

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
ME Semester –II Examination Dec. - 2011

Subject code: 1722007

Date: 16/12/2011

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 (a)** A two span continuous beam ABC has span length AB=8m and BC=6m, AB carries a factored udl of 15kN/m completely covering the span AB & BC carries a pint load of 40kN at its mid span. Support 'A' is fixed & 'C' is simple 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 high-rise structural systems with neat sketches which can resist lateral loads and discuss various methods of approximate analysis for the same. **07**
- Q.2 (a)** A class room is 7mX18m is provided with 120mm RCC slab with 30mm floor finish over rolled steel beams 3m centre to centre. The compression flange is effectively restrained by the slab. Design one of the intermediate beams using IS:800, 2007. Assume density of RCC & Floor finish as 25kN/m³ and Live load as 3kN/m². **07**
- (b)** Design an un-stiffened seat angle connection between ISMB350 and column flange of ISHB300 for a beam reaction of 120kN, using M20 bolts of property class 4.6. Take Fe410 grade steel with $f_y=250\text{N/mm}^2$. Draw the details of the connection. **07**
- OR**
- (b)** Explain fatigue failure and fatigue resistance of steel structures. As per code which members should be checked for fatigue assessment? **07**
- Q.3 (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 suspension cable of horizontal span 150m is supported at the same level. It is subjected to a uniformly distributed load of 35kN per horizontal metre. The cross sectional area of the cable 3000mm². If the maximum stress is limited to 580N/mm², calculate the minimum central dip needed. **07**

OR

- Q.3 (a)** Determine critical wind force (as per IS875-III) on each storey of a 3-D frame of a general building situated in Chennai having open terrain with well scattered obstructions having range of height between 1.5 to 10m. The building is on an upwind slope of hill. The actual horizontal length (L) of the upwind slope is 180m with slope $\Theta=10^\circ$. The building is at a horizontal distance(X) of 85m 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**
- 4-bays of 4.0 m in X-direction
 - 8-bays of 4.0m in Z-direction
 - 12 storey with 3.3m storey height
- (b)** A suspension cable of span 120m and dip 12m carries a uniformly distributed load of 10kN/m of horizontal span over the full span. Find the vertical and horizontal forces transmitted to 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.
- The anchor cable makes 30° to the horizontal at the pylon.
- Q.4 (a)** 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**
- (b)** Design a bolted web cleat connection for an ISMB300 and a coped beam of size ISMB200 using bolts of 16mm diameter and grade 8.8. The factored load reaction is 90kN. **07**
- OR**
- Q.4 (a)** Design a welded seat angle connection between a beam ISMB400 and flange of column ISHB350 for a reaction of beam 180kN, assuming Fe410 grade steel ($f_y=250\text{Mpa}$) and site welding. **07**
- (b)** Explain Advantages and disadvantages of welded connections in detail. **07**
- Q.5 (a)** A pratt truss girder through bridge is provided for single broad gauge track. The effective span of bridge is 45m (15panels @ 3m c/c) and height 4.5m. The stringers are spaced 2m between centerline. The main girders are provided at a spacing of 6m between their centerlines. The total Dead load per girder=12kN/m, EUDLL (Equivalent Uniformly Distributed Live Load) for 45m span for each track=4000kN. Design critical top chord member OR Critical Bottom chord member for the data given above. Take impact factor as 0.33. **10**
- (b)** Draw & explain various parts of a cable suspension bridge. **04**
- OR**
- Q.5 (a)** Answer the following:- **07**
- (1) Write short notes on rigid, simple and semi-rigid connections
 - (2) How are the connections classified?
- (b)** Determine the collapse load using plastic analysis for a frame ABCD for the following data:- **07**
- ‘AB’ & ‘CD’ are vertical members with lengths 2m & 3m respectively, A & D are the fixed supports. BC is a horizontal member with 3m 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 M_p .
