Total No. of Questions : 10]

SEAT No. :

**P2144**

[Total No. of Pages : 3

# [5059]-503
## B.E. (Civil)
## STRUCTURAL DESIGN AND DRAWING-III
## (2012 Course) (Semester-I) (End Semester) (401003)

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

***Instructions to the candidates:***

1) ***Answer Q.1 or Q.2, Q.3 or Q.4; Q.5 or Q.6; Q.7 or Q.8; and Q.9 or Q.10.***
2) ***Figures in bold to the right, indicate full marks.***
3) ***IS 456, IS 1343, IS 3370 and IS 13920 are allowed in the examination.***
4) ***The designs should comply with the latest codal provisions.***
5) ***If necessary, assume suitable data and indicate clearly.***
6) ***Use of electronic pocket calculator is allowed.***

***Q1)*** a) Explain P-line and C-line with neat sketches. **[4]**

b) A simply supported prestressed concrete beam 350 mm × 800 mm has span of 10m and supports a live load of 25 kN/m. The beam is post tensioned by cable having cross sectional area 1200 $mm^2$. The cable eccentricity is zero at support and varies parabolically to 250 mm at the mid-span. The initial prestressing force is 1350 kN and loss ratio is 0.78 determine the stresses at transfer and service condition at mid span. Take unit weight of presressed concrete as 24 $kN/m^3$. **[6]**

OR

***Q2)*** a) Explain the concept of prestressing a structural element. Also explain pretensioning and post tensioning methods with neat sketches. **[6]**

b) The overall dimension of an end block of a post tensioned beam is 400 mm × 800 mm. The girder is prestressed by a single cable comprising of 12 strands. The strands used are 12.7 mm; 7-ply strand with the nominal area of 92.9 $mm^2$ and breaking load of 160 kN as per IS 6006. Design the bearing plate given that $f_{ck}$ = 35 MPa and $f_{ci}$ = 28 MPa. **[4]**

***Q3)*** a) Determine the ultimate moment of resistance of a post tensioned box section having bonded tendons. The box section has outer dimensions of 750 mm × 1200 mm and inner dimensions of 550 mm ×800 mm. The total cross sectional area of the tendons is 1000 $mm^2$ with the centroid at the distance of 100mm from the soffit. Take $f_{ck}$ = 40 MPa, $f_p$ = 1800 MPa and $f_{pe} = 0.7\ f_p$. **[4]**

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

b) A four storey building has the following data: **[6]**

- Overall plan dimension = 20m × 16m
- Number of bays 4m each in X direction = 5
- Number of bays 4m each in Z direction = 4
- First storey height = 4m
- Height of $2^{nd}$, $3^{rd}$, and $4^{th}$ storey = 3.0m
- Size of beams = 300 mm × 600 mm
- Size of columns = 500 mm × 400 mm
- Slab thickness = 150 mm
- Live load = 3.5 kN/$m^2$ on floors and 2 kN/$m^2$ on roof
- External masonary walls of thickness 230 mm and internal walls of 115 mm thickness have been provided.
- Building located in Pune on hard strata with 5% damping evaluate the seismic weight of each floor and hence total seismic weight of building Calculate the base shear using seismic coefficient method.

OR

***Q4)*** a) How are lateral loads analyzed in multistoried buildings? Explain any one method. **[4]**

b) Design the three span continuous beam PQRS for combined effect of lateral and gravity loads for flexure only. The three beams have equal span of 5m. The design data for the beam is $M_p(-)$ = 88.07 kNm; $M_Q(-)$ = 137.92 kNm; $M_{PQ}(+)$ = 84.41 kNm and $M_{QR}(+)$ = 61.45 kNm. Moments due to lateral load is 108 kNm. Draw the details of reinforcement as per IS 13920. **[6]**

***Q5)*** A T-shaped retaining wall is to be provided to retain a horizontal leveled backfill of height 4.5m. The backfill has unit weight of 17 kN/$m^3$, angle of repose = 30°, coefficient of friction between concrete and soil = 0.55, SBC of soil = 180 kN/$m^2$, depth of foundation = 1.0m. Perform stability analysis and design the stem. Sketch the reinforcement along with curtailment of reinforcement. **[16]**

OR

***Q6)*** Design an inverted L-shaped retaining having stem and toe to retain a backfill of 2.8m. The backfill is horizontal and the unit weight of the soil is 17 kN/$m^3$, angle of repose = 30°, SBC of soil = 180 kN/$m^2$, good foundation is available at a depth of 1.0m. Design and sketch the details of reinforcement in the wall and toe slab. **[16]**

***Q7)*** Two columns C1 and C2 of size 400mm × 400mm are spaced at 3.0m apart carrying a service load of 650 kN and 800 kN respectively. C1 is boundary column, Design a slab beam type combined footing. Safe bearing pressure on soil is 180 kN/$m^2$. Use M30 grade of concrete and steel of grade Fe 500. **[16]**

OR

***Q8)*** Design a slab type combined footing for two columns spaced 3m apart carrying a service load of 800 kN and 1000 kN each. The columns are 230 mm × 400mm and 230 mm × 500mm respectively. The SBC of soil is 180 kN/$m^2$. Use M30 grade of concrete and steel of grade Fe 500. **[16]**

***Q9)*** Design a rectangular water tank resting on ground. The tank dimensions are 7m × 3m × 3m high. Use M30 and Fe 500 grade material. Sketch details of reinforcement. **[18]**

OR

***Q10)***a) Design the circular water tank of 10m diameter and 5m height with rigid base. Use M 30 and Fe 500 grade material. Sketch details of reinforcement. **[10]**

b) Explain step-by-step procedure of finding crack width for a wall of rectangular water tank. **[8]**

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