

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – II • EXAMINATION – WINTER 2012

Subject code: 1722007**Date: 02-01-2013****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) IS800 : 2007
 - ii) IS875 (Part III)
 - iii) IS1893 (Part I) : 2002
 - iv) SP 1 and/or Steel table

- Q.1** (a) A classroom is 8mX15m is provided with a 150mm RCC slab with the 25mm floor finish over rolled steel beams 3m center to center. The compression flange is effectively restrained by the slab. Design one of the intermediate beams of span 8m using IS:800, 2007. Assume the density of RCC & Floor finish as 25kN/m³ and Live load as 2.5kN/m². **07**
- (b) Explain methods of approximate analysis for lateral load resisting systems with neat sketches in multi storey buildings. **07**

- Q.2** (a) A two span continuous beam ABC has span length AB=8m and BC=10m and carries a factored udl of 15kN/m completely covering the spans AB & BC. A & C are fixed supports. Find the section modulus required for 'I' section of the beam needed. Assume yield stress for the material as 250N/mm². **07**
- (b) How does the limit state design method differ from the working stress method? Explain in detail. **07**

OR

- (b) Design a un-stiffened seat angle connection between ISMB300 and the column flange of ISHB250 for a beam reaction of 120kN, using M18 bolts of property class 4.6. Take Fe 410 grade steel with $f_y=250\text{N/mm}^2$. Draw the details of the connection. **07**
- Q.3** (a) A suspension cable of 120m horizontal span is supported at the same level. It is subjected to a uniformly distributed load of 20kN/m (horizontal). If the maximum tension in the cable is limited to 4000kN, calculate the minimum central dip needed. **07**
- (b) Explain importance of fatigue failure and fatigue assessment in structural steel members as per code. **07**

OR

- Q.3** (a) Draw and explain the various components of a cable suspended bridge. **07**
- (b) Determine critical wind force (as per IS875-III) on each storey of a 3-D frame of a general building situated in Delhi having open terrain with well scattered obstructions having an average height 16m. The building is on an upwind slope of the hill. The actual horizontal length (L) of the upwind slope is 300m with slope $=15^\circ$. The building is at a horizontal distance(X) of 105m from the crest of the hill. Assume normal permeability of the building for internal pressure coefficient. The size of the building is as follows: **07**
- 3-bays of 5.0 m in X-direction

- 3-bays of 5.0m in Z-direction
- 15 storey with 3.5m storey height

Q.4 (a) Design a bolted cover plate splice for an ISHB300 column connected to an ISHB300, to transfer axial load of 250kN. 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 ISMB500 and a coped beam of size ISMB250 using bolts of 16mm diameter and grade 8.8. The factored load reaction is 100kN. **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 145kN, assuming Fe410 grade steel ($f_y=250\text{Mpa}$) and site welding. **07**

Q.4 (b) Explain various structural connections according to connection rigidity and joint location. **07**

Q.5 (a) A pratt truss girder through bridge is provided for single broad gauge track. The effective span of the bridge is 24m (8panels @ 3m c/c) and height 4m. The stringers are spaced 2.2m between centerline. The main girders are provided at a spacing of 5m between their centerlines. **08**

The total Dead load per girder=11kN/m, EUDLL (Equivalent Uniformly Distributed Live Load) for 24m span for each track=2800kN. Design critical top chord member OR Critical Bottom chord member of the data given above. Take the fatigue coefficient as 0.75.

(b) What are the parameters which affect the strength of a column. Also explain possible failure modes of a column. **06**

OR

Q.5 (a) 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 5m 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 . **07**

(b) Explain the procedure for calculation of earthquake load for a multi storey building as per IS1893. **07**
