Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (CE)/SEM-2/CE-612/2013

2013
STABILITY OF STRUCTURES

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

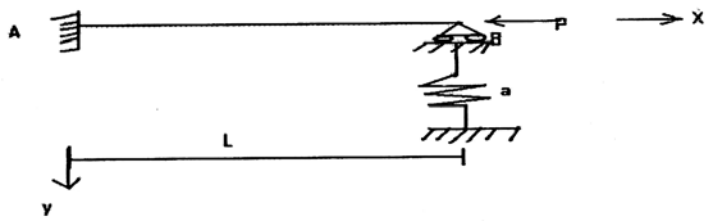
(Long Answer Type Questions)

Answer any *three* of the following :

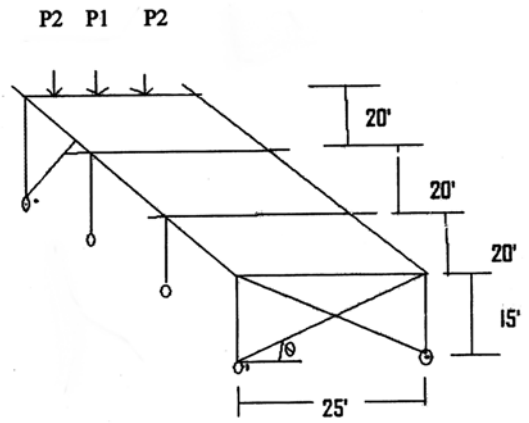
3 × 15 = 45

1. Write down differential equations of beam-columns.

2. Derive the Euler-Lagrange differential equation and the necessary kinematic (geometric) and natural boundary conditions for the prismatic cantilever column with a linear spring (spring constant α) attached to its free end shown in Fig. below



3. turn-buckled threaded rods (Fy = 50 ksi, Fu = 70 ksi) are to be provided for the bracing system for a single-story frame shown in Fig. below. The typical loading on each girder consists of three concentrated loads. The factored loads are : P_1 = 200 kips and P_2 = 100 kips. Determine the diameter of the rod by the AISC.



4. The current AISC LRFD Specification specifies that the critical value of P/A for axially loaded column shall not exceed the following :
   i) For $\lambda c \leq 1 : 5$ $F_{cr} = (0.658\ \lambda c^2)\ F_y$
   ii) For $\lambda c > 1 : 5$ $F_{cr} = (0.877/\lambda c^2)\ F_y$

   Plot these curves and superimpose using double arguments (l/r and λc) on the horizontal axis.
5. Derive of Element Geometric Stiffness Matrix.
6. Determine an approximate value for the critical load of a propped column. The column is hinged at the top loaded end and fixed at its base. Use the energy method. Assume the deflected shape of the column by the deflection curve of a uniformly loaded propped beam whose boundary conditions are the same as those of the column.

GROUP – B

(Short Answer Type Questions)

Answer any *five* of the following. 5 × 5 = 25

7. Would the final results, internal forces, and deflections be different or the same if the axial force is applied first followed by the transverse land or vice versa in a beam-column ? State the reason for your answer.

8. A concentrated load of 5 kips is applied at the free end of a cantilever beam (W 12 × 50) of 20 feet long as shown in Figure. E = 29 × 10^3 ksi, G = 11.2 ×10^3 ksi, P = 5 kips, e = ½ in, K_T = 1.82 in^4. Find the maximum stresses.

9. Differentiate between displacement method and force method.

10. Write down the assumption of Double Modulus Theory.

11. How to determine Mcr under uniform bending ?

12. Why use potential energy as opposed to direct equilibrium ?

13. Define dynamic and cyclic analysis.