

D 42165

(Pages : 3)

Name.....

Reg. No.....

**FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE
EXAMINATION, DECEMBER 2007**

CE 04 502—STRUCTURAL DESIGN—I

(2004 Admissions)

Time : Three Hours

Maximum : 100 Marks

*Use of IS 456-2000 is permitted.
Missing data may be suitably assumed.
Answering Question No.1 is compulsory.*

Note : Use of IS 456 is permitted.

- I. (a) What are the requirements of an ideal reinforcing steel ? (5 marks)
- (b) How do you ensure safety against excessive deflection while designing an R.C.C. beam ?
What are the code recommendations ? (5 marks)
- (c) Distinguish between : (5 marks)
- (i) Factor of safety and partial safety factor.
- (ii) Characteristic load and design load. (5 marks)
- (d) Write short notes on idealized stress-strain curve for steel and concrete. (5 marks)
- (e) Explain the design of two-way slabs. (5 marks)
- (f) Explain the design of two-way slabs. (5 marks)
- (g) Differentiate between dog-legged stairs and folded plate stairs. (5 marks)
- (h) Comment critically on the concept of effective length in the analysis and design of long columns. (5 marks)
- (8 × 5 = 40 marks)
- II. (a) A cantilever R.C.C. inverted T-beam of clear projection of 2.5 m. are provided to support a canopy slab of 90 mm. thick at 2.75 m. centres. Design one of the interior beams by working stress method. Given the following :—
- (i) Live load on slab : 0.75 kN/m.²
- (ii) Weight of weathering course : 1.5 kN/m.²
- (iii) Concrete : M-20 grade
- (iv) Reinforcing steel : Fe-415

(15 marks)

Or

Turn over

- (b) A rectangular beam carries an all inclusive load of 18 kN/m^2 . Given the following :—

Span of beam : 10 m.

Depth of beam is limited to 750 mm.

Materials : M-20 concrete and Fe-415 steel.

Design the beam by working stress method.

(15 marks)

- III. (a) A beam of size $300 \text{ mm.} \times 600 \text{ mm.}$ carries a factored bending moment of 120 kN-m. , a factored shear of 100 kN and a factored torsion moment of 60 kN-m. Design reinforcements required using M-25 concrete and Fe-415 steel.

(15 marks)

Or

- (b) (i) Sketch various types of shear reinforcement normally provided in practice. (5 marks)
- (ii) A column of size $250 \times 500 \text{ mm.}$ supports a cantilever beam of span 2.5 m. The cross-section of beam is $230 \times 500 \text{ mm.}$ It is reinforced with 4 bars of $20 \text{ mm. } \phi$ of Fe-415 steel. Calculate the anchorage length required. Concrete of M-20 grade is used.

Show sketch of anchorage provided.

(10 marks)

- IV. (a) Design the slab for the following details :—

Clear dimension of hall : $3 \text{ m.} \times 9 \text{ m.}$

Slab rests on a wall of thickness : 230 mm.

Live load : 3 kN/m^2

Finishing load : 1 kN/m^2

Materials : M-20 concrete and Fe-415 steel. Sketch details of reinforcement.

(15 marks)

Or

- (b) Design the slab for the following data :—

Size of room : $5.5 \times 4 \text{ m.}$

Superimposed load : 5 kN/m^2

Materials : M-20 concrete and Fe-415 steel

Edges of slab are simply supported and corners are held down.

Sketch details of reinforcement.

(15 marks)

V. (a) Design a dog-legged stair for the following details :—

| | | |
|-------------------------|---|-----------------------------------|
| Floor to Floor height | : | 3.6 m. |
| Steps size | : | 150 mm. rise and 280 mm. tread |
| Imposed load | : | 3 KN/m ² |
| Dimension of stair case | : | 2.4 m. × 5.5 m. |
| Materials | : | M-20 concrete and Fe-415 steel. |

Assume that stairs are supported on landing slabs.

Sketch details of reinforcement.

(15 marks)

Or

(b) Design an axially loaded column to the following requirements :—

| | | |
|--|---|---|
| Actual length of column | : | 7.80 m. |
| Axial load | : | 750 kN. |
| End conditions of column | : | Both the ends are held in position and restrained against rotation. |
| Quantity of steel : | | |
| Use minimum amount of steel | | |
| Materials | : | M-20 concrete and Fe-415 steel |
| Transverse reinforcement | : | Helical |
| Adopt working stress method of design. | | |

(15 marks)

[4 × 15 = 60 marks]