Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**ME –New SEMESTER II– • EXAMINATION – Summer 2017**

**Subject Code: 2722007** **Date:29/05/ 2017**

**Subject Name: Advanced Design of Steel Structures**

**Time:2:30 to 5:00 Pm** **Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Draw neat sketch wherever is necessary**
5. **Use of IS:800, IS:801, IS:811, IS:875, IS:1893 and SP1/Steel Table is permitted.**

**Q.1** **(a)** Roofing system of an industrial shed consists of trusses spaced at 4.5 m apart. The span of roof truss is 27 m and rise is 4.5 m. The level of eaves is 6.5 m above the ground. Assume suitable configuration of truss. Design the purlin only. Choose suitable section for the inclined member no need to show any check. The shade is situated on flat terrain with sparsely populated buildings. The shed has less than 20 % permeability. **14**

**Q.2** **(a)** Write short note on 'Effect on shear force on plastic moment capacity'. **07**

**(b)** Determine the collapse load using plastic analysis for frame ABCD. Member 'AB' & 'CD' are vertical members with lengths 3m & 4m respectively, A & D are the fixed supports. BC is a horizontal member with 4m length. The frame carries a horizontal rightward force 'W' at point B & a central vertical concentrated load 'W' on member BC. The frame has uniform plastic moment. **07**

**OR**

**(b)** Calculate the moment carrying capacity of a laterally unrestrained ISMB500 member of length 5.0m **07**

**Q.3** Design a continuous beam ABCD using plastic approach with following data **14**

(i) Span AB = 6m. Load= Two equidistant Point loads of 150kN.

(ii) Span BC = 5 m. Load= udl of 40 kN/m

(iii) Span CD = 5 m. Load= A single point load of 300 kN.

Support A and D are fixed and supports B and C are hinged. Take load factor =1.5 and shape factor 1.25 for

(i) Provide uniform section throughout

(ii) Provide the most economical section.

**OR**

**Q.3** A Pratt truss girder through bridge is provided for single broad gauge track. The effective span of bridge is 35 m (10 panels @ 3.5 m c/c). The cross-girders are spaced 4.5 m apart. The stringers are spaced 2 m c/c. 0.5 kN/m stock rails and 0.4 kN/m check rails are provided. Sleepers are spaced at 0.4m c/c and are of size 2.8m x 250mm x 250mm. The main girders are provided at a spacing of 5m c/c. Height of truss is 7 m. Analyze the member force and design due to dead loads and Live + Impact loads in top and bottom chord member. For live load, EUDIL = 3500 kN for each track. CDA = 0.324. **14**

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| **Q.4** | **(a)** | A column in a building is 3.5m in height. It's both the ends are hinged and the reaction load (factored) due to beam is 400kN at an eccentricity of 110mm from the major axis of the section. Design the column using steel of fy=250 $N/mm^2$. | **07** |
| | **(b)** | Design a connection for a bucket using high strength bolts of property 8.8 to carry a factored vertical load of 200 kN.<br>i) No slip is permitted at the ultimate load,<br>ii) A slip is permitted at the ultimate load but not at the working load. | **07** |
| | | **OR** | |
| **Q.4** | | Design a suitable beam-column assuming fy=250 $N/mm^2$ and effective length of column as 0.7L along both the axes for<br>(i) A factored axial load = 400 kN<br>(ii) A factored bending moment at top=1150 kN m<br>(iii) A factored shear force = 500 kN. | **14** |
| **Q.5** | **(a)** | Explain the design criteria of steel structures under fatigue load. | **07** |
| | **(b)** | Enlist factors affecting mechanical properties of steel. Sketch stress vs Strain plot for ordinary and high-strength steel with important points marked on it. Enlist various mechanical properties of structural steel as per IS800 : 2007 | **07** |
| | | **OR** | |
| **Q.5** | **(a)** | Explain the cold form steel with its Advantages and Disadvantages. | **07** |
| | **(b)** | Discuss about various loads to be taken for design of steel structures. Also, discuss various load combination as per codal provisions and their importance. | **07** |