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Name .....

Reg. No. .....

# FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION OCTOBER 2011

Civil Engineering

CE/PTCE 09 502—STRUCTURAL DESIGN–I

Time : Three Hours Maximum : 70 Marks

(1) *Answer* **all** *questions from Part A.*

(2) *Answer any* **four** *questions from Part B*

(3) *Answer* **one** *question from each module in Part C.*

(4) *All designs should be based on limit state method unless otherwise mentioned in the question.*

(5) *Use of IS 456 permitted.*

(6) *Any missing data may be assumed*

## Part A

1. Briefly explain anchorage.
2. Differentiate between limit state method and working stress method.
3. What are T and L beams ?
4. Explain the limit state design steps for two way slabs when corners are not held down.
5. Differentiate between short columns and long columns.

(5 × 2 = 10 marks)

## Part B

1. A balanced rectangular beam is singly reinforced with $b$ = 200 mm and $d$ = 300 mm. Determine the moment of resistance of the beam using working stress method. M-15 concrete and Fe-415 steel are used.
2. Design a singly reinforced beam to resist a factored bending moment of 80 kNm. Use M-25 concrete and Fe-415 steel.
3. Briefly explain the different design philosophies in RCC design.
4. Design a RCC floor slab for a room having inside dimensions 4 m × 10 m and supported on all four sides by a 40 cm thick brick wall. The superimposed load is 3 kN/m$^2$. Use M-20 concrete and Fe-415 steel. The design for bending moment is only to be done. Drawings are not required.
5. Explain the different types of slabs along with its structural behaviour.

**Turn over**

6. A reinforced concrete column 8 m long (effective) and 400 mm in diameter is reinforced with 8 bars of 20 mm diameter. Find the safe load the column can carry. Take $\sigma_{CC}$ = 4 N/mm$^2$ and $\sigma_{SC}$ = 130 N/mm$^2$. Use working stress method.

(4 × 5 = 20 marks)

## Part C

### Module 1

1. For a balanced rectangular section, derive from first principles, the expression for moment of resistance using working stress method.

*Or*

2. Determine the moment of resistance of a singly reinforced beam 160 mm wide and 300 mm deep to the centre of reinforcement, if the stresses in steel and concrete are not to exceed 140 N/mm$^2$ and 5 N/mm$^2$ respectively. The reinforcement consists of 4 bars of 16 mm diameter. Take $m$ = 18. If the above beam is used over an effective span of 5 m, find the maximum load the beam can carry, inclusive of its own weight. Working stress method should be followed.

(10 marks)

### Module 2

3. Find the moment of resistance of a T beam with the following data : width of flange = 800 mm, width of rib = 200 mm, Thickness of slab = 120 mm. Effective depth = 400 mm, Tensile steel area = 3500 mm$^2$. Use M-20 concrete and Fe-415 steel.

*Or*

4. A rectangular beam 300 mm wide and 600 mm effective depth is reinforced with a tensile reinforcement of 9000 mm$^2$ and compressive reinforcement of 3000 mm$^2$. The compressive reinforcement has an effective cover of 50 mm. Determine the ultimate moment of resistance. Use M-20 concrete and Fe-415 steel.

(10 marks)

### Module 3

5. Design a one-way slab with a clear span of 4 m, simply supported on 250 mm thick masonry walls and is subjected to a live load of 3 kN/m$^2$ using M-20 concrete and Fe-415 steel. Complete design, checks and detailing are required.

*Or*

6. Design a RC slab for a room 4 m × 4.5 m measuring from inside. The thickness of the walls is 400 mm. The live load is 2.5 kN/m$^2$. The edges are simply supported and corners are free to lift. Use M-20 concrete and Fe-415 steel.

(10 marks)

Model 4

7. Design a short circular column to carry an axial load of 700 kN. Use M-200 concrete. Take $\sigma_{SC}$ = 130 N/mm$^2$. The working stress method should be followed.

*Or*

8. Design a short square column to carry an axial load of 800 kN. Use M-20 concrete. Take $\sigma_{SC}$ = 130 N/mm$^2$. Use working stress method.

(10 marks)