

CBCS SCHEME

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18AE56

Fifth Semester B.E. Degree Examination, June/July 2024

Theory of Vibration

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define the term "vibration" and discuss types of vibrations with examples. (10 Marks)
- b. Derive the velocity and acceleration of SHM and represent the same in graphically. (10 Marks)

OR

- 2 a. Add the following harmonic motion and verify the solution graphically
 $x_1 = 2 \cos (wt + 0.5)$
 $x_2 = 5 \sin (wt + 1.0)$ (10 Marks)
- b. Develop the Fourier series for the curve shown in Fig Q2(b)

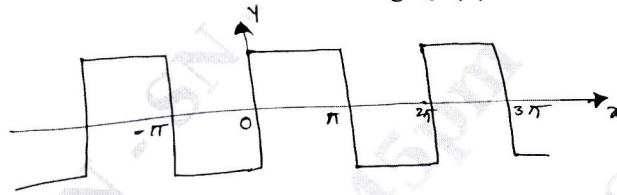


Fig Q2(b)

(10 Marks)

Module-2

- 3 a. Derive the natural frequency of free transverse vibration in case of cantilever beam. (10 Marks)
- b. Determine the natural frequency of compound pendulum. (10 Marks)

OR

- 4 a. Derive the equilibrium equation for damped free vibration to show that $C = 2m\omega_n$ and also find displacement equation in case of over damped system. (10 Marks)
- b. Vibrating system consisting of a mass of 50Kg a spring of stiffness 30kN/m and a damper. Damping is 20% of the critical value. Determine :
 - i) Damping factor
 - ii) Critical damping coefficient
 - iii) Logarithmic decrement
 - iv) Ratio of consecutive amplitude. (10 Marks)

Module-3

- 5 a. Derive for the maximum displacement in case of forced vibration of damped system. (10 Marks)
- b. A 5Kg mass is placed at the end of a 300mm long steel beam. The Young's modulus is 200GPa and moment of inertia is $10^{-8}m^4$. When the system is excited by a harmonic force of 150N, an amplitude 0.5mm is observed. Find the frequency of excitation.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

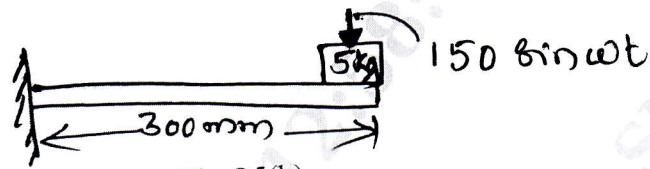


Fig Q5(b)

(10 Marks)

OR

- 6 a. Explain the method to find natural frequency of vibrating body by single reed instrument. (10 Marks)
- b. Derive for the critical speed of the shaft. (10 Marks)

Module-4

- 7 a. For the Fig Q7(a) shows spring mass system. Determine : i) equation of motion
ii) frequency equation and natural frequencies iii) mode shape and vectors.

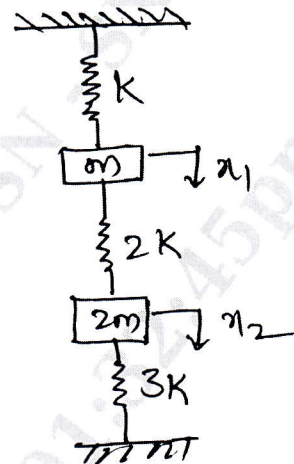


Fig Q7(a)

(10 Marks)

- b. Fig Q7(b) shows a system subjected to vibration, find an expression for the natural frequency.

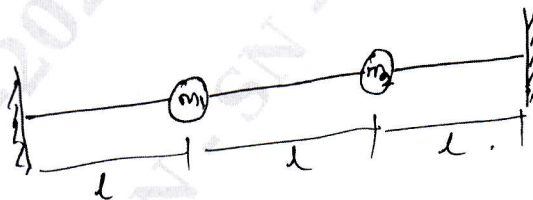


Fig Q7(b)

(10 Marks)

OR

- 8 Determine the frequency equation and general solution of two degrees of freedom torsional system. Shown in Fig Q8.

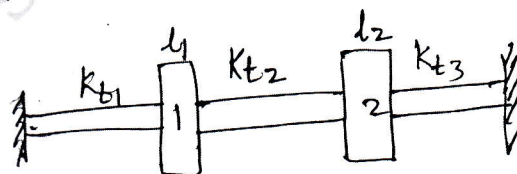


Fig Q8

(20 Marks)

Module-5

- 9 Determine the influence coefficient for the system shown in Fig Q9.

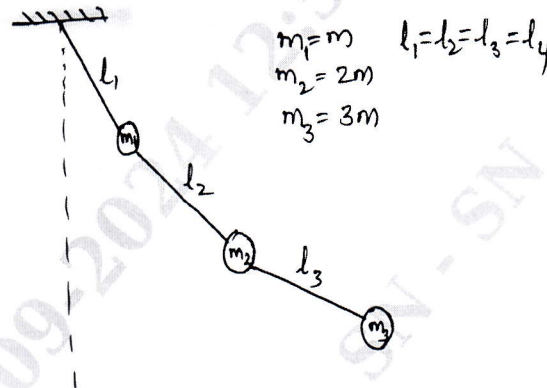


Fig Q9

(20 Marks)

OR

- 10 Use Stodala method to find the fundamental mode of vibration of the system shown in Fig Q10. Given $m = 2$, $k = 20$.

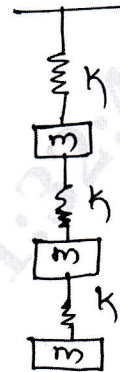


Fig Q10

(20 Marks)
