Code No: R2032011 **R20** SET - 1

III B. Tech II Semester Supplementary Examinations, December-2023
DESIGN AND DRAWING OF STEEL STRUCTURES
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Answer any **ONE** Question from **Part–A**, and any **THREE** Questions from **Part–B**
Note: Use of IS 800:2007, IS: 875 (Part III)-1987, structural steel tables is permitted.

*****

PART–A **(28 Marks)**

1 Given a column section ISHB 300 @ 63 Kg/m with one cover plate 400 mm x 20 mm on either side, and an axial load of 2000 kN, calculate the total weight of the column section, including the cover plates. What is the maximum allowable bearing pressure on the concrete for the gusseted base design, assuming a safe limit of 4 N/mm^2 ? Determine the required dimensions of the gusset plate for the gusseted base design, considering the bending stress in the base plate as 185 N/mm^2. Calculate the total axial load on the gusseted base, including the self-weight of the base and column, given an axial load of 2000 kN. Create an isometric view of the gusseted base design, showing the column section, cover plates, and gusset plate connections. [28M]

2 Design the main tie, principal rafter, and riveted joint components of a steel roof truss, taking into account a vertical reaction of 500 kN at the left-hand support and a 30-degree inclination angle for the principal rafter. Consider a panel length of 1.28 m. Include a detailed and dimensioned sketch to illustrate the design configuration. [28M]

PART–B **(42 Marks)**

3 a) What are the mechanical properties of steel that are relevant for structural design? Explain each property briefly. [7M]

b) A steel beam with a length of 6 meters is subjected to a uniformly distributed load of 20 kN/m. The beam has a rectangular cross-section with dimensions of 300 mm × 500 mm. Calculate the maximum bending stress in the beam and determine if it satisfies the yield strength requirement of the steel, which is 250 MPa. [7M]

4 a) Discuss the design considerations for beam-to-beam connections in welded connections. Explain the importance of connection strength, load transfer mechanisms, and factors influencing the choice of connection type and detailing. [7M]

b) Design a cantilever steel beam to support a uniformly distributed load of 6 kN/m over a length of 6 meters. The beam should be designed using the limit state method and welded connections only. The yield strength of the steel is 280 MPa. The beam must satisfy the shear and deflection criteria specified in the relevant design code. Determine the required section modulus and the minimum size of the beam's rectangular cross-section. [7M]

5 a) Describe the design of lacings and battens for compression members. What are their roles in enhancing the load-carrying capacity and stability of the compression members? [7M]

b) Design a tubular roof truss to support a roof with a span of 12 meters. The truss should be capable of carrying a live load of 10 kN/m and a wind load of 5 kN/m. Use the appropriate load combinations as per the IS code. Consider the strength and stability of the tubular members and joints. [7M]

6 a) Design a slab base for a column that carries an axial load of 250 kN and a moment of 50 kNm. The column is made of reinforced concrete, and the permissible stress in the concrete is 25 MPa. The soil bearing capacity is 300 kPa. Calculate the required dimensions of the slab base to ensure stability and adequate bearing capacity. [7M]

b) Explain the concept of allowable bending stress in concrete for column bases. Discuss the factors that affect the determination of the maximum allowable bending stress and its significance in the design process. Provide examples of situations where different allowable bending stresses are used. [7M]

7 a) Describe the concept of curtailment of flange plates in plate girder design. Explain the purpose of curtailment and discuss the factors that influence the decision to curtail the flange plates. [7M]

b) Design a welded plate girder 24 m in effective span and simply supported at the two ends. It carries a U.D.L of 100 kN/m. Use the steel with yield stress 250 MPa. [7M]