BCE-041

Diploma in Civil Engineering

Term-End Examination

June, 2012

00819

BCE-041 : THEORY OF STRUCTURES II

Time : 2 hours *Maximum Marks : 70*

Note : *Question number **1** is **compulsory**. Attempt any other **four** questions. In all solve **five** questions. All questions carry **equal** marks. Assume suitable data wherever necessary and mention it clearly. Use of calculator is **allowed**. Use of IS456 code is **not** permitted.*

1. Choose the most appropriate answer from the given alternatives. **7x2=14**

(a) In Limit-State method of design of concrete structures for the flexural members, the area of the stress block per unit width of the beam is :

(i) 0.42 fck x_u (ii) 0.45 fck x_u

(iii) 0.87 fck x_u (iv) 0.36 fck x_u

(b) The maximum longitudinal Compressive reinforcement in a column is provided as a percentage of the gross area of the column. This percentage is :

(i) 0.8 (ii) 8.0

(iii) 6.0 (iv) 4.0

(c) The maximum tensile reinforcement in a beam shall be provided as a percentage of the gross sectional area of the beam. This percentage is :

(i) 2 (ii) 3

(iii) 4 (iv) 6

(d) In Limit-state method for the design of RCC flexural members the stress strain relationship of concrete is assumed to be parabolic upto a certain strain. This strain is :

(i) 0.35% (ii) 0.30%

(iii) 0.25% (iv) 0.20%

(e) In Limit-State method for the design of RCC flexural members the maximum strain in concrete is assumed as :

(i) 0.35% (ii) 0.3%

(iii) 0.25% (iv) 0.2%

(f) The minimum tensile reinforcement in beams is provided as a percentage of the gross sectional area of the beam. This percentage for steel of grade Fe 415 is :

(i) 0.15 (ii) 0.20

(iii) 0.12 (iv) 0.34

(g) The pitch of helical ties in a circular column shall not be more than :

(i) 100 mm

(ii) 75mm

(iii) $\frac{1}{6}$ of the diameter of concrete core

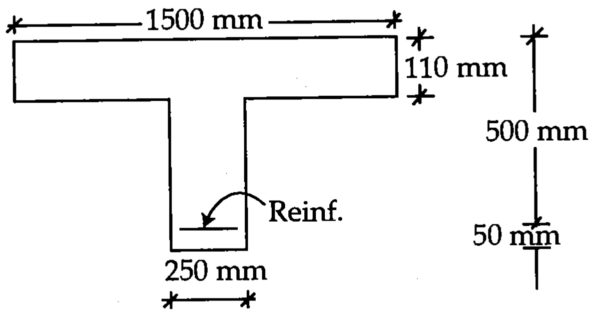
(iv) least of (i) , (ii) and (iii)

2. Design the slab of an office floor having an effective size of 3.0m x 6.5m. This slab is simply supported on 250mm thick masonary walls on all four sides. This slab has to carry an imposed load of 4 kN/m^2. Assume a suitable floor finish load, concrete of grade M20 and steel of grade Fe 415. **14**

3. (a) Mention basic assumptions made in the theory for the design of reinforced concrete flexural members by working stress method. **7**

   (b) Draw the strain and stress diagrams for a singly reinforced rectangular section to be designed by working stress method and determine the depth of the neutral axis for a balanced section. **7**

4. The T-beam shown below is simply supported on 250mm thick walls and has a clear span of 7m. This T-beam has to carry a uniformly distributed load of 40 kN/m (service load excluding its self weight). Design the tensile reinforcement for the beam adopting M25 grade of concrete and Fe 415 grade of steel. **14**



5. Design the longitudinal and transverse reinforcement for a circular column of diameter 300 mm and carrying a factored load of 1200 KN. The unsupported length of the column is 3.0 m with both ends effectively held in position but not restrained against rotation. Adopt concrete of grade M20 and steel of grade Fe 415. **14**

6. Determine the moment of resistance and number of 16ϕ bars required for a reinforced concrete rectangular beam of 250 mm width and overall depth of 550 mm. Use an effective cover of 50 mm, M25 grade of concrete and steel of grade Fe 415. Permissible stress in steel $\sigma_{st} = 230$ N/mm^2 and in concrete $\sigma_{cbc} = 8.5$ N/mm^2. The modular ratio m can be taken as 11. **14**

7. (a) Mention the critical sections for bending moment and shear force for a reinforced concrete wall footing by means of neat sketches. **7**

   (b) Derive the formulae for maximum bending moment and shear force for the design of concrete wall footing using the sketches drawn in 7(a) above. **7**

8. Write short notes on *any four* of the following :
   (a) Embedment length for reinforcement. **4x3½=14**
   (b) Effective flange width of L-Beams
   (c) Limit-State of serviceability
   (d) Types of Staircases
   (e) Retaining walls
   (f) Considerations of slenderness ratio in the design of compression members.

Note: ***The following design data may be used wherever required.***

(a) Design Shear strength τ_c of concrete in N/mm^2 (Limit-State method):

100 A_{st}/bd	Concrete M20	Concrete M25
0.15	0.28	0.29
0.25	0.36	0.36
0.50	0.48	0.49
0.75	0.56	0.57
1.00	0.62	0.64
0.25	0.67	0.70
1.50	0.72	0.74
1.75	0.75	0.78
2.00	0.79	0.82
2.25	0.81	0.85
2.50	0.82	0.88
2.75	0.82	0.90

(b) Design Bond stress τ_{bd} N/mm^2 (Limit-State method) for bars in tension.

	Steel Fe 250	Steel Fe 415
Concrete M20	1.20	1.92
Concrete M25	1.40	2.24

(c) Design shear strength of concrete τ_c max. N/mm^2 (Limit-State method).

Concrete M20 2.8

Concrete M25 3.1

(d) For solid slabs, design shear strength of concrete shall be taken as K τ_c. The values of K are as below:

Overall depth of slab (mm)	K
300 or more	1.00
275	1.105
250	1.10
225	1.15
200	1.20
175	1.25
150 or less	1.30

(e) Modification factor K_2 for different percentages of tension reinforcement A_{st} in flexural RCC members for stress in steel at service loads, $f_s = 240 \text{ N/mm}^2$, may be taken as below:

100 A_{st}/bd	**K_2**
0.2	1.7
0.4	1.32
0.6	1.15
0.8	1.05
1.0	1.0
1.2	0.95
1.4	0.90
1.6	0.88
1.8	0.86
2.0	0.84
2.2	0.82
2.4	0.80
2.6	0.79
2.8	0.78