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Sixth Semester B.E. Degree Examination, July/August 2021
Design and Drawing of RC Structures

Time: 4 hrs.

Max. Marks:100

Note: 1. Answer any TWO full questions from Part-A, ONE from Part-B.**2. Use of IS456, SP16, IS3370, IS456-2000 is permitted.****PART - A**

- 1** A rectangular beam of cross section 300×600 mm is supported on 4 columns which are equally spaced at 4.0 m C/C. The columns are 300×300 mm in section.
 Beam Reinforcements :
 Positive (Sagging) reinforcements – 6 – #16 mm out of which 2 bars are to be antailed.
 Negative reinforcement at supports – 4 – #16 mm anchor bars 2 – #16 mm
 Stirrups - #8 @ 200 mm C/C throughout M20 grade of concrete and Fe415 steel are used.
 Draw longitudinal section and important cross sections. **(20 Marks)**
- 2** A rectangular slab is provided over a room of clear dimensions $4.2\text{m} \times 5.4\text{m}$ supported over 230 mm wall. With four edges discontinuous and corners prevented from lifting. Slab thickness is 130 mm.
 Shorter span reinforcement - # 10 mm @ 150 C/C
 Longer span reinforcement - # 10 mm @ 225 C/C.
 Edge strip reinforcement # 8 mm @ 200 C/C.
 Torsional reinforcement # 8 mm @ 200 C/C in 4 layers.
 Draw (i) Plan showing reinforcement details. **(10 Marks)**
 (ii) Cross section along shorter span. **(05 Marks)**
 (iii) Cross section along longer span. **(05 Marks)**
- 3** An isolated RCC column and footing has the following details:
 Height of column above GL = 3.0 m
 Depth of footing below GL = 1.5 m
 Column size $230\text{mm} \times 600\text{mm}$
 Size of footing $2.20\text{ m} \times 2.80\text{ m}$
 Thickness of footing 750 mm at the face of column tapers to 300 mm along the edges.
 Reinforcements
 Column : #25 – 8 numbers distributed along longer face of the column
 #20 – 2 numbers one each at the middle of the shorter side of column.
 lateral tier - # 8 @ 200 C/C
 Footing : # 12 @ 150 mm C/C – Parallel to shorter side
 # 12 @ 210 mm C/C – Parallel to longer side
 Draw
 (i) Sectional Elevation of column and Footing. **(08 Marks)**
 (ii) Sectional Plan of column and Footing showing reinforcement details. **(04 Marks)**
 (iii) Bar Bending schedule **(08 Marks)**
- 4** A rectangular beam of cross section $300 \times 450\text{mm}$ is supported on 5 columns which are equally spaced at a c/c distance of 3.3m. The columns are $300 \times 300\text{mm}$ in section. The reinforcement in beam consists of 4 bars of 16mm dia (+ve reinforcement) at midspan and 4 bars of 16mm dia at all supports (–ve reinforcement). 2 bars of +ve reinforcement have been curtailed near each support. Anchor bars consists of 2 – 16mm dia. Stirrups are of 8mm dia. 2 legged vertical at 200 c/c. Draw longitudinal section and important cross sections. Grade of concrete M20 and steel Fe 415 grade. **(20 Marks)**

5 A dog legged staircase is to be detailed with the following particulars :

Size of stair case room	= 2200 × 4600mm
Width of flight	= 1050mm
Width of landing	= 1050 mm
Number of treads in each flight	= 10
Thread	= 250mm and
Rise	= 150mm
Wall thickness	= 230mm all-round
Waist slab thickness	= 150mm
Main steel	= 120mm HYSD bars @ 100 c/c and
Distribution steel for each flight	8mm = @ 200 c/c
First flight starts from ground floor level (GFL) and foundation is 750mm below GFL :	
Second flight rests on wall. Draw to a suitable scale	

- Plan
 - Section along first flight
 - Section along second flight.
- (20 Marks)

PART – B

6 Design a counterfort type retaining wall to support the earth of height 6.2 m above ground level. Top surface of backfill is horizontal. The SBC of soil at a depth of 1.3 m below GL is 180 kN/m². Angle of repose = 30°, Unit weight 18 kN/m³ and coefficient of friction between wall and soil is 0.55. Spacing between counterforts 3.0 m C/C

Use M20 grade of concrete and Fe415 grade steel. (40 Marks)

Draw (i) Cross section at midway between counterfort. (06 Marks)

(ii) Cross section through counterfort. (10 Marks)

(iii) Sectional plan. (04 Marks)

7 Design a hinged box portal frame with the following details:

Spacing of frames 3.6 m C/C

Height of column above hinge = 4.0 m

Distance between the centres of column = 8.0 m

Thickness of RC slab = 125 mm continuous over the portal frames.

Live load on roof = 2.0 kN/m².

SBC of soil at a depth of 1.2 m below ground level = 150 kN/m²

Size of beam is restricted to 230 mm × 500 mm and column 230 mm × 400 mm

Materials : M20 grade concrete and Fe415 steel. (40 Marks)

Draw : (i) Sectional Elevation showing details of slab reinforcements. (04 Marks)

(ii) Sectional Elevation showing details of reinforcements in Beam, Column and Footing. (10 Marks)

(iii) Typical cross sections of beam and column. (03 Marks)

(iv) Plan showing footing reinforcement. (03 Marks)

8 Design a cantilever retaining wall to retain earth embankment 4.75m height above ground level. The density of earth 18kN/m³ and its angle of repose - 30°. The embankment is horizontal at the top. SBC of the soil may be taken as 200 kN/m² available at 1.25m below ground level the coefficient of friction between soil and concrete is 0.5. Adopt M20 grade of concrete and Fe 415 steel. (40 Marks)

Draw to a suitable scale :

- Cross sectional elevation
- Longitudinal section showing stem reinforcement and curtailment—for a length of 2m.
- Section showing heel and toe reinforcement. (20 Marks)

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