

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/  
MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2017**

**STRUCTURAL DESIGN**

[Time : 3 hours

(Maximum marks : 100)

[Note :— Use of IS 456-2000, IS 800-2007,  
SP-16 and Steel tables are permitted]

PART — A

(Maximum marks : 10)

Marks

I Answer *all* questions in one or two sentences. Each question carries 2 marks.

1. State the grades of concrete and their strength.
2. What are the permissible stresses in concrete and steel ?
3. How slab is classified into one way slab and two way slab ?
4. What are the methods of connections of steel members ?
5. List the different types of roof truss.

(5×2 = 10)

PART — B

(Maximum marks : 30)

II Answer any *five* of the following questions. Each question carries 6 marks.

1. What are the functions of steel reinforcement in R.C.C. ?
2. Discuss the characteristic load and characteristic strength.
3. Discuss the development length of reinforcement bars and curtailment of tension reinforcement.
4. What are the IS code provisions of design of axially loaded columns for longitudinal reinforcement ?
5. What are the advantages and disadvantages of HSFG Bolts over bearing type bolts ?
6. What are the Physical properties of structural steel ?
7. List the loads acting on a roof truss.

(5×6 = 30)

## PART — C

(Maximum marks : 60)

(Answer *one* full question from each unit. Each full question carries 15 marks.)

## UNIT — I

- III (a) A simply supported rectangular beam of effective span 4m carries a live load of 20kN/m on the Entire span. The beam in addition carries a concentrated load of 10kN at the mid span. Design the beam for flexure using M20 grade concrete and Fe 415 grade steel. 8
- (b) A reinforced concrete beam 200mm wide and 410mm effective depth is reinforced with 3 HYSD bars of 16mm diameter. The grade concrete is M20. Check whether the beam is under reinforced or over reinforced. 7

OR

- IV (a) A reinforced concrete rectangular beam of width 230mm and overall depth 400mm is carrying a uniformly distributed load of 20kN/m including self weight over a span of 6m. Use M20 grade concrete and Fe 415 grade steel. Assume 40mm effective cover to reinforcement. Design the beam for flexure. 8
- (b) Find the moment of resistance of the T-beam section with the following details. Slab thickness = 100mm. Effective flange width = 1600mm. Effective depth = 460mm and Overall depth = 500mm. Tensile reinforcement 5 numbers of 25mm diameter, web width 250mm. Use M20 grade concrete and Fe 415 grade steel. 7

## UNIT — II

- V (a) Design a short column square in section to carry an axial load of 1200kN using M20 grade concrete Fe415 grade steel. 8
- (b) Design a square footing of uniform thickness for a column 400mm × 400mm carrying a load of 1500kN. The bearing capacity of the soil is 180kN/m<sup>2</sup>. Use M20 grade concrete and Fe 415 grade steel. 7

OR

- VI (a) A room of inner dimensions 3m×7m clear is to be covered by a RCC slab resting on masonry walls 300mm thick. The slab carries a live load of 2kN/m<sup>2</sup> and floor finish is 1.9kN/m<sup>2</sup>. Assuming the slab to be simply supported. Design the slab using M20 grade concrete and Fe 415 grade steel. 8
- (b) How is effective span of stairs determined under different conditions ? 7

## UNIT — III

- VII (a) Design a tie member using a single channel section to carry an axial tension of 870kN. If the yield and ultimate stresses are 450 and 570MPa. The member to be effectively connected at its ends by fillet weld through its web  $L_c = 300\text{mm}$ . 8
- (b) Design a single angle discontinuous strut to carry a design load of 200kN,  $f_y = 250\text{MPa}$ . The length of strut is 1.5m, fixity may be fixed. 7

OR

- VIII (a) Design a lap joint between the two plates each of width 120mm, if the thickness of one plate is 16mm and the other is 12 mm. The joint has to transfer a design load of 160kN. The plates are of Fe 410 grade. Use bearing type bolts. 8
- (b) What are the advantages and disadvantages of welded connections? 7

## UNIT — IV

- IX (a) (i) List any 4 component parts of plate girder and discuss its function.  
(ii) List any 8 component parts of a roof truss. 8
- (b) Design angle purlin for the following data by simplified method.  
Spacing of trusses = 3.5m, Spacing of purlins = 1.6m  
Weight of AC sheets including laps and fixtures = 0.205kN/m<sup>2</sup>  
Live load = 0.6kN/m<sup>2</sup>, Wind load = 1k/m<sup>2</sup> suction.  
Inclination of main rafter of truss = 21°. 7

OR

- X (a) Discuss the classification of cross sections as per IS:800 - 2007 for plastic analysis of steel members. 8
- (b) Design a rolled steel beam using I-section for simply supported beam of span 6m, carries a uniformly distributed load of 15kN/m over entire span. The beam is laterally restrained,  $F_y = 250\text{MPa}$ . 7