Code No: G8703/R13

M. Tech. I Semester Supplementary Examinations, Jan/Feb-2018

STRUCTURAL DYNAMICS

Common to Structural Engineering (87) and Structural Design (85)

Time: 3 Hours **Max. Marks: 60**

Answer any FIVE Questions
All Questions Carry Equal Marks

1. a Define dynamic and analyze the structure to a dynamic loading. 6M
   b How the deterministic loadings are classified and explain them. 6M

2. a Derive the dynamic equilibrium equation of motion. 6M
   b A simply supported beam of span 'l' with flexural rigidity EI is carrying a weight 'W' at the centre of the span. Compute the natural frequency. 6M

3. a The frame is subjected to an exciting force F(t) = 200 sin 20t as shown in Figure 1. Assuming 6% of critical damping, determine: (a) Steady state response of vibration and (b) The maximum dynamic stress in the columns. 6M

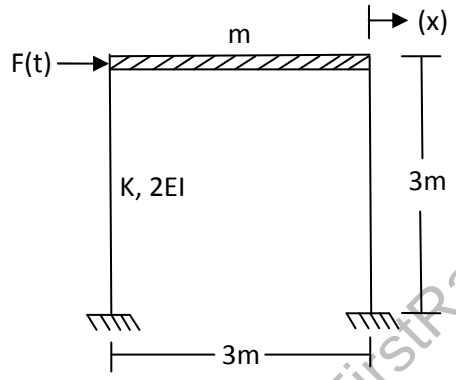

Figure 1

   b Derive "Duhamel's Integral" 6M

4. a The stiffness matrix and the mass matrix of a two degree freedom system are given by 6M

$$K = \begin{bmatrix} 4 & 2 \\ 2 & 4 \end{bmatrix} \quad \text{and} \quad m = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

   Determine the natural frequencies and corresponding modes of vibration, normalized with respect to the matrix such that $x^T mx = 1$.
   b Reduce the above system to a system of two independent differential equations by decoupling the variables by the normal mode method. 6M

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5. a Define critical damping. If the motion is given by $12\frac{d^2x}{dt^2} + c\frac{dx}{dt} + 1.5x = 0$. Where c=20% of critical damping, determine the damped circular frequency. 6M
   b A spring mass system has maximum velocity 40 cm/s and time period 2 s. If the initial displacement is 2 cm, determine (i) the amplitude, (ii) the initial velocity, (iii) the maximum acceleration and (iv) the phase angle. 6M

6. a Show that the mode shapes are orthogonal with respect to stiffness matrix. 6M
   b Explain briefly about the concept of lumped mass procedure with examples. 6M

7. a What is logarithmic decrement? Develop an expression for the same. 6M
   b Write short notes on 'Approximate solution of continuous system' 6M

8. a Explain "Logarithmic Decrement" 6M
   b Explain the following in detail with examples 6M
      i) Free vibration
      ii) Forced vibration
      iii) Degrees of freedom

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