Extra

INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

End-Spring Semester 2017-18

Date of Examination : 20-04-2018 Session (FN/AN) AN Duration 3 hrs

Subject No. : CE42002; CE60044 Subject Name :Theory of Elastic Stability & behavior of Metal structures

Department/Center/School : Civil Engineering

Specific charts, graph paper, log book etc., required No : Graph paper

Special Instructions (if any) : Answer all questions. Assume suitable data, if required.

Q. 1. A cantilever column is pulled by a rope at its end **A** and the rope is taken over a pulley at **B** as shown in the Figure 1. Compute the value of **P** under which column buckles. Consider two different case: (i) $c = l$ and (ii) c/l is very large. **(7.5)**

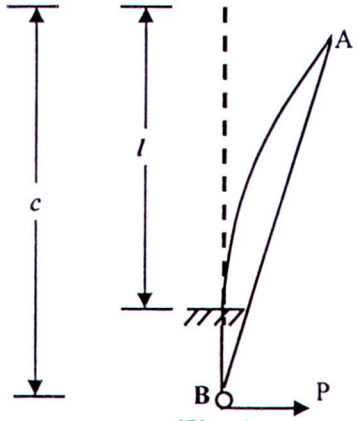

Fig. 1

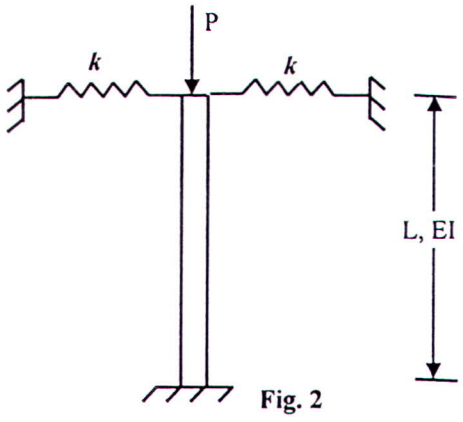

Fig. 2

Q. 2. A column of constant flexural stiffness, EI, and length L, is fixed at one end and supported elastically against translation (linear spring of stiffness of k) at the other end as shown in Fig.2. Compute the buckling load of the column, P_{cr}. **(7.5)**

Q. 3. A uniform ring of flexural rigidity EI is subjected to uniformly distributed load q as shown in Fig. 3. From the fundamentals, evaluate the buckling load of the ring. Assuming that the ring is inextensible, derive expressions for radial and tangential displacements of the ring when it has buckled. **(9)**

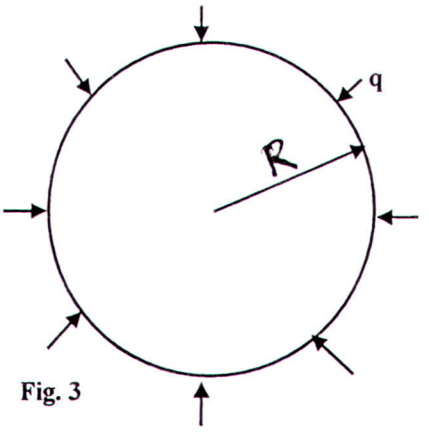

Fig. 3

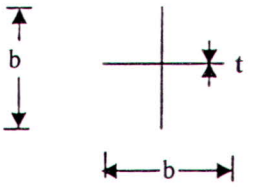

Fig. 4

Q. 4. Determine the critical compressive load P_{cr} and the corresponding buckling mode of a simply supported centrally compressed beam of span L with a cruciform cross section shown in Fig. 4, from torsional buckling considerations. (7)

Q.5. Evaluate the buckling load of the frame shown in Fig. 5. The flexural rigidity of all the members is ***EI*** and length is ***L***. Assume that the members are inextensible. The support **A** is fixed and the support **B** is hinged. **(9)**

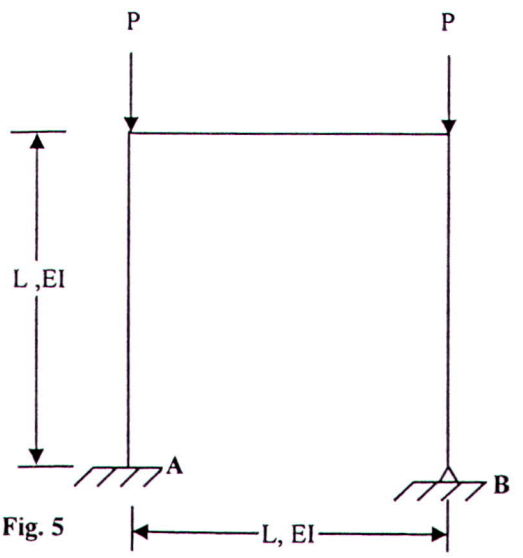

Fig. 5

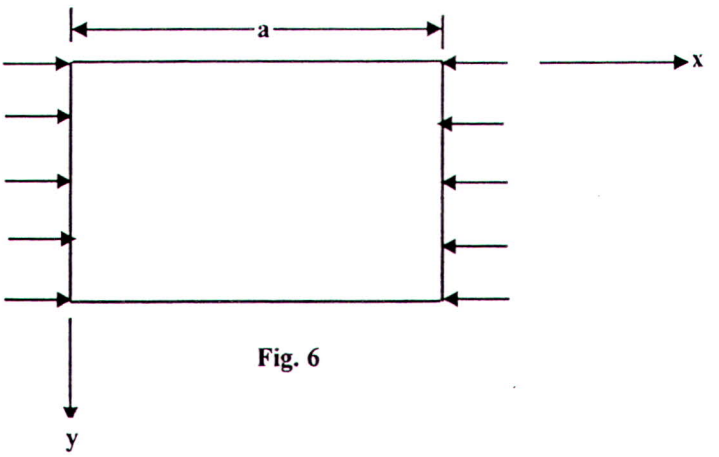

Fig. 6

Q. 5. Calculate the buckling load of a square isotropic plate of side a as shown in Fig. 6. The sides, on which in-plane loads are applied ($x = 0,a$), are clamped and the other two sides ($y = 0,a$) are simply supported. **(10)**