



QUESTION BANK

ON

Structural Design-I (Th.1)

4th Semester

**Prepared By: Subinoy Banerjee
(Guest Faculty)**

DEPARTMENT OF CIVIL ENGINEERING

Govt. Polytechnic, Mayurbhanj

1. STRUCTURAL DESIGN-I

Question bank

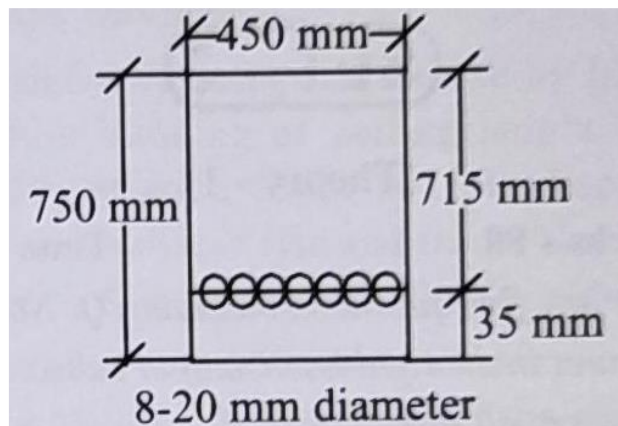
Ch -1 Working stress method (WSM)

1} Objectives [2 MARKS]

- What is designing and detailing of a structure.
- What is PCC and RCC
- Define modular ratio.
- What is UR,OR & BAL. sections of a RC structures
- State the different methods of design of concrete structures.
- What are the grades of concrete & steel ?
- What is lever arm ?
- What do you know by M-15 grade of concrete ?
- Calculate the value of neutral axis constant for M20 grade of concrete and mild steel reinforcement in WSM.
- What is the permissible stress ?
- Calculate the value of neutral axis constant for M20 grade of concrete and mild steel reinforcement in WSM.

2} Subjective [5 MARKS]

- Advantages of WSM.
- Disadvantages of WSM.
- Assumption in WSM.
- Find the moment of resistance of the RCC beam section shown in figure, if the stresses in steel and concrete are not to exceed 230 N/mm^2 and 7 N/mm^2 respectively. Use WSM ?



3} Subjective [10 MARKS]

- A reinforced concrete beam is simply supported over a span of 5m and it carries a uniformly distribution load of 25000 N/m including its own weight. If the size of the beam is restricted to $300 \times 500 \text{ mm}$, determine the areas of tension and compression steel if required. Given M20 concrete and HYSD bars of Fe415. Use WSM.

b) Design a rectangular beam for an effective span of 6 m. The superimposed load is 60 kN/m and size of beam is limited to 30cm x 60 cm overall. Use M20 mix and Fe415 grade steel. Use WSM

c) Design a rectangular beam to resist a bending moment equal to 75 KN-M using M25 and Fe415 grade steel.

Ch-2 Philosophy Of Limit State Method (LSM)

1} Objectives [2 MARKS]

- a) what is limit state of serviceability ?
- b) What do you mean by Limit State ?
- c) What is partial safety factor ?
- d) What are the value of partial safety factor for Concrete and steel ?
- e) What is lapping ?
- f) What is the difference between effective depth and overall depth ?

2} Subjective [5 MARKS]

- a) Write down the assumptions for limit state of collapse in compression ?
- b) Write down the assumptions for limit state of flexure in bending ?

Ch-3 Analysis and Design of Single and Double Reinforced Sections (LSM)

2} Subjective [5 MARKS]

- a) Write about advantages of LSM over WSM ?
- b) Derive the stress block parameters for flexure ?
- c) Write the assumptions made in the limit state of collapse compression?
- d) Explain in details why under-reinforced section is preferred than over-reinforced section ?
- e) A short RCC column 450 mm x 450 mm is provided with 8 bars of 16 mm diameter. If the effective length of the column is 2.5 m, find ultimate load for the column. Use M 20 concrete and Fe 415 steel. Solve by LSM method ?

3} Subjective [10 MARKS]

- a) Design a square column for a working load of 900 kN. The unsupported length of column is 4.8 m. The ends of column are effectively held in position but not restrained in direction. Use M and Fe Adopt LSM.
- b) A simply supported rectangular beam section 230 mm x 440 mm effective depth is reinforced with 6 x 16 diameter bars at bottom. It is subjected to a factored shear of 200 kN at support. Design the shear reinforcement at support. Use M20 and Fe 415 ?
- c) Design a simple supported singly reinforced beam of 230 mm wide which carries a factored load of 30 kN/m including its self weight. The span of beam is 6m. Design the beam for flexure and shear by limit state method if materials are M 25 concrete and HYSD bars of Fe415

Ch-4 Shear, Bond and Development Length (LSM)

1} Objectives [2 MARKS]

- a) What is development length ?
- b) What is bond ? And its Type ?

2} Subjective [5 MARKS]

- a) Calculate development length required to be provided for M25 concrete and Fe 415 steel of diameter for bars (i) In tension (ii) In compression?
- b) A steel bar of 12 mm diameter of Fe415 grade is embedded in M20 concrete. Calculate its development length in tension and compression as well as anchorage value for a bend of 90°

3} Subjective [10 MARKS]

- a) A beam has an effective depth of 500 mm and a breadth of 350 mm. It contains 4-25 mm bars calculate the shear reinforcement needed for a factored shear force of 350 kN for M20 mix and Fe250 grade steel ?
- b) A simply supported beam with clear span 6m, width (b) 400 mm, effective depth (d) = 560 mm, carries a limit state load of 175 kN/m (including self weight, dead load and live load). It is reinforced with 4 bars of 286 mm diameter tension steel ($A = 2464 \text{ mm}^2$) which continue right into the support. Take - 20 N/mm^2 . $f = 250 \text{ N/mm}^2$. Design shear reinforcement using LSM ? Ch-5 Analysis and Design of T-Beam (LSM)

1} Objectives [2 MARKS]

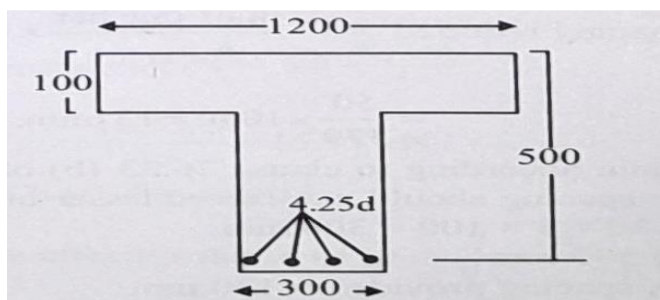
- a) Write the expression for effective width of flange of an isolated T-beam.

2} Subjective [5 MARKS]

- a) What are the advantages of using T-beam over rectangular beam ?

3} Subjective [10 MARKS]

- a) Calculate the moment of resistance of a T-beam as shown in figure. Assuming M20 mix and Fe415 grade steel.



- b) A T-beam of effective flange width of 1800 mm, thickness of slab 100 mm, width of rib 230 mm and effective depth of 500 mm is reinforced with 4 nos. 25 mm diameter bars. Calculate the factored moment of resistance if M20 and Fe415 is used. Use LSM ?

- c) A tee beam of effective flange width of 1800 mm, thickness of slab 100 mm, width of rib 230 mm and effective depth of 500 mm is reinforced with 7 (seven) nos 28 mm diameter bars. The materials are M 20 and Fe 415 (Use LSM).

- (i) Find actual neutral axis
- (ii) Find factored moment of resistance
- (iii) Find factored UDL inclusive of its own weight assuming simply supported at both ends having effective span 4.5 m.

CH-6 Analysis and Design of Slab and Stair case (LSM)

1} Objectives [2 MARKS]

- a) What is the minimum percentage of distribution steel for a slab for mild steel and HYSD steel ?
- b) What is staircase?
- d) What is one way slab & two way slab ?
- e) What is dog legged staircase ?
- f) Write short note on
 - i) Flight
 - ii) Riser
 - iii) Tread of a staircase

2} Subjective [5 MARKS]

- a) Design a cantilever slab to carry a live load of 3 kN/m^2 . The overhang of slab is 1.25 m. Use M20 and Fe415?

3} Subjective [10 MARKS]

- a) Design a two way slab for a panel with all four edges continuous. The size of room is 4.2 m x 5.3 m. The L.L. on the slab may be taken as 2000 N/m^2 and F.F. 800 N/m . Use M, and Fe, Use LSM. Apply all types of checks
- b) A simply supported one-way slab for an office building of a clear span 3m is supported over beams of 300 mm width. Design the slab for a live load of 3 kN/m^2 . The materials used are M20 and Fe 415 steel. (Use LSM)
- c) Design a dog legged staircase by LSM for a public building of ceiling height 3.5. The width of each flight is to be kept 1.5 m. Choose suitable rise and trade. Use M20 and Fe415. Give a neat sketch of the detailing ?
- d) Design a cantilever slab to carry a live load of 3 kN/m^2 . The overhang of the slab is 1.25 m. Use M20 concrete and Fe415 steel. Check for shear and deflection as per IS 456. Draw neat sketch of reinforcement ?

CH-7 Design of Axially loaded columns and Footings (LSM)

1} Objectives [2 MARKS]

- a) What is the cover requirement of footings ?
- b) What is the criterion of minimum eccentricity in column design?
- c) What is the difference between short column and long column ?
- d) Define slenderness ratio. What is its importance?

2} Subjective [5 MARKS]

- a) Design a RCC column of the following specification using LSM.

- (i) Axial factored load = 1800 KN
- (ii) Effective length = 2.25 m
- (iii) Grade of steel = Fe 415
- (iv) Grade of concrete = M 25.

- b) A short RCC column 450 mm x 450 mm is provided with 8 bars of 16 mm diameter. If the effective length of column is 2.5 m, find ultimate load for the column. Use M20 and Fe 415. Use LSM ?

3} Subjective [10 MARKS]

- a) Design a short circular column to carry a service load of 1600 kN. Use lateral ties and helical reinforcement. The materials are M20 grade concrete and HYSD reinforcement of grade Fe500. Use LSM and draw reinforcement details ?
- b) Design a square footing for a RCC column 250 * 250 mm carrying a load of 250 kN founded on a soil of SBC 160 kN/m² in LSM. Use M25 and Fe415 and give a neat sketch of the detailing ?
- c) Design a RCC column to resist axial factored load of 1800 KN. Given column length of 3m with both end fixed using M20 grade concrete and Fe415 steel ?