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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## August 2024 Supplementary Examinations

**Programme: B.E.** **Semester: V**
**Branch: Civil Engineering** **Duration: 3 hrs.**
**Course Code: 20CV5PCDRC** **Max Marks: 100**
**Course: Design of RCC Structural Elements and CAD Lab**

**Instructions**: 1. Answer 5 full questions internal choice is given in unit 1 and 3.
2. Use of IS 456 2000 and only SP 16 charts for column design is permitted.
3. Assume missing data suitably and clearly state them.





### UNIT - I

| | | | |
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| 1 | a) | Explain characteristic load, characteristic strength and design strength of a material. | **06** |
| | b) | Obtain the expression for limiting depth of neutral axis. Also show that $x_{u\,lim}$ = 0.44 d for Fe 550 grade steel. | **06** |
| | c) | Determine moment of resistance for a rectangular beam section 230mm wide and 450mm overall depth. The beam is reinforced with 2 bars of 20mm diameter and 1 bar of 16 mm diameter on tension side with an effective cover of 40 mm. Use $f_{ck}$= 20 N/mm$^2$, fy= 250 N/mm$^2$. Also determine the limiting moment of resistance for the given section. | **08** |

**OR**

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|---|---|---|---|
| 2 | a) | Calculate the ultimate flexural strength for a T beam having the following section properties. Width of flange = 1000 mm, depth of flange = 100 mm, width of rib = 230 mm, effective depth = 510 mm, area of tensile steel = 5 bars of 20 mm diameter with an effective cover is 50 mm Adopt M20 grade of concrete and Fe 550 grade of steel. | **10** |
| | b) | A simply supported reinforced concrete beam has a section 250 mm wide and overall depth 500 mm. The support section is reinforced with 2 bars of 20 mm diameter and 2 bars of 16 mm diameter on tension side, out of these 1 bar of 16 mm diameter is bent-up bars, 2 bars of 12 mm diameter on compression. In addition the beam is provided two legged-vertical stirrups of 8 mm diameter are provided at a spacing of 200 mm. Using M20 grade concrete and Fe 415 grade of steel, estimate the shear strength of the support section. Take effective cover as 50 mm. | **10** |

### UNIT - II

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| 3 | | Design a simply supported RC rectangular beam over an effective span of 5.50m. The size of the beam is limited to 230 x 500 mm overall, the beam carries a superimposed load is 35 kN/m. Use M20 grade of concrete and Fe 415 grade of steel. Also design the shear reinforcement. Assume effective cover as 50mm. | **20** |

## UNIT - III

4 Design a two way slab for a hall measuring 4.5 m x 6m with one long edge discontinuous. Assume a live load of is 4.5 kN/$m^2$, floor finish = 0.50 kN/$m^2$. Use M20 grade of concrete and Fe 415 grade of steel. Sketch the reinforcement details. **20**

**OR**

5 a) Explain limit state of serviceability with respect to deflection. **05**

b) A cantilever slab 100 mm thick having a span 1.80 m is reinforced with 10 mm diameter bars 225 mm centre to centre at an effective cover of 25 mm. Use M20 grade and Fe 415 steel of grade, shrinkage strain is 0.0003 for the slab, when it carries imposed load of 1.50kN/$m^2$ and floor finish 0.20 kN/$m^2$. Permanent load may be assumed to be 70% of the live load in addition to its self weight. Calculate the short term deflection. Also calculate deflection due to shrinkage. **15**

## UNIT - IV

6 a) A column 230 mm x 450 mm in section and reinforced with 6 Nos. of 16 mm diameter of grade Fe 415, determine the ultimate strength in axial compression for concrete of grade M20, if unsupported length of column is 3.0 m. Also determine the ultimate strength in axial compression for mild steel. **08**

b) Design reinforcement in a rectangular column of size 300 mm x 400 mm carries a factored load as 1200 kN and moment as 100 kNm. The column has an unsupported length of 3.0m and its ends are effectively held in position at both ends, but not restrained against rotation. Use concrete of grade M20 and steel of grade Fe 415. Assume effective cover as 40 mm. Provide the reinforcement on two sides. **12**

## UNIT - V

7 Design a rectangular footing of column of size 300 mm x 300 mm, to carry an axial load of 1000 kN. The safe bearing capacity of soil is 210 kN/$m^2$. Use M20 grade of concrete and Fe 415. One side of footing width is 2.20m wide. Sketch the reinforcement details. **20**

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