(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2693 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. VII) THEORY EXAMINATION 2011-12

DESIGN OF STEEL STRUCTURES

Time : 3 Hours *Total Marks : 100*

Note :– (1) Attempt **all** questions. Numerical accuracy is as important as procedure.

(2) For analysis and design use Limit State Design Method, following the recommendations given in IS : 800-2007. Use of this code is allowed in examination.

(3) Draw neat cross section and longitudinal section in design problems. Assume any missing data suitably.

1. Attempt any **four** of the following : **(5×4=20)**

(a) Discuss the main objectives of a designer for designing a steel structure.

(b) Explain with neat sketches, the different types of steel structures used.

(c) With examples, explain how does the Limit State Design Method differ from the Working Stress Design Method.

(d) What is serviceability limit state ? Explain why it is considered as important as failure limit state.

(e) Name and sketch, the rolled steel sections used for steel structures.

(f) State the main advantages of steel as a structural material.

2. Attempt any **two** of the following : **(10×2=20)**

(a) A single bolted, double cover butt joint is used to connect two plates each 6 mm thick. The thickness of cover plate is 4 mm. The bolts used are of 20 mm diameter, provided at 60 mm pitch. Calculate the load carried by the joint and its efficiency. Use steel having f_y = 250 N/mm², f_u = 410 N/mm², and 4.6 grade bolts.

(b) Determine the size and length of a fillet weld for a lap joint to transmit a factored load of 130 kN assuming site welds. The width of two plates to be joined is 75 mm and 150 mm. Use steel having f_u = 410 N/mm², E41 electrodes. The thickness of two plates is 8 mm.

(c) Design a bolted connection of a truss joint as shown in Figure 1 below using M 16 black bolts of 4.6 grade and steel having f_u = 410 N/mm². Use 10 mm thick gusset.

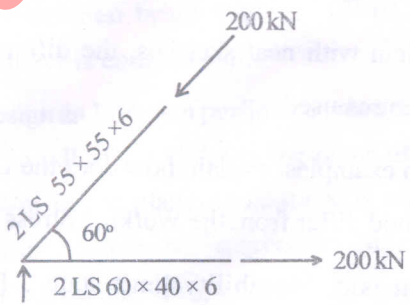

Figure – 1

3. Attempt any two of the following : (10×2=20)

(a) An ISA 100 × 75 × 8 mm is used as a tension member in a roof truss. The longer leg is connected to a gusset plate of 10 mm thick by means of four bolts. Find which arrangement amongst following will provide greater strength in block shear.

(i) Four bolts are arranged in one line which is at 60 mm from corner line of ISA. 16 mm dia bolts at 50 mm pitch are used.

(ii) Four bolts are arranged in two lines which are at 40 mm and 80 mm from the corner line of ISA. The two bolts in each line are 12 mm dia in chain type, with pitch of 50 mm. In both cases the end distance is 40 mm.

(b) Design a tension member of roof truss subjected to working loads of 90 kN (DL) and 130 kN(LL). Use double angle section connected back to back on either side of gusset plate of 8 mm thickness. Use bolted connection f_y = 250 MPa, f_u = 410 MPa for both member and bolt material.

(c) Design a single angle tension member to carry a tensile load of 350 kN. Assume that the length of the member is 3m. Take thickness of gusset plate as 10 mm.

4. Attempt any two of the following : (10×2=20)

(a) Design a laced built up column consisting of two rolled steel I-Sections to resist a factored axial compressive load of 4500 kN. The length of column is 5.5 m restrained in direction at both ends and position at base but not in position at top. Use $f_y = 250$ N/mm².

(b) Design the lacing system for above built up column in part (a) using single lacing system.

(c) Design a slab base footing for a column made of ISHB 250 @ 51.10 kg/m to carry a compressive load of 780 kN. The grade of concrete used is M 20.

5. Attempt any two of the following : (10×2=20)

(a) Design a laterally supported simply supported beam for a 4 m span, loaded for a concentrated load of 400 kN at mid span. The load is transferred through base plates of 200 mm length to the supports. Design a check for deflection using ISMB 400 section which is available.

(b) Calculate the moment carrying capacity of a laterally unrestrained beam made of ISMB 400 and length of member is equal to 4 m.

(c) Design an I-Section purlin to cover a span of 4 m, subjected to an udl of 1.5 kN/m in the plane of minor axis and 0.5 kN/m in the plane of major axis under working loads. Assume that the perlin is continuous over the supports and no lateral buckling occurs. The grade of steel used is $f_y = 250$ N/mm².