

2020

RANK *Improvement* **WORKBOOK**



**Answer key and Hint of
Objective & Conventional Questions**

Civil Engineering

Design of Concrete and Masonry Structures



MADE EASY
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LEVEL 1 Objective Questions

1. (c)

2. (d)

3. (a)

4. (b)

LEVEL 2 Objective Questions

5. (50)

6. (a)

7. (c)

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8. (c)

9. (d)

10. (a)

11. (c)

12. (b)

13. (b)

14. (c)

15. (a)

16. (b)

17. (c)

■■■■

2

Shear, Torsion, Bond, Anchorage and Development Length

LEVEL 1 Objective Questions

1. (c)
2. (6.4)
3. (a)
4. (c)
5. (a)

LEVEL 2 Objective Questions

6. (d)
7. (d)
8. (a)
9. (b)
10. (c)
11. (a)

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12. (a)
13. (c)
14. (b)
15. (216 mm)
16. (132 mm²)
17. (a)
18. (b)
19. (46.875 ϕ)
20. (a)
21. (d)
22. (82 mm)

LEVEL 3 Conventional Questions

Solution : 4
Safe in bond.

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3

Beams, Slabs, Columns and Footings

LEVEL 1 Objective Questions

1. (a)
2. (a)
3. (a)
4. (b)
5. (b)
6. (b)
7. (d)
8. (a)
9. (78 mm)
10. (814 mm²)
11. (c)
12. ($e_x = 28$ mm, $e_y = 20$ mm)

LEVEL 2 Objective Questions

13. (*)
14. (b)
15. (a)
16. (d)

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17. (1763.4 kN)
18. (d)
19. (a)
20. (3-25 ϕ)
21. (0.20 N/mm²)
22. (4221 mm²)
23. (204.35 kN-m)
24. (1.064 N/mm²)
25. (0.8125 N/mm²)
26. (1.22)
27. (b)
28. (a)
29. (b)
30. (a)
31. (b)
32. (2-12 mm ϕ)
33. (925.3 kN)
34. (c)

LEVEL 3 Conventional Solutions**Solution : 1**

(a) $M_u = 4354.3 \text{ kN-m.}$

(b) 52.92 kN/m

Solution : 2

$$324.14 \text{ mm}^2$$

Solution : 4

$$M_{u \text{ lim}} = 691.73 \text{ kNm, } P_t\% = 1.2916\%$$

Solution : 5

$$\text{Safe concentrated load} = 27.41 \text{ kN}$$

$$\text{and Safe UDL} = 13.4 \text{ kN/m}$$

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4

Prestressed Concrete

LEVEL 1 Objective Questions

1. (a)
2. (150 mm)
3. (61.7 kN)
4. (b)
5. (d)

LEVEL 2 Objective Questions

6. (85 N/mm²)
7. (d)
8. (c)
9. (b)
10. (140 kN-m)
11. (c)
12. (b)
13. (0.5664 mm)
14. (1.55)
15. (10 mm)
16. (a)
17. (d)
18. (*)

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19. (a)
20. (a)
21. (b)
22. (86.20 kN-m)
23. (32 N/mm²)
24. (0.15 m)
25. (15.27 mm)

LEVEL 3 Conventional Questions

Solution : 1

- (i) $f_{\text{top}} = 2.172 \text{ MPa}$, $f_{\text{bottom}} = 7.728 \text{ MPa}$
- (ii) Max comp. stress = 11.172 MPa
- (iii) Load factor = 1.47

Solution : 2

- (i) Min. possible depth = 855.35 mm say 860 mm
- (ii) Min prestressing force = 1586.2 kN, eccentricity = 228.46 mm

Solution : 3

At transfer

$$f_{\text{top}} = 1.96 \text{ MPa}$$

$$f_{\text{bottom}} = 8.94 \text{ MPa}$$

At service load condition

$$f_{\text{top}} = 13.03 \text{ MPa}$$

$$f_{\text{bottom}} = -3.75 \text{ MPa}$$

Solution : 4

At transfer

$$f_{\text{top}} = 0.784 \text{ MPa}$$

$$f_{\text{bottom}} = 11.716 \text{ MPa}$$

At final stage

$$f_{\text{top}} = 9.228 \text{ MPa}$$

$$f_{\text{bottom}} = 0.972 \text{ MPa}$$

Solution : 5

Due to elastic deformation = 58.68 MPa

Due to creep of concrete = 93.89 MPa

Due to creep of steel = 90 MPa

Due to shrinkage of concrete = 63 MPa

Solution : 6

(i) 15 mm deflection

(ii) Final deflection = 8.54 mm

Solution : 7

Min. prestressing force = 6151.58 kN

UDL = 28 kN/m

Eccentricity = 1283.35 mm

Solution : 8

Loss due to

(i) Elastic shortening = 56.2 MPa

(ii) Creep of concrete = 79.3 MPa

(iii) Shrinkage of concrete = 60 MPa

(iv) Relaxation of steel = 40 MPa

Solution : 9

Stress at transfer stage

$$f_t = -0.090 \text{ N/mm}^2$$

$$f_b = 14.483 \text{ N/mm}^2$$

At final stage

$$f_t = 10.97 \text{ N/mm}^2$$

$$f_b = -0.6241 \text{ N/mm}^2$$

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LEVEL 1 Objective Questions

1. (a)

2. (a)

3. (c)

4. (d)

5. (a)

LEVEL 2 Objective Questions

6. (c)

7. (a)

8. (d)

9. (c)

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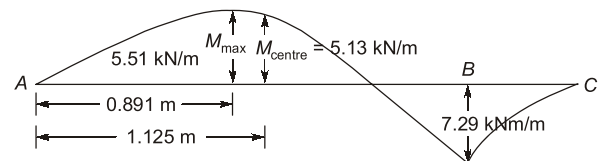
LEVEL 3 Conventional Questions

Solution : 1

σ_{cbt} = Stress in concrete in bending tension
= 0.177 MPa

f_{ct} = Direct tensile stress in concrete
= 0.38 MPa

f_{st} = Stress in steel = 37.23 MPa



Bending moment diagram

Solution : 6

$(FOS)_{\text{over-turning}} = 2.21$

$(FOS)_{\text{sliding}} = 0.971$

Solution : 7

Base pressures = 108.96 kN/m² and 3.37 kN/m²

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