Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E –IIst SEMESTER–EXAMINATION – JULY- 2012

Subject code: 1722007 **Date: 12/07/2012**

Subject Name: Advanced steel structures

Time: 10:30 am – 13:00 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 **(a)** Explain various types of forces for which a multistory building is to be designed. Also explain the rules to be followed for buildings in seismic areas. **07**

(b) Determine the collapse load using plastic analysis for a frame ABCD of the following data:-'AB' & 'CD' are vertical members with lengths 4m each, A & D are the fixed supports. BC is a horizontal member with 6m length. The frame carries a horizontal rightward force 'W' at point B & a uniformly distributed load 'W' on member BC. The frame has uniform plastic moment M_P. **07**

Q.2 **(a)** Design and detail a bolted web cleat connection for a beam of ISMB450 and a coped beam of size ISMB250 using bolts of 18mm diameter and grade 4.6. The factored load reaction is 150kN. **07**

(b) What are the lateral load resisting systems in multistory buildings? Explain various methods of approximate analysis. **07**

OR

(b) Determine critical wind force (as per IS875-III) on each storey of a 3-D frame of a general building situated near Coimbatore having open terrain with well scattered obstructions. The average height of the surrounding building is 15m. The building is on an upwind slope of hill. The actual horizontal length (L) of the upwind slope is 150m with slope $\Theta=10^{o}$. The building is at a horizontal distance(X) of 75m from the crest of the hill. The size of the building is as follows: Assume normal permeability of the building for internal pressure coefficient. **07**

- 6-bays of 4.5 m in X-direction
- 8-bays of 4.5m in Z-direction
- 15 storey with 3.8m storey height

Q.3 **(a)** A suspension cable of 150m horizontal span and 15m dip is supported at the same level. It is subjected to a uniformly distributed load of 20kN/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) A hall 8m x 20m is provided with 200mm RCC slab with 25mm floor finish over rolled steel beams spaced at 4m centre to centre. The compression flange is effectively restrained by the slab. Design one of the intermediate beams (8m span) using IS: 800, 2007. Assume density of RCC & Floor finish as 25kN/m^3 and Live load as 2kN/m^2. **07**

OR

Q.3 **(a)** Explain the necessity of stiffening girders and their types in cable suspended bridges. **06**

(b) A column in a building is 3.5m in height. Its 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=250N/mm^2. **08**

Q.4 **(a)** Design an un-stiffened seat angle connection between ISMB350 beam and column flange of ISMB250 for a beam reaction of 120kN, using M20 bolts of property class 4.6. Take Fe 410 grade steel with fy=250N/mm^2. Draw the details of the connection. **07**

(b) Design a bolted cover plate splice for an ISHB300 column connected to an ISHB300, to transfer axial load of 500kN. Both the columns are of grade Fe-410 steel. The ends are not machined for full contact in bearing. Draw detailed sketch of the connection. **07**

OR

Q.4 **(a)** Explain design procedure for a stiffened seated connection to transfer beam reaction to column flange. **07**

(b) Design and detail a welded seat angle connection between a beam ISMB400 and flange of column ISHB400 for a reaction of beam 200kN, assuming Fe410 grade steel (fy=250Mpa) and site welding. **07**

Q.5 **(a)** A pratt truss girder through bridge is provided for single broad gauge track. The effective span of bridge is 28m (7panels @ 4m c/c) and height 5m. The stringers are spaced 2m between centerline. The main girders are provided at a spacing of 4.5m between their centerlines. **07**

The total Dead load per girder=12kN/m, EUDLL (Equivalent Uniformly Distributed Live Load) for 28m span for each track=2580kN. Calculate the design load for critical top chord member and critical bottom chord member for the data given above. Take fatigue coefficient as 0.75.

(b) Calculate the moment carrying capacity of a laterally unrestrained ISMB450 member of length 4.5m **07**

OR

Q.5 **(a)** Explain as per code: **07**

- Design of connection for block shear failure.
- Design of butt joint involving two different plate thicknesses.

(b) A three span continuous beam ABCD has span length AB=8m, BC=6m and CD=8m. It carries a factored udl of 20kN/m completely covering the spans AB & BC and it carries a central point load of 45kN in span CD. 'A' is a fixed support and 'D' is a hinged support. Find the plastic moment capacity required for 'I' section of the beam. Assume yield stress for the material as 250N/mm^2. **07**

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