 500 mm is designed to withstand a working pressure of 1.5 N/mm². High tensile wires of 5 mm diameter stressed to 1500 N/mm² at transfer are used. Permissible maximum stresses in concrete at transfer and working and working loads are 13.5 N/mm² and 1.0 N/mm² (compressive) respectively. Loss ratio is 0.85. Determine the minimum thickness of concrete for the pipe and pitch of the wires used for prestressing. 20

Section-D

8. What are the advantages of using composite construction with prestressed and Insitu concrete in structural members? 20
9. A partially prestressed T-girder designed to support a live load of 8 kN/m over an effective span of 20 m is made up of a top flange 100 mm wide and 120 mm thick with a rib 300 mm thick. The overall depth of the girder is 720 mm. The tensioned steel consists of nine

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strands of 12.5 mm diameter with a tensile strength of 1750 N/mm^2 , located at 585 mm from the top. The un-tensioned steel is of 7 cold worked deformed bars, of 25 mm diameter with $f_y = 425 \text{ N/mm}^2$, located at 80 mm from the soffit of the girder. The effective prestressing force in the tendon is 830 kN. Calculate the strain (ϵ_0) at the top fibre of the girder. Also estimate the width of the cracks developed under service loads and check the crack width using the hypothetical tensile stresses provided for in IS 1343-2012. 20