

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – II • EXAMINATION – WINTER • 2013****Subject code: 1722007****Date: 02-01-2014****Subject Name: Advanced Steel Structures****Time: 10.30 am – 01.00 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 to use.
(i) IS 800:2007, (ii) IS 875(Part III), (iii) IS1893 (Part I):2002
(iv) SP-1 and/or Steel table

- Q.1 (a)** Discuss the parameters considered for Earthquake load for multistoried buildings as per IS 1893. **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 hinged supports. BC is a horizontal member with 6m length. The frame carries a horizontal rightward force 20kN at the mid point of member AB & a central vertical concentrated load 60 kN on member BC. The frame has uniform plastic moment M_p . Find the minimum section required to resist the applied loads. **07**
- Q.2 (a)** Discuss briefly the systems adopted to provide adequate resistance to seismic lateral loads with neat sketches. **07**
- (b)** Design a bolted web cleat connection for an ISMB400 and a coped beam of size ISMB300 using bolts of 20mm diameter and grade 4.6. The factored load reaction is 180kN. **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 Bhuj 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 160m with slope $\Theta=10^\circ$. The building is at a horizontal distance(X) of 90m from the crest of the hill. The size of the building is as follows: Assume normal permeability of the building for internal pressure coefficient.
- 3-bays of 4.0 m in X-direction
 - 4-bays of 4.0 m in Z-direction
 - 12 storey with 3.3m storey height
- Q.3 (a)** A beam ISMB300 is connected to a flange of a column ISHB250 to transmit end reaction of 120 kN due to factored loads. Design web angle connection using M20 bolts of 4.6 grade and steel Fe410. **07**
- (b)** Design a bolted cover plate splice for an ISHB250 column connected to an ISHB250, to transfer axial load of 400kN. 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.3 (a)** Design a welded unstiffened seat angle connection between a beam ISMB350 and flange of column ISHB250 for a reaction of beam 150kN, assuming Fe410 grade steel ($f_y=250\text{Mpa}$) and site welding. **08**

- (b) Give the classification of connections based on rigidity. **06**
- Q.4** (a) Draw and explain the various components of a cable suspended bridge **07**
- (b) A suspension cable of horizontal span 140m is supported at the same level. It is subjected to a uniformly distributed load of 30kN per horizontal meter. If the minimum tension in the cable is limited to 4000 KN, calculate the minimum central dip needed. **07**
- OR**
- Q.4** (a) A suspension cable of span 160m and dip 15m carries a uniformly distributed load of 25kN/m of horizontal span over the full span. The anchor cable at the top of the tower makes 35° to the horizontal. Find the vertical and horizontal forces transmitted to top of the supporting pylons. **07**
- a) If the cable is passed over a smooth pulley.
- b) If the cable is clamped to a saddle with rollers on the top of the piers.
- (b) A commercial building has 8 storeys each of 3 m height. the building is having 2 bays one of 4m and the other of 5m. The height of the first storey from the foundation is 1.5m. The roof is accessible and all the floors are used as offices. Calculate the load on the interior column on the second floor and on the interior column on the third floor. The spacing of column in the perpendicular direction as 4 m. Live load on each floor =2000N/m². Live load on roof= 1200N/m². Assuming total dead load=4000N/m² **07**
- Q.5** (a) A two span continuous beam ABC has span length AB=6m and BC=7m, AB carries a factored UDL of 12kN/m completely covering the span AB & BC carries a point load of 50kN at its mid span. Support 'A' is fixed & 'C' is hinged support. Find the section modulus required for 'I' section of the beam needed. Assume yield stress for the material as 250N/mm². **07**
- (b) Explain the difference in design philosophy of Working Stress Method and Limit State Method. **07**
- OR**
- Q.5** (a) Enlist different types of loads to be considered for designing a steel bridge and explain any two of them briefly. **04**
- (b) A pratt truss girder through bridge is provided for single broad gauge track. The effective span of the bridge is 32m (8panels @ 4m c/c) and height 5m. The stringers are spaced 2 m between centerline. The main girders are provided at a spacing of 5m between their centerlines. **10**
- The total Dead load per girder=12kN/m, EUDLL (Equivalent Uniformly Distributed Live Load) for 32m span for each track=3000kN. Design critical top chord member OR Critical Bottom chord member of the data given above. Take the fatigue coefficient as 0.75.
