Total No. of printed pages = 3

**CT-504/RCC/5th Sem/2014/N**

# DESIGN OF RCC STRUCTURES

Full Marks – 70

Pass Marks – 28

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. A reinforced concrete beam section of size 300 mm×500 mm is reinforced as follows : 14

   (i) 4 numbers of 12 mm diameter bars

   (ii) 3 numbers of 20 mm diameter bars

   For each case determine the extreme fibre stresses and allowable moment of resistance assuming M 20 grade concrete and Fe 415 steel.

2. Explain balanced, under-reinforced and over reinforced concrete sections with diagram. Show that for balanced concrete section

$$n_b = \frac{93.33}{93.33 + \sigma_{st}} \times d$$ where $n_b$ = balanced neutral

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axis depth and d = effective depth of the beam section. What is modular ratio ? How does creep of concrete affect the modular ratio ? 14

3. What is meant by limit state ? Discuss the different limit states to be considered in reinforced concrete design. A beam section is reinforced with 4 numbers of 25 mm diameter bars. Assuming M 20 grade concrete and Fe 415 grade steel, determine the ultimate moment of resistance. 14

4. (a) A reinforced concrete beam of size 300 ×500 effective depth is reinforced with 4 numbers of 20 mm diameter bars as tensile reinforcement. The shear reinforcement consist of 2-legged 8 mm diameter stirrup @ 150 mm centre to centre spacing. Estimate the shear capacity of the section for M 20 concrete and Fe 415 steel.

   (b) What is bond in reinforced concrete ? What are the mechanisms by which bond resistance is mobilised in reinforced concrete ? Explain clearly the difference between flexural bond and development bond. 8+6=14

5. What are one-way and two-way slabs ? Design a one-way slab with a clear span of 5.0m, simply supported on 230 mm thick masonry walls and subjected to a live load of 3 $kN/m^2$ and a surface finish load of 1 $kN/m^2$ using Fe 415 steel. Assume that the slab is subjected to very severe exposure condition. 14

6. What is meant by slenderness ratio of a compression member ? Classify columns based on slenderness ratios and define them. Distinguish between unsupported length and effective length of a compression member. 14

Table : Design stresses at specified strains for Fe 415.

| Strain | 0.00144 | 0.00163 | 0.00152 |
|---|---|---|---|
| Stress (MPa) | 288.7 | 306.7 | 324.8 |
| Strain | 0.00241 | 0.00276 | ≥ 0.0038 |
| Stress (MPa) | 342.8 | 351.8 | 360.9 |