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M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)

BANGALORE – 560 054

SEMESTER END EXAMINATIONS – JANUARY 2015

Course & Branch	: **B.E: Civil Engineering**	**Semester**	: **V**
Subject	: **Design of RC Elements**	**Max. Marks**	: **100**
Subject Code	: **CV506**	**Duration**	: **3 Hrs**

Instructions to the Candidates:

- Answer one full question from each unit.
- Any data missing can be suitably assumed
- Use of IS 456:2000 and SP:16 column charts are permitted.

UNIT – I

1. a) Discuss the characteristic strength of materials and characteristic loads and represent the same on a normal distribution curve. (06)

   b) A rectangular beam of C/S 300x750mm is subjected to a BM of 300kNm at service conditions. The beam is provided with 4#25 on the tension side and 4#20 on the compression side. Check the safety of the beam with respect to flexure. Also calculate i) compression and tensile forces and ii) equivalent lever arm (14)

   Grade of concrete and steel is M30 and Fe500 respectively. Assume severe exposure.

2. a) Obtain an expression for limiting depth of neutral axis and calculate the limiting depths for different grades of steel as given in the code. Is it valid for all the cross sections? (06)

   b) A L - section has a flange of width 600 mm and thickness 100 mm with a web of width 300 mm and overall depth 750 mm. It is provided with 4#25 on the tension side. The section is used as SS beam over an effective span of 8m. Determine the depth of neutral axis, compression and tensile forces, lever arm, moment of resistance at collapse and the safe central concentrated load the beam can carry. Grade of concrete is M25 and grade of steel is Fe415. The beam is exposed to moderate condition. Neglect torsion. (14)

UNIT – II

3. a) Discuss the factors influencing the crack widths in flexural members. (06)

   b) A rectangular simply supported beam of span 9m is of overall size 300x825mm reinforced with 8#25 on the tension side. The beam carries two concentrated loads of 150kN each at one third points. Determine the maximum short term deflection. Calculate the approximate total deflection. Is the total deflection satisfying the code provisions? Characteristic strength of concrete is M25. Exposure is moderate. Account for the self weight and the concentrated loads are characteristic loads. (14)

4. a) Discuss the two approaches suggested by the code in controlling deflection in flexural members. (06)

   b) A rectangular simply supported beam of span 9m is of overall size 300x750mm reinforced with 8#20 on the tension side. The beam carries two concentrated loads of 125kN each at one third points. Characteristic strength of concrete and steel is M25 and Fe500 respectively. Exposure is moderate. Account for the self weight and the concentrated loads are characteristic loads. Calculate the surface crack widths at the following points: (14)

      i) Bottom corner of the beam
      ii) Below the centre of reinforcement
      iii) Below the centre between two bars

   Are the crack widths satisfying the code? Comment

UNIT – III

5. A precast T - beam with a flange width and flange thickness of 750 & 100 mm respectively. Effective span is 12m; superimposed working load on the beam is 35 kN/m (Account for the web self weight). Design the beam for flexure & shear. Check for deflection. Adopt M30 concrete & Fe500 steel. Sketch the details of reinforcements. Width of support = 300mm. Exposure is severe. Width and depth of web is 300 and 800mm respectively. (20)

6. a) Differentiate between equilibrium and compatibility torsion with sketches. (05)

   b) A cantilever beam is required with only tension steel. Clear span = 2.5m. The load consists of a UDL 25 kN/m (excluding self weight of the beam) over the entire span and a concentrated load of 50kN at the free end. The given loads are characteristic loads. The beam is continuous over one support and free at the other end. Design for flexure & shear. Adopt M30 concrete & Fe500 steel with severe exposure. Check for deflection. Sketch the details and comment on the problem. Width of support = 300mm. (15)

UNIT – IV

7. a) Discuss the structural behavior of one way and two way slabs. (05)

   b) The clear dimensions of a staircase hall are 2.5x5m with the floor to floor height being 3.6m. A two flight stair is to be provided between the floors. Design the overall geometry of the stairs. If the landing slab spans perpendicular to the flight and is supported on walls, design an intermediate flight. The flight is supported on the landing slabs. Adopt M25 concrete with moderate exposure & Fe500 steel. The stair is used inside a residential building. Landing slab need not be designed. Sketch the details of the flight. (15)

8. A framed building consists of slabs supported on beams. Design a slab of panel size 6500x4500mm (c/c of beams) without any intermediate supports subjected to a LL = 4.0kN/m^2, floor finish and light partitions = 2.5kN/m^2 Adopt moderate exposure with grade of concrete as M25 and grade of steel Fe500. The slab is discontinuous along one long edge only. Sketch the details. (20)

UNIT – V

9. a) Discuss the behavior of columns with varying slenderness ratio. (04)
   b) A rectangular column of size 300x600mm is subjected to an axial load of 3000kN at service condition. Adopting M40 concrete and Fe500 steel, design a suitable rectangular footing of uniform depth. SBC of soil at 2 m depth below GL is 250kN/m^2. The elements are subjected to extreme exposure. Sketch the details of reinforcement. The length to width ratio of footing is 2. (16)

10. a) Discuss the behavior of columns with lateral ties and spiral reinforcements subjected to axial load with sketches. (06)
    b) Design a column of unsupported length 3.2m to carry an axial load of 3000 kN & BMs of 200kNm and 100kNm at service conditions about both axis. The column is subjected to severe exposure with grade of concrete and steel being M30 and Fe500 respectively. Provide equal steel on all the faces. The columns are restrained in direction at both ends, while one end only is fixed in position. Sketch the reinforcement details. Size of the column is 375x750mm. (14)

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