CBCS SCHEME

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18MR71

Seventh Semester B.E. Degree Examination, June/July 2024
Mechanical Vibrations

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define :
i) Natural frequency
ii) Resonance
iii) Damping
iv) Frequency
v) Time period. **(05 Marks)**

b. Explain the classification of vibration system. **(07 Marks)**

c. Explain Beats and derive equation for Amplitude of resonant motion. **(08 Marks)**

OR

2 a. Add the following harmonic motions and check the solution graphically.
$x_1 = 2\cos(\omega t + 0.5)$, $x_2 = 5\sin(\omega t + 1.0)$. **(10 Marks)**

b. Develop the Fourier series for the curve shown in Fig.Q2(b).

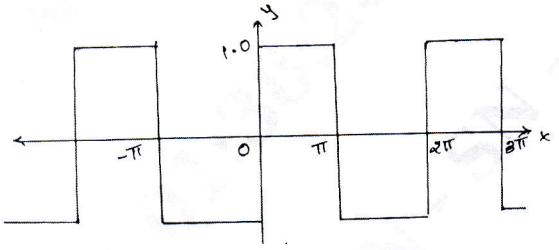

Fig.Q2(b)

(10 Marks)

Module-2

3 a. Determine the natural frequency for undamped free vibration system by using :
i) Newton's method ii) Energy method. **(10 Marks)**

b. Fig.Q3(b) shows a spring mass system. Determine :
i) Equivalent spring stiffness
ii) Natural frequency of the system.

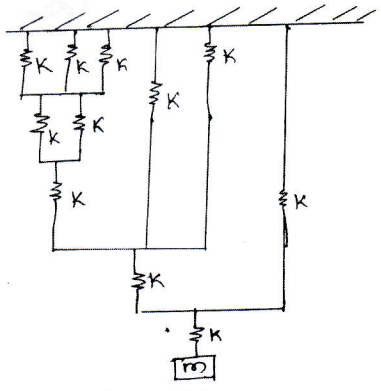

Fig.Q3(b) **(10 Marks)**

OR

4 a. Derive differential equation of damped free vibration and arrive at equation for underdamped system. **(10 Marks)**

b. A spring mass damper system has m = 3kg, K = 100N/m, C = 3Ns/m. Determine :
   i) Damping factor
   ii) Natural frequency of Damped vibration
   iii) Logarithmic decrement
   iv) Ratio of two successive amplitudes. **(10 Marks)**

Module-3

5 a. What is Magnification factor? Derive an expression for the same and discuss its variation with frequency ratio. **(10 Marks)**

b. A mass of 10kg suspended from one end of helical spring. The other end is fixed. The stiffness of spring is $10N/mm^2$. The viscous damping causes the amplitude to decrease $1/10^{th}$ of initial value in four complete oscillations. If a periodic force of 150cos50tN is applied at the mass with vertical direction. Find the amplitude of forced vibration what is its value at resonance? **(10 Marks)**

OR

6 a. Explain with neat sketch : i) Fullarton tachometer ii) Fraction tachometer. **(10 Marks)**

b. A vertical shaft 12.5mm in diameter rotates in long bearings and a disc of mass 15kg attached to the shaft at mid span. The span of the staff between the bearings is 0.5m. The mass centre of the disc is 0.5m from the axis of shaft. Neglecting the mass of shaft and taking the deflection as for beam fixed at both ends, determine the critical speed of rotation. Also determine the range of speed in which the stress in the shaft due to bending will exceed 125MPa. Take E = 200GPa. **(10 Marks)**

Module-4

7 a. Determine the influence coefficients for the system show in Fig.Q7(a).

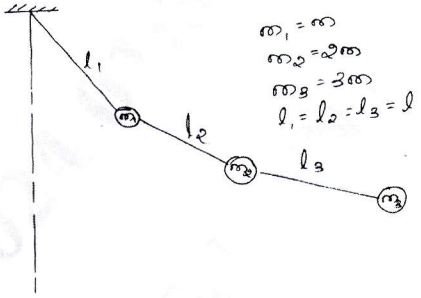

Fig.Q7(a) **(10 Marks)**

b. Using Holzer method find the first natural frequency of the system shown in Fig.Q7(b). Assume $m_1 = m_2 = m_3 = 1kg$, $k_1 = k_2 = k_3 = 1N/m$.

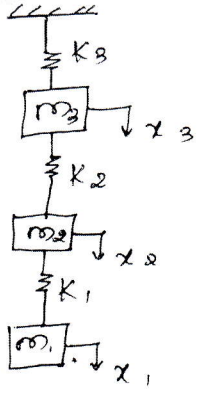

Fig.Q7(b) **(10 Marks)**

OR

8 a. Using Stodola's method determine the fundamental mode of vibration and its natural frequency of the spring mass system shown in Fig.Q8(a).

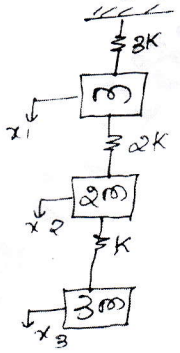

Fig.Q8(a) **(12 Marks)**

b. A shaft 100mm diameter is supported in short bearings 3m apart and carries 3discs weighting 900N, 1400N, 700N situated in 1m, 2m and 2.5m from one of the bearings respectively. Assuming E = 200GPa and density of shaft material = 7800kg/m^3, calculate the frequency of transverse vibration by Dunkerley's method. **(08 Marks)**

Module-5

9 a. Explain machine condition monitoring techniques. **(10 Marks)**

b. With neat sketch explain experimental modal analysis. **(10 Marks)**

OR

10 a. Write short notes on :
i) Sound intensity probes
ii) Spectrum analyzers
iii) FFT. **(12 Marks)**

b. Explain machine maintenance techniques. **(08 Marks)**

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