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# MANIPAL UNIVERSITY

## SEVENTH SEMESTER B. ARCH. DEGREE EXAMINATION – NOVEMBER 2015

### SUBJECT: ARC 409 – STRUCTURES VII

(2010 SCHEME)

Monday, November 23, 2015

Time: 10:00 – 13:00 Hrs. Max. Marks: 50

- **Answer any FIVE FULL Questions.**
- **Use of IS 456 is permitted.**

1A. A reinforced concrete beam of rectangular section has 300mm width. It is reinforced with 3 bars of 20mm dia at an effective depth of 600mm. It is provided with 8mm dia two-legged stirrups at a spacing of 200mm. If M20 grade concrete and Fe 415 grade HYSD steel bars are used, estimate the following:

i) Maximum moment of resistance of the section

ii) Maximum shear strength of the section

1B. Enumerate three situation in which a doubly reinforced section becomes a necessity. What is the effect of the depth of cover to compression steel on its stress at ultimate load?

(6+4 = 10 marks)

2A. Determine the ultimate moment of resistance of a T-beam of the following specification:
Flange width = 45mm; Depth of flange = 150mm; Rib thickness = 300mm;
Effective depth = 440mm; Ast = 2100 mm2. Use M25 concrete and Fe 415 grade steel.

2B. Why is limitation of deflection in a structure called serviceability condition? What are the methods available in IS 456 to ensure that the deflection in a beam is within allowable limits?

(6+4 = 10 marks)

3A. Design an axially loaded column 400mm × 400mm fixed at both ends with an unsupported length of 3m for carrying factored load of 2300 kN. Use M20 concrete and Fe 415 grade steel.

3B. Design a R.C.C slab for a room of clear dimensions 4m × 5m. The slab is supported all around on walls of width 300mm.The slab has to carry a live load of $4kN/m^2$ and a floor finish load of $1kN/m^2$. Assume that the corners are held down. Use M20 concrete and HYSD bars of Fe 415 grade. Sketch the details of reinforcement.

(5+5 = 10 marks)

4A. A prestressed concrete beam supports an imposed load of 4 kN/m over an effective span of 10m. The beam has a rectangular section with a width of 200mm and depth of 600mm. Find

the effective pre-stressing force in cable if it is parabolic with an eccentricity of 100mm at the center and zero at the ends for the following condition:

i) If the bending effect of the pre-stressing force is nullified by the imposed load for the mid-span section (neglecting self-weight of the beam)

ii) If the resultant stress due to self-weight, imposed load and pre-stressing force is zero at the soffit of the beam for mid-span section (Assume unit weight of concrete to be $24kN/m^3$)

4B. How do you estimate loss of pre stress due to the following:

i) Elastic deformation of concrete

ii) Wobble effect of the cable

(6+4 = 10 marks)

5A. A pre-stressed concrete beam of size 40cm × 60 cm has a span of 6m, and is subjected to a uniformly distributed load of 16kN/m which includes the self- weight. Determine the extreme fibre stresses at the mid-span if:

i) Pre-stressing cables are along the longitudinal centroid-axis

ii) Pre-stressing cables are at the lower on third of the section.

5B. What are the various forms of pre-stressing steel?

(6+4 = 10 marks)

6A. What are various losses of pre-stress?

6B. Explain the concept of load-balancing in pre-stressed concrete

(5+5 = 10 marks)