Total No. of Questions : 8] *[Total No. of Printed Pages : 2*

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MVSE - 302(A)

M.E./M.Tech., III Semester

Examination, June 2016

Stability Theory in Structural Engineering (Elective-II)

Time : Three Hours

Maximum Marks : 70

Note: i) Answer any five questions.
ii) All questions carry equal marks.
iii) Assume data missing but essential may be assumed suitably and should be stated.

1. What is the importance of structural instability? State the different classical methods used for stability analysis and discuss any one in detail.

2. Using a single fourth-order differential equation, deduce the expression for the buckling load for a column of length L, modulus of elasticity E, and moment of inertia I when one end is fixed and other end is free.

3. A column is hinged at the base and elastically restrained by a beam at its upper end as shown in figure 1. Working from the first principles show that the critical load is given by the expression:
$Pcr = 14.7\ EI/L^2$

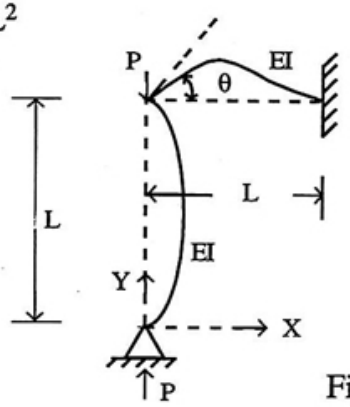

Figure 1

4. For a beam-column of span 'L' simply supported at the ends and carrying an axial load 'P' and a transverse load 'Q' acting at midpoint, find the magnification factors for deflection and bending moment under the load 'Q'.

5. Prove that if there are no lateral load and body forces then the differential equation of thin plate buckling under the action of in-plane forces Nx, Ny and Nxy is given by

$$D\left(\frac{\partial^4 w}{\partial x^4}+2\frac{\partial^4 w}{\partial x^2\partial y^2}+\frac{\partial^4 w}{\partial y^4}\right)=Nx\frac{\partial^2 w}{\partial x^2}+Ny\frac{\partial^2 w}{\partial y^2}+2Nxy\frac{\partial^2 w}{\partial x\partial y}$$

Where w = the lateral deflection of the plate.

6. For a cantilever I-beam of span "L" with web vertical and acted upon by a torque "T" at the free end of the beam, show that the expression for torque T is given by:
$T = Gjd\beta - E\Gamma\, d^3\beta$
Where,
β = Angle of twist
C = Torsional rigidity = GJ
$E\Gamma$ = Warping rigidity of beam section
J = Torsional constant of beam section
G = Modulus of elasticity in shear
Γ = Warping constant

7. Show that the energy method can be used to find an approximate value of the critical load for a column when the true shape of the buckled column is not known.

8. Write short notes on following:
a) Post buckling behaviour of plates
b) Lateral instability of beams
c) Torsional-flexural buckling
d) Application of Matrix method in stability problems

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