CBCS SCHEME

USN | | | | | | | | | | |

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)

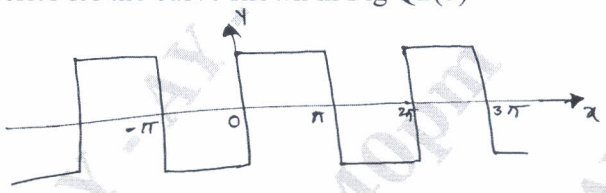

Fig Q2(b) **(10 Marks)**

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 $C = 2mw_n$ 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.

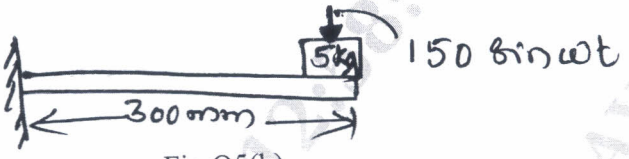

Fig Q5(b) **(10 Marks)**

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.

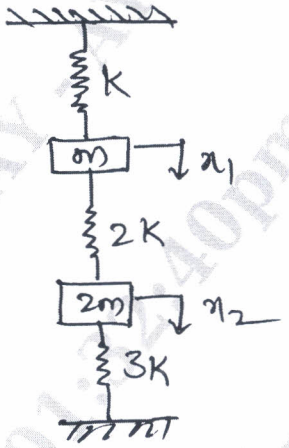

Fig Q7(a) **(10 Marks)**

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

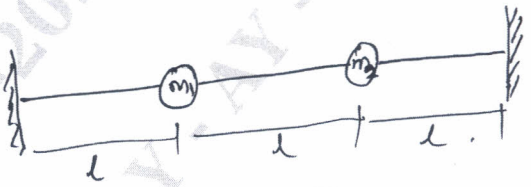

Fig Q7(b) **(10 Marks)**

OR

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

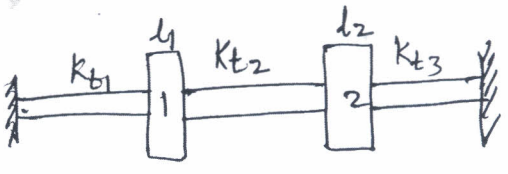

Fig Q8 **(20 Marks)**

Module-5

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

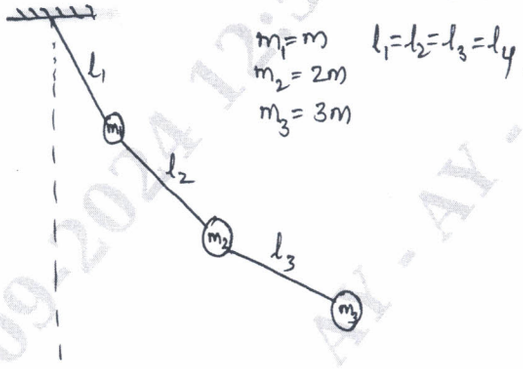

Fig Q9 **(20 Marks)**

OR

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

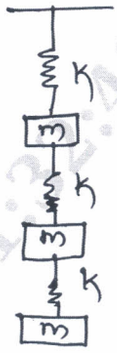

Fig Q10 **(20 Marks)**

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