

**B.Tech. Civil (Construction Management) /
B.Tech. Civil (Water Resources Engineering)**

Term-End Examination

01051

December, 2015

ET-508(A) : STRUCTURAL DESIGN - I

*Time : 3 hours**Maximum Marks : 70*

Note : Attempt any **four** questions. All questions carry equal marks. Use of IS : 456 code and scientific calculator is allowed. Any missing data may be assumed suitably.

1. Determine ultimate moment of resistance of a doubly reinforced beam section for the given data :
 $b = 300$ mm, $d = 550$ mm and $d' = 50$ mm. Take $A_{st} = 3054$ mm² and $A_{sc} = 982$ mm² of Fe 415 grade and f_{ck} as 20 MPa. All notation names have their usual meaning.

 $17\frac{1}{2}$

2. Design flexural reinforcement for a beam whose size is limited to 250×400 mm. It has to carry a concentrated load of 30 kN placed at the mid-span point. Assume that the beam is subjected to moderate exposure conditions. Assume $f_{ck} = 25$ MPa and $f_y = 415$ MPa.

 $17\frac{1}{2}$

3. Design a simply supported slab to cover a room with internal dimensions $4.0 \text{ m} \times 5.0 \text{ m}$ which has 230 mm thick brick walls all around. Assume a live load of 3 kN/m^2 and a finishing load of 1 kN/m^2 . Use M20 concrete and Fe 415 steel. The slab corners are free to lift up. Assume mild exposure conditions.

$17\frac{1}{2}$

4. A corner column ($400 \text{ mm} \times 400 \text{ mm}$), located in the lowermost storey of a system of braced frames, is subjected to the following factored loads :

$$P_u = 1300 \text{ kN}, \quad M_{ux} = 190 \text{ kNm} \quad \text{and} \\ M_{uy} = 110 \text{ kNm}.$$

The unsupported length of the column is 3.5 m . Design the reinforcement in the column, assuming M25 concrete and Fe 415 steel.

$17\frac{1}{2}$

5. Determine suitable dimensions of a cantilever retaining wall, which is required to support a bank of earth 4.0 m high above the ground level. The backfill surface is to be inclined at an angle of 15° with the horizontal. Assume good soil for foundation at a depth of 1.25 m below the ground level with a safe bearing capacity of 160 kN/m^2 . The backfill is to comprise granular soil with a unit weight of 16 kN/m^3 and an angle of shearing resistance of 30° . Assume the coefficient of friction between the soil and concrete to be 0.5 .

$17\frac{1}{2}$

6. Design tensile and shear reinforcement at the support of a cantilever beam of span 3.5 m and constant width 300 mm. The depth of the beam is linearly varying from 800 mm at support to 350 mm at free end. The beam is loaded with a UDL of 30 kN/m including its self-weight. Assume M25 concrete and Fe 415 steel.

17 $\frac{1}{2}$

