

**END SEMESTER/ RE-TEST EXAMINATION, 2020**

**CT-504**

**Design of Concrete Structure**

**Full Marks-70**

**Time: 3 hours**

**Part A: 25 marks.**

Q.1) Choose the correct answer:

1 X 15 = 15

i) As per IS 456, the reinforcement in column should not be less than

- a) 0.5% and not more than 5% of cross-sectional area
- b) 0.6% and not more than 6% of cross-sectional area
- c) 0.7% and not more than 7% of cross-sectional area
- d) 0.8% and not more than 6% of cross-sectional area

ii) According to steel beam theory of doubly reinforced beam

- a) Tension is resisted by tension steel
- b) Compression is resisted by compression steel
- c) Stress in tension steel equals the stress in compression steel
- d) All the above

iii) An RCC slab is designed as two way slab if

- a) It supports live loads in both directions
- b) The ratio of spans in two directions is less than 2
- c) The slab is continuous over two supports
- d) The slab is discontinuous at two edges

iv) The amount of reinforcement for main bars in a slab is based upon



- a) Minimum bending moment
  - b) Maximum bending moment
  - c) Maximum shear force
  - d) Minimum shear force
- v) An under-reinforced section means
- a) Steel is provided at the underside only
  - b) Steel provided is insufficient
  - c) Steel provided on one face only
  - d) Steel will yield first
- vi) The Young's Modulus of steel is
- a)  $1.5 \times 10^5$  MPa    b)  $2 \times 10^5$  MPa    c)  $2.5 \times 10^5$  MPa    d)  $3 \times 10^5$  MPa
- vii) The anchorage value of a standard U type hook is
- a) 12 X diameter of bar
  - b) 14 X diameter of bar,
  - c) 16 X diameter of bar
  - d) None of the above
- viii) The diameter of main bar in RCC columns, should not be less than
- a) 6 mm    b) 8 mm    c) 10 mm    d) 12 mm
- ix) The minimum clear cover for R.C.C. columns shall be
- a) Greater of 40 mm or diameter
  - b) Smaller of 40 mm or diameter
  - c) Greater of 25 mm or diameter
  - d) Smaller of 25 mm or diameter



- x) The moment of resistance of an under-reinforced section is
- Equal to balance section
  - Less than balanced section
  - More than balanced section
  - Less than under reinforced section.
- xi) The neutral axis of a T beam exists in
- Within the flange
  - at the bottom edge of the slab
  - below the slab
  - all the above
- xii) Spacing of stirrups in a rectangular beam, is
- Kept constant throughout the length,
  - decreased towards the centre of the beam
  - increased at the ends
  - Increased at the centre of the beam.
- xiii) Hanger bars do not qualify as compression reinforcement in doubly reinforced beams, when its area is less than or equal to
- 0.2%
  - 1.0%
  - 1.2%
  - 1.5%
- xiv) The maximum strain in concrete at the outermost compression fibre is taken as..... in bending:
- 0.0032
  - 0.0035
  - 0.0037
  - 0.0038
- xv) In order to obtain the best workability of concrete, the preferred shape of aggregate is
- Rounded
  - Elongated
  - Angular
  - All of these

Q.2) Answer the following questions:

1 X 10 = 10

- What do you mean by modular ratio?
- What is shear reinforcement?
- Define doubly reinforced section.
- Write the expression of ultimate moment of resistance of a rectangular beam for under reinforced section.
- What is slenderness ratio?
- Define development length.
- What do you mean by two way slabs?
- Define Development length. What is its significance?
- What do you mean by partial safety factor?
- Define bond of a concrete.

**Part B: 45 marks.**

Q.3) Differentiate working stress method and limit state method. A reinforced concrete beam section of size 300 mm X 550 mm effective depth is reinforced with 4 numbers of 20 mm diameter bars. Assuming M25 grade concrete and Fe 415 steel, determine i) allowable moment of resistance and ii) ultimate moment of resistance

3+6 = 9



Q.4) Define doubly reinforced beam section. A beam section of size 250 mm X 450 mm total depth is reinforced as 3- 25 Ø as tensile reinforcement and 2-20 Ø as compression reinforcement. Assuming M20 grade concrete and Fe 415 steel, ultimate moment of resistance of the beam section.

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Q.5) What is a compression member? Classify column based on slenderness ratio and define them. Define effective length and unsupported length.

1+4+4=9

Q.6) Define shear reinforcement along with figure. A reinforce concrete beam of size 250 mm X 500 mm effective depth is reinforced with 3 nos. of 25 mm diameter bar as tensile reinforcement. The shear reinforcement consists of 2 legged 8 mm diameter stirrup @ 150 mm c/c spacing. Estimate the shear capacity of the section for M25 grade concrete and Fe 415 steel.

3+6=9

Q.7) A simply supported RCC beam over an effective span of 7 m carrying an imposed load of 37kN/m. Design the beam using M25 concrete and Fe415 steel. Show the sketch showing arrangement of reinforcement.

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