M.E DEGREE EXAMINATIONS: OCTOBER/NOVEMBER-2008

Third Semester

STRUCTURAL ENGINEERING

P07SEE13 - Stability of Structures

Time: Three Hours   **Maximum Marks: 100**

Answer ALL Questions: -

PART –A (20 x 1 = 20 Marks)

1. A structure may have ------------ kinds of failure
   a) one   b) two   c) three   d) several

2. Form failure depends on ------- of the structure
   a) geometry   b) loading   c) material   d) both geometry and loading

3. When the magnitude of the load on a structure is such that the equilibrium changes from stable to neutral, the load is called
   a) buckling load b) critical load   c) ultimate load   d) safe load

4. The equilibrium approach deals with the equilibrium configuration of
   a) perfect system b) imperfect system   c) static systems   d)dynamic systems

5. Buckling parameter, for uniform column with one end fixed and the other end hinged
   a)10.903   b) 17.221   c) 4.493   d) 2.00

6. The derivative error ------------ with the order of derivative
   a) increases   b) decreases   c) has no relation   d) None of the above

7. What is the effect of increasing the DOF of a system
   a) flexibility increases and stiffness decreases
   b) b) stiffness increases and flexibility decreases
   c) both flexibility and stiffness increases
   d) d) both flexibility and stiffness decreases

8. Based on linear theory the value of (P/P_{cr}) is
   a) 1.00   b)1.152   c) 1.25   d) 1.35

9. Buckling load for the column having one end clamped and the other end free is given by
   a) $P_{cr} = (\pi^2/4)$ (EI/L^2.)   c) $P_{cr} = 4 \pi^2$ (EI/L^2.)
   b) $P_{cr} = 2.49$ (EI/L^2.)   d) π^2 (EI/L^2.)

10. The lowest buckling load P_t for pin ended uniform column in the inelastic range is
    $P_t = \pi^2 \eta$ (EI/L^2.) The value for η for most of the metals lie between

    a) 0.8 and 0.95 b) 0.5 and 0.65 c) 0.65 and 0.8 d) 0.8 and 1.00

11. Pure torsional mode exists in a section whose centroidal axis coincides with the shear center exists
    a) true b) false c) partly true

12. The method which assumes the first variation of the total potential to vanish is
    a) Rayleigh-Ritz method   c) Finite difference method
    b) Galerkin's method   d) Finite element method

13. Infinite rotational spring stiffness indicates a
    a) clamped end   b) free end   c) hinged end   d) simply supported end

14. Zero torsional spring stiffness indicates a
    a) clamped end   b) free end   c) pinned end   d) simply supported end

15. Buckling load of a symmetric frame subjected to an axial load Pcr is equal to
   a) 16.47 (EI/L^2)   b)12.90 (EI/L^2)   c) 15 (EI/L^2)   d) 15.47 (EI/L^2)

16. Buckling load of rectangular plate axially compressed, simply supported along two opposie edges and clamped along other two edges is given by (Nx)cr =
   a) $9D \pi^2 /a^2$ b)8.5 D π^2 /a^2 c) 9.5 D π^2 /a^2 d) 9.0 $D^2 \pi^2 /a^2$

17. For buckling of uniform column fixed at one end and hinged at other end, Pcr=
   a) 14.94 (EI/L^2)   b) 12.5 (EI/L^2)   c) 16.0 (EI/L^2)   d) 14.2 (EI/L^2)

18. Buckling of simply supported rectangular plate compressed in two perpendicular direction is given by
   a)N=2 D π^2 /a^2 b) N= D π^2 /a^2 c) N= 2.5 D π^2 /a^2 d) N= $D^2 \pi^2 /a^2$

19. For buckling of tapered simply supported column Pcr=
   a) 7.84 (EI/L^2)   b) 8.94 (EI/L^2)   c) 2.174 (EI/L^2)   d) 6.84 (EI/L^2)

20. For buckling of square plate under uniform axial load with two opposite edges clamped
   (for n=4), (Nx)cr =
   a) 6.19 D π^2 /a^2 b) 5.47 D π^2 /a^2 c) D π^2 /a^2 d) 5.19 D π^2 /a^2

PART-B (5 x 16 = 80 Marks)

21 a) Derive an expression for buckling load of column fixed at both ends

(OR)

21 b) Determine the buckling load of a column with one end fixed and the other end hinged using fourth order differential equation.

22 a) a column of length 'L' hinged at both ends and having a moment of inertia 'I' for the middle 60% of its length and I/2 for the remaining length. Find the critical load on the column using finite difference method.

(OR)

22 b) A uniform section propped cantilever is subjected to compressive load at the simply supported end. With origin at the simply supported end, the Galerkin's trial function is given by $\varphi = x L^3 - 3 L x^3 + 2x^4$ Is it a suitable trial function to be used in general equation? Hence find the value of he critical load.

23 a)Estimate the critical value of the axial load acting on a cantilever of constant stiffness EI which is supported on an elastic medium varies linearly from zero at the free end to a maximum of 170 EI/L at the fixed end.

(OR)

23 b) Derive an expression for deflection of a beam with a point load at mid span.

24 a) A simply supported beam carries a uniformly distributed load of intensity 'q' per metre run. Find an expression for the displacement profile in terms of maximum displacement.

(OR)

24 b) Obtain the critical load for a column of I section, if the column ends are hinged such that the ends can rotate, but cannot deflect about X and Y axes. The ends are free to warp, but cannot rotate about Z axis.

25 a) Obtain an expression for critical load of a uniaxially compressed plate fixed along all the edges by energy method.

(OR)

25 b) Determine the critical load of a uniformly compressed square plate whose edges are fixed and compressed by a uniformly distributed force by energy method.

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