Total No. of Questions : 9]

SEAT No. :

P2575

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# [5257]-5002

## T. Y. B. Arch.

## THEORY OF STRUCTURES - V

## (2015 Pattern)

*Time : 3 Hours]* *[Max. Marks : 70*

***Instructions to the candidates:***

1) ***Solve Any Three Questions From Each Section***
2) ***Figures to the right indicate full marks***
3) ***Assume suitable data where necessary only***
4) ***Use M 20 Grade concrete and Fe 500 grade steel***
5) ***Every R. C. C. Design should be accompanied by relevant Schedule and Re-inforcement Sketch.***
6) ***Use of non-programmable Calculators Allowed.***

### SECTION - I (Solve any Three)

***Q1)*** Design the Staircase Slab of the Building Shown in the accompanying sketch. Tread = 290mm, Number of Treads in each Flight = 11, Floor to Floor Height = 3800, Mid Landing = Upper Landing = 1400mm. The Staircase Slab is Supported on 230mm wide Beams on the Inner Edges of the Landings. **[12]**

***Q2)*** a) Design the Beam B2 as a L Beam across span 6.8m. Restrict the overall depth to 550mm. Assume Slab Depth = 120 of Slab S1 & S2 Take Live Load as 4kN/$m^2$. Design for Flexure only **[8]**

b) State the Advantages of a T Beam. Explain how to calculate the Flange Width of a L Beam. **[4]**

***P.T.O.***

***Q3)*** Design Beam B4 as a Doubly Reinforced Beam of Clear Span 7.39m to carry an u.d.l of 24kN/m. Restrict the Overall depth to 550mm. Design for flexure and Shear. **[12]**

**Table 19 Design Shear Strength of Concrete, $\tau_c$, N/mm²**

*(Clauses* 40.2.1, 40.2.2, 40.3, 40.4, 40.5.3, 41.3.2, 41.3.3 *and* 41.4.3)

| $100\frac{A_s}{bd}$ | Concrete Grade | | |
|---|---|---|---|
| | M 15 | M 20 | M 25 |
| (1) | (2) | (3) | (4) |
| ≤ 0.15 | 0.28 | 0.28 | 0.29 |
| 0.25 | 0.35 | 0.36 | 0.36 |
| 0.50 | 0.46 | 0.48 | 0.49 |
| 0.75 | 0.54 | 0.56 | 0.57 |
| 1.00 | 0.60 | 0.62 | 0.64 |
| 1.25 | 0.64 | 0.67 | 0.70 |
| 1.50 | 0.68 | 0.72 | 0.74 |
| 1.75 | 0.71 | 0.75 | 0.78 |
| 2.00 | 0.71 | 0.79 | 0.82 |
| 2.25 | 0.71 | 0.81 | 0.85 |
| 2.50 | 0.71 | 0.82 | 0.88 |
| 2.75 | 0.71 | 0.82 | 0.90 |
| 3.00 | 0.71 | 0.82 | 0.92 |

| fy in N/mm² | d'/de | | | |
|---|---|---|---|---|
| | 0.05 | 0.1 | 0.15 | 0.2 |
| fsc for fy = 415 N/mm² | 355 | 353 | 342 | 329 |
| fsc for fy = 500 N/mm² | 424 | 412 | 395 | 370 |

***Q4)*** a) Write Short Notes on any two of the Following drawing sketches wherever necessary **[6]**

i) Piles - Need, Explain any two Types of Piles briefly

ii) Different Types of Deep Foundations.

iii) Reinforcement Detailing in a Central Stringer Beam Staircase with Cantilever Treads.

iv) Write down the assumptions in Rankine's theory of Earth Pressure

b) Draw the Reinforcement Detail of the Slabs S1. -S2-S1 from the Schedule given below **[5]**

**Slab Schedule**

| Slab | Depth | Steel along shorter span | | Steel Along Longer Span | Remark |
|---|---|---|---|---|---|
| | | Bottom Reinforcement | Top Reinforcement at Supports | | |
| S1 | 120 | 10Φ @ 200c/c | 10Φ@180c/c | 8Φ @ 325c/c | One way Continuous |
| S2 | 120 | 10Φ @ 250c/c | 10Φ@180c/c | 8Φ @ 325c/c | One way Continuous |
| | | | | | |

## SECTION - II (SOLVE ANY THREE)

***Q5)*** An U.C.R Masonry wall is to be provided to retain Earth on its Vertical Face. Density of Retained Earth = 16kN/$m^3$, Density of Masonary = 25kN/$m^3$ Top Width of Wall = 1.2m, Take Bottom Width of wall = 0.6h Height of Wall = 4.8m = h, Angle of Repose = 30°, Coefficient of Friction $\mu$ = 0.6, S.B.C of Soil = 225kN/$m^2$. Check the Stability of the wall with respect to Overturning and Sliding and Calculate Maximum and Minimum Pressure at Base **[12]**

***Q6)*** a) Explain the Dis-Advantages of Pre- Stressed Constructions over conventional R.C.C Construction. **[4]**

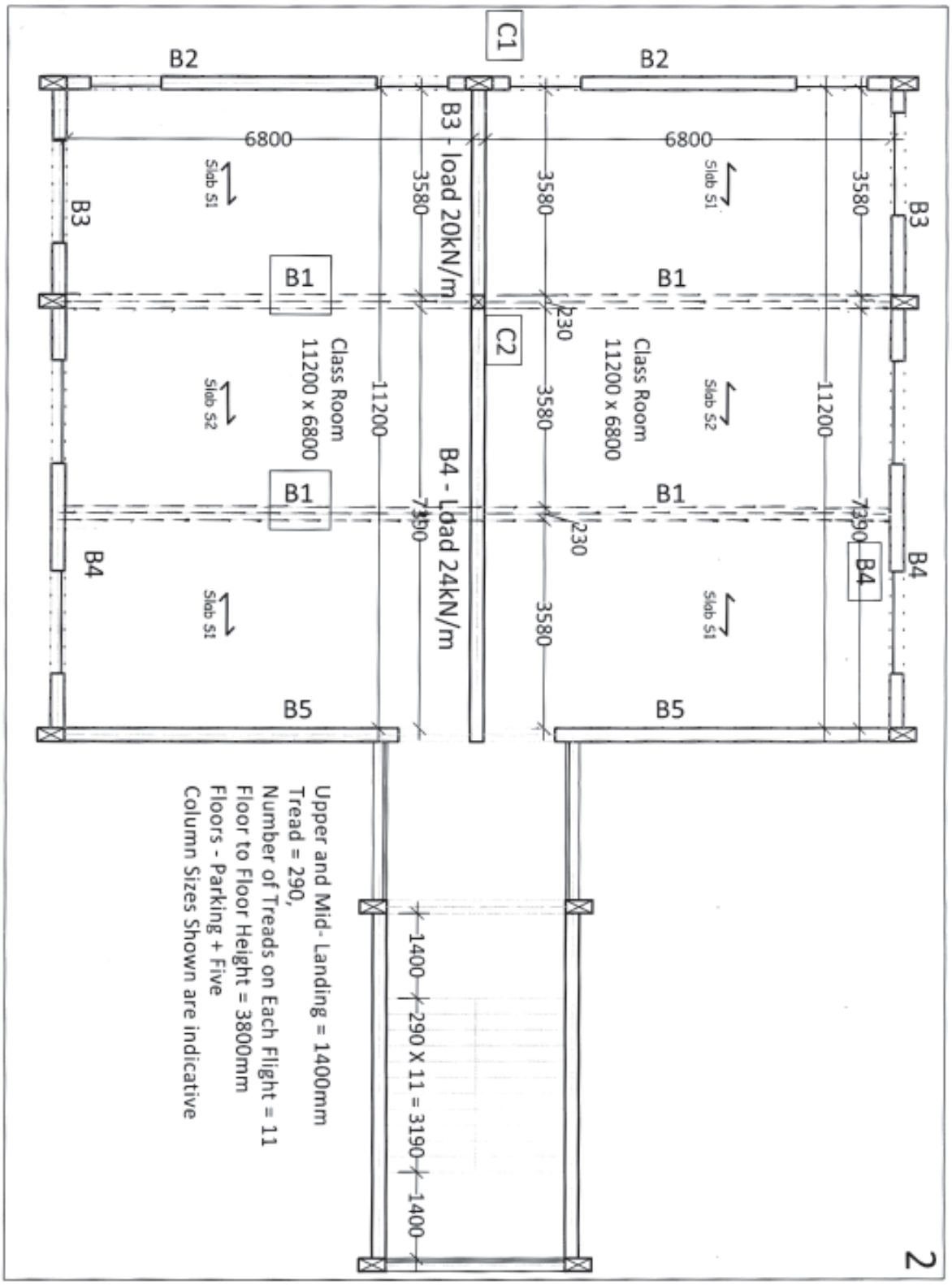
b) A Pre- stressed beam of size 300 x 700 is simple supported on a span of 11m. It carries an udl of 35 kN/m over its entire span inclusive of its self-weight. It is pre-stressed by tendons supplying 2200 kN force which are placed at 125mm below the neutral axis. Calculate the extreme fiber stresses at end span (support) and at mid span. **[8]**

***Q7)*** a) Two Columns of size 300 x 300 and 400 x 400 spaced 2.0m apart rest in a Soil of S.B.C 200kN/$m^2$. They carry loads of 600kN and 1100 kN respectively. Design the combined footing in plan only. Take Length of the footing as 2.0 times the width. **[8]**

b) Write a Short Note on Raft Foundation - Need and Advantages **[3]**

OR

***Q8)*** Find the Load acting on column C1 per floor. Assume Load on B2 to be 38kN/m and Load on B3 to be 20kN/m. Calculate Load on every Floor considering Parking + 5 Floors. Design Column on First Floor using 3% steel and take one side as 230. Keep the length the same and change the width and design Column on Parking Floor. Draw Sketch of reinforcement of both the columns. **[12]**



***Q9)*** Design the Isolated Pad Footing of a Column 250 x 650 to carry a load of 1600kN in a Soil of S.B.C 240KN/$m^2$. Check for Single Shear. Draw Sketch of Reinforcement. **[11]**