B.E. (Mechanical Engineering) Eighth Semester (C.B.S.)
Elective - III : Mechanical Vibrations

P. Pages : 2

Time : Three Hours

1442

Max. Marks : 80

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Notes : 1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Differentiate between damped and undamped vibration with reference to few practical examples. **4**

b) A spring mass system has a natural frequency of 12 Hz. When the spring constant is reduced by 800 N/m, the frequency is changed by 50%. Determine the mass and spring constant of the original system. **6**

c) Explain the simplest method of determination of spring constant practically. **3**

OR

2. a) A transformer of 3000 kg is mounted on an isolator embodying a coil spring and a coulomb damper. Design the isolator, so that the natural frequency of the system is 4.5 Hz and an initial displacement of 5 mm given to the transformer dies out completely in three cycles. **8**

b) Write short note on vibrometer. **5**

3. a) Derive Lagrange's equation for a motion of a vibrating system. **14**

OR

4. Find the flexibility influence coefficients for the following fig. 4 **14**
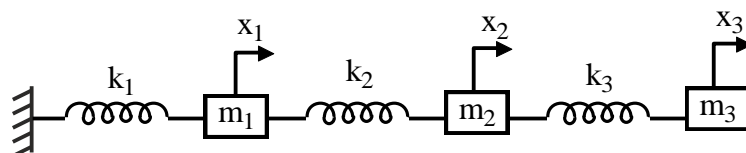
5. Explain Holzer's method for torsional vibration. **13**

OR

6. Use Holzer method to find the natural frequencies of the system shown in fig. 6.33, Take $I_1 = I_2 = I_3 = 1$ and $k_{t_1} = k_{t_2} = 1$ **13**

7. A bar of uniform cross-section having length ℓ is fixed at both ends as shown in fig. 7. The bar is subjected to longitudinal vibration having a constant velocity V_O at all points. Derive suitable mathematical expression of longitudinal vibration in the bar. **13**

8. a) Compare the frequency of longitudinal vibrations and of transvers vibrations of a copper tube. **6**

   b) Determine the effects of rotary inertia and shear deformation on the natural frequencies of a simply supported uniform beam. **7**

9. a) What is FEM ? How it is useful in solving complex vibration problems. **3**

   b) The vibration of a cantilever are given by $y = y\left(1 - \cos\dfrac{\pi x}{2\ell}\right)$. Calculate the frequency with following data for the cantilever using Rayleigh's method modulus of elasticity of the material $2 \times 10^{11}\,\text{N}/\text{m}^2$. Second moment of area about bending axis $0.02\,\text{m}^4$, Mass $= 6 \times 10^4\,\text{kg}$, length $= 30\,\text{m}$. **11**

10. Using FEM determine the lowest natural frequency and model shapes for a uniform simply supported beam. **14**

11. Write short notes on **any three.** **13**

   i) Vibration pick up.

   ii) Seismometers.

   iii) Spectrum analyzer.

   iv) Accelerometer.

12. a) What is significance of vibration measurement and monitoring ? Explain with two practical examples. **6**

   b) Explain philosophy of vibration conditioning monitoring. **7**

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