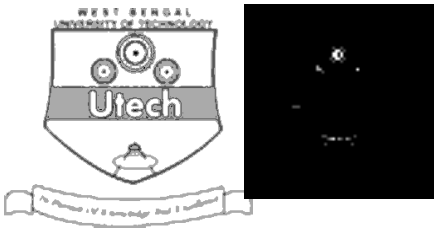
STRUCTURAL DESIGN-I (SEMESTER - 4)

CS/B.Tech (CE)/SEM-4/CE-405/09



1. .....
Signature of Invigilator

2. .....
Signature of the Officer-in-Charge

Reg. No. | | | | | | | | | | | | | | |

Roll No. of the Candidate | | | | | | | | | | | | | | |

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CS/B.Tech (CE)/SEM-4/CE-405/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

STRUCTURAL DESIGN-I (SEMESTER - 4)

Time : 3 Hours] [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **36 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
   b) For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

	Group – A										Group – B				Group – C				
Question Number																	***Total Marks***	***Examiner's Signature***
Marks Obtained																		

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Head-Examiner/Co-Ordinator/Scrutineer

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GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) According to IS 456-2000, the mudulus of elasticity of conrete E_c (in N/mm^2) can be taken as

a) $5700\sqrt{f_{ck}}$ b) $570\sqrt{f_{ck}}$

c) $5000 f_{ck}$ d) $5000\sqrt{f_{ck}}$ ☐

ii) Lever arm co-efficient in working stress method depends on

a) σ_{cbc} only b) σ_{st} only

c) both σ_{cbc} & σ_{st} d) none of these. ☐

iii) Limit state of serviceability of concrete section should satisfy

a) cracking, deflection and maximum compression

b) cracking only

c) deflection and cracking

d) deflection and maximum compression. ☐

iv) The maximum shear stress (q_{max}) in a rectangular beam is

a) 1.25 times the average

b) 1.50 times the average

c) 1.75 times the average

d) 2.0 times the average. ☐

v) The maximum shear stress (q) in concrete of a reinforced cement concrete beam is

a) shear force/lever arm ∝ width

b) lever arm/shear force ∝ width

c) width/lever arm ∝ shear force

d) shear force ∝ width/lever arm. ☐

vi) If the average bonding stress is 0.6 N/mm^2 for M-15 grade concrete, the length of embedment of a bar of diameter d according to IS 456 specification is

a) 28d b) 38d

c) 48d d) 58d. ☐

vii) The minimum percentage of tension reinforcement in RCC beams is

a) $0{\cdot}85/f_y$ b) 0·4

c) 4·0 d) $40\ S_v/f_y.d$ ☐

viii) The deflection including the effect of temperature, creep and shrinkage after erection of partitions and the application of finishes should not normally exceed

a) span/250

b) span/250 or 20 mm whichever is less

c) span/350

d) span/350 or 20 mm whichever is less. ☐

ix) The main reinforcement in RCC cantilever members is placed at

a) top fibre b) side fibres

c) bottom fibre d) top and bottom fibres. ☐

x) The diameter of longitudinal bars of a column should never be less than

a) 6 mmb) 8 mm

c) 10 mm d) 12 mm. ☐

xi) According to load factor method, the permissible load W on a short column reinforced with longitudinal bars and lateral stirrups is

a) stress in concrete ∞ area of concrete

b) stress in steel ∞ area of steel

c) (stress in concrete ∞ area of concrete) + (stress in steel ∞ area of steel)

d) none of these. ☐

xii) A RCC column is regarded as long column if the ratio of its effective length and lateral dimensions exceeds

a) 10 b) 15

c) 20 d) 12.

xiii) The self-weight of footing is

a) not considered for calculating the upward pressure on footing

b) also considered for calculating the upward pressure on footing

c) not considered for calculating the area of footing

d) both (b) and (c).

xiv) Which one of the following section performs better on the ductility condition ?

a) Balanced section

b Over-reinforced section

c) Under-reinforced section

d) Non-prismatic section.

xv) What is the value of the flexural strength of M_{25} concrete ?

a) 4 Mpa b) 3·5 Mpa

c) 2 Mpa d) 1·75 Mpa.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Find the moment of resistance of a rectangular beam section of dimension 250 mm ∞ 500 mm. Nominal cover = 20 mm. Use M 20 concrete and Fe 415 grade of steel.

3. A reinforced rectangular beam of span 5 m is 300 mm wide and 550 mm deep to the centre of the tensile reinforcement which consists of four bars of 20 mm diameter. The beam carries a load of 20 kN/m inclusive of its weight. Design the shear reinforcement of the beam. Use M20 concrete and Fe 415 grade of steel.

4. Distinguish between "balanced sections" as per working stress and limit state methods of design showing stress-strain diagrams in both the cases.

5. A "*T*"-Beam of flange width 1000 mm. Flange thickness 100 mm, rib width 250 mm has an effective depth of 500 mm. The beam is reinforced with 4 bars of 20 mm diameter. Find the ultimate moment of resistance of the beam. Use M20 concrete and Fe415 grade of steel.

6. A square column of 400 mm ∞ 400 mm dimension is reinforced with 8 nos. of 16 mm diameter bars. Its length is 5 m. Determine its ultimate load capacity. Use M20 concrete and Fe415 grade of steel.

7. Distinguish between. "One-way slab and Two-way slab".

8. Design an axially loaded braced column of rectangular sections for the following data :

   Ultimate axial load P_u = 3000 kN ; Unsupported length l = 3·25 m ; Effective length l_{ex} = 3·0 m and l_{ey} = 2·75 m. Grade of concrete M20 and steel of grade Fe415. 5

9. Determine the anchorage length of bars at the simply supported end of reinforced concrete beam with a flexural reinforcement of 3 nos. 20 ϕ bars and ultimate shear force of 300 kN at the centre of support. Consider Grade of concrete M20 and steel of grade Fe415.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

10. A 3-span continuous *RC* slab of clear span 3·2 each supported on 250 mm thick masonry walls. The slab is subjected to a live load of intensity 4 kN/m^2 and a dead load (due to floor finish, ceiling plaster, partitions etc.) of 1·5 kN/m^2 in addition to its self weight. Using suitable coefficients, determine critical BM design the slab only in flexure. Consider mild exposure condition and M-20 & Fe-415 grade material. Show the reinforcement details in neat sketch. Apply any method of design.

11. Design a floor slab 3·6 m ∞ 7·0 m with two adjacent edges discontinuous. It is subjected to a live load of 3 kN/m^2. Use M-20 & Fe-415. Sketch plan and two cross-section proportionately. Apply any method of design.

12. Design a simply supported R.C.C. beam of rectangular cross-section of span 3·6m subjected to a uniformly distributed load of 27 kN/m (which includes all dead loads and live loads except the self weight of the beam). The overall depth of beam is restricted to 425 mm. Show the reinforcement details through neat sketches.

    Use M-20 & Fe-415 and any method of design.

13. Design a square footing for a column of (300mm ∞ 300mm) to carry an axial load of 1500 kN. The footing is placed on a soil having bearing capacity of 120 kN/m^2. Use M-20 & Fe-415 grade materials.

14. Design a reinforced concrete rectangular footing for a column of section 400mm ∞ 300mm which is subjected to a load of 1200 kN at service state. Consider

Weight of soil W_e = 320 kN/m^3

Angle of repose $\phi = 30^\circ$

Allowable bearing capacity of soil q_0 = 150 kN/m^2

Grade of concrete M-20 and steel of grade Fe-415.

15. Design a dog-legged staircase with a space of 2·6 ∞ 4·8 (clear dimensions) for a *RC* framed residential building having floor to floor height = 3 m. Initially the live load is 3 kN/m^2. Assume that there are four *RC* columns at four corners of stair room. Use M-20 & Fe-415 and any method of design.

END