314 Register No.:

April 2018

Time – Three hours
(Maximum Marks: 75)

[N.B: (1) Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory. Answer any FOUR questions from the remaining in each PART – A and PART – B

(2) Answer division (a) or division (b) of each question in PART – C.

(3) Each question carries 2 marks in PART – A, 3 marks in Part – B and 10 marks in PART – C.

(4) IS456-2000, IS800-2007, steel table and structural Engg. hand book approved by the Board are permitted.

(5) Suitable data may be assumed wherever necessary.]

PART – A

1. Define modular ratio.
2. Define characteristic strength of concrete.
3. How effective spans are determined for continuous beams?
4. List out the different types of shear reinforcement in beams.
5. When a slab is to be designed as a two way slab?
6. What is meant by slenderness ratio of a column?
7. What is meant by shape factor?
8. Specify the critical section for punching shear in an isolated RC footing.

PART – B

9. Differentiate working stress method and limit state method.
10. Explain how the effective width of flange is determined for T and L-beams.
11. What are the advantages and disadvantages of inclined stirrups over vertical stirrups.
12. What is the difference between one way slab and two way slab.
13. Differentiate short and long columns.
14. Explain the term block shear. How it affects the strength of a tension member?

[Turn over.....

15. What are the requirements of fillet welds when used in lap joints?

16. What are the assumptions made in the design of columns by limit state method.

PART – C

17. (a) Determine the area of tension steel required for a balanced section of size 300mm x 500mm (effective) when M20 grade concrete and deformed bars of Fe415 grade steel are used. Determine also the limiting value of ultimate moment of resistance of the section.

(Or)

(b) Design a singly reinforced rectangular beam to carry an udl of 30kN/m (inclusive of self weight) over an effective span of 8m for the limit state of collapse in flexure using M15 grade concrete and Fe415 grade steel.

18. (a) Design a RC lintel for an opening of 1.5m width on a masonry wall of 230mm width using M15 concrete and mild steel. The height of wall above the opening is 1.8m. Assume a bearing of 200mm on either side.

(Or)

(b) A simply supported beam of effective span 6m and M20 grade concrete carries an udl of 35kN/m. The overall size of the beam is 230mm x 500mm. It has 6 bars in the tension zone and 4 bars in the compression zone, all are 16mm dia, Fe415 steel without any curtailment or crank. Design the shear reinforcement for the full length of the beam using mild steel.

19. (a) Design the roof slab of a reading room of clear dimensions 3x10m using M20 grade concrete and Fe500 grade steel by limit state method. There is no access to the roof. Width of supports is 250mm. A weathering coarse of weight 2kN/m² is to be provided over the slab. Check the slab for stiffness.

(Or)

(b) Design a simply supported two way slab for the roof of a room of clear dimensions 4m x 4m using M20 grade concrete and Fe415 grade steel. The corners are not prevented from lifting. Width of supporting walls around is 230mm. Imposed load on the slab is 2kN/m². Weight of weathering course is 2.5kN/m².

20. (a) Design a rectangular RC column of side ratio 1.5 to carry an axial load of 3000kN. Take $f_{ck} = 200MPa$ and $f_y = 500MPa$. The unsupported length of column is 4m. The ends of the column are effectively held in position but not restrained against rotation. The lateral dimension of the column should not exceed 600mm.

(Or)

(b) A RC column, 300mm square in size, carries an axial load of 1000kN including its self weight. SBC of soil is 90kN/m². M15 grade concrete and Fe250 grade mild steel reinforcement are to be used. Determine the size and thickness required for the square base (with uniform depth) for the limit state of collapse in flexure. Determine also the area of tension steel required at the critical section (The effect of shear need not be considered).

21. (a) Design a tie member using a single channel section to carry an axial tension of 1200kN if the yield and ultimate stresses in steel are 500MPa and 600MPa respectively. Check for block shear is not necessary. Assume the member to be effectively connected at its ends by side fillet welds through its web with L_c=300mm.

(Or)

(b) Design a suitable section for a compression member of effective length 5.0m to carry an axial load of 3000kN using a single rolled heavy I-section and 16mm thick plates of yield stress 400MPa.
