Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER • 2014

Subject code: 1722007 **Date: 05-12-2014**

Subject Name: Advanced Steel Structures

Time: 02:30 pm - 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Following IS codes and special publications are allowed**

i) IS800: 2007 ii) IS875 (Part III) iii) IS1893 (Part I): 2002 iv) SP 1 and or Steel table

Q.1 Calculate design wind forces on a steel multi-storey building 60 m tall and plan size 10m x 20m to be constructed in Bombay. Assume average storey height to be 3.0m. The frames are to be spaced at 5m c/c in both directions. (14)

Q.2(a) A factored end reaction of 120 KN is transferred from a beam ISMB450 at 72.4 Kg/m to the column ISHB250 at 59.1 Kg/m. Design the framed connection when the fillet welds are applied directly on both the sides of the beam web. (07)

(b) A beam ISLB400 at 569 N/mm is supported on a column ISHB250 at 547 N/mm at each end. The beam has to transfer 100 KN load to the column. Design a web angle connection using M20 bolts of grade 4.6 and Fe 410 steel. Draw a neat sketch of details of connections. (07)

OR

(b) ISMB350 carries a factored reaction of 100 KN. It is connected to a column ISHB250 at 51.0 Kg/m. Design welded connection using unstiffened seat angle. Assume steel grade Fe 410 and site welding. (07)

Q.3

(a) A suspension cable of 180m horizontal span and 15 m dip is supported at the same level. It is subjected to a uniformly distributed load of 15kN/m (horizontal). Find the vertical and horizontal forces transmitted to the supporting pylons if (a) the cable is passed over a smooth pulley and (b) if the cable is clamped to a saddle with rollers on the top of the pier. (07)

(b) Explain important mechanical properties of steel with reference to various loads like static load, impact load and repeated load. (07)

OR

Q.3

(a) A suspension bridge is of 45 m span with a 16 m wide roadway. It is subjected to a load of 20 kN/m^2 including dead loads. The bridge is supported by a pair of cables having a central dip of 4.2 m. Find the cross sectional area of the cable necessary if the maximum permissible stress in the cable material is not to exceed 600 N/m^2. (07)

(b) Explain high-rise structural systems with neat sketches which can resist lateral loads and discuss various methods of approximate analysis for the same. (07)

Q.4 Design a suitable beam-column assuming fy=250 N/mm^2 and effective length of column as 0.8L along both the axes for (14)

(i) a factored axial load = 400 kN

(ii) a factored bending moment =1200 kN m

(iii) a factored shear force = 500 kN.

OR

Q.4 Design a continuous beam ABCD using plastic approach with following data (14)

(i) Span AB = 6m. Load= Two equidistant Point loads of 450kN.

(ii) Span BC = 7 m. Load= udl of 80 kN/m

(iii) Span CD = 8 m. Load= A single point load of 650 kN.

Take Dead load factor =1.7 and shape factor 1.12 for (i) provide uniform section throughout (ii) provide the most economical section. Support A is fixed and supports B,C and D are hinged.

Q.5

(a) Explain the earthquake load calculation for multi storey building as per IS1893. Discuss advanced structural forms for earthquake resisting multi storey buildings larger than 60storeys. (07)

(b) A four storey one bay steel moment resisting frame having 3 m storey height is located in Ludhiyana (Seismic Zone IV).The Soil conditions are medium and the damping is 5 %. Determine the seismic load as per IS1893-2002 on the frame. Take lumped mass on roof =1700 KN and lumped mass on all other floors = 2700 KN. This frame is to be used as office building with plan dimensions as 6m x 5m. (07)

OR

Q.5 In a plate girder of through type bridge, carrying a single broad guage track, the cross girders are provided at 4.0 m c/c. The stringers are placed at 2 m c/c. Using the data given below, design the stringers. (14)

Size of slipper = 2.8 m x 250 mm x 250 mm are provided 450 mm c/c.

The spacing between the main girder = 4 m.

Equivalent udl for 4.0 m for BM per track = 500 KN

Equivalent udl for 4.0 m for SM per track = 650 KN

The impact factor for 4 m span = 1.0. unit wt. of timber=7.5 KN/m^2.

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