CBCS SCHEME

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18MR71

# Seventh Semester B.E. Degree Examination, Feb./Mar. 2022
## 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. Explain : i) Types of vibration ii) Beats Phenomenon **(10 Marks)**

b. Add the following harmonics motions and check the solution Graphically.
$x_1 = 3\sin(\omega t + 30^\circ)$, $x_2 = 4\cos(\omega t + 10^\circ)$ **(10 Marks)**

**OR**

2 a. Explain the following :
i) Forced vibration
ii) Damped vibration
iii) Simple Harmonic Motion
iv) Degree of Freedom. **(08 Marks)**

b. Find the Fourier series for the saw tooth wave as shown in Fig Q2(b)

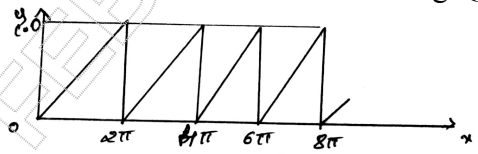


Fig Q2(b) **(12 Marks)**

### Module-2

3 a. Derive equation of motion and natural frequency of vibration of a spring mass system of by energy method. **(08 Marks)**

b. Determine the natural frequency of the system shown in Fig Q3(b)-i) and Fig Q3(b)-ii)

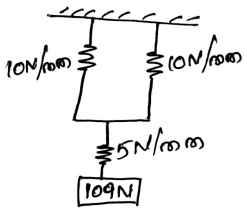


Fig Q3(b)-i)

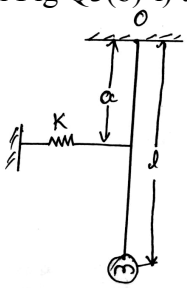


Fig Q3(b)-ii) **(12 Marks)**

**OR**

4 a. Set up the differential equation for a viscous damping system and obtain the complete solution for critically damped system. **(12 Marks)**

b. A spring mass damped system shown in Fig Q4(b) determine : i) Natural frequency ii) Damping factor iii) Frequency of Damped vibration iv) Logarithmic Decrement.

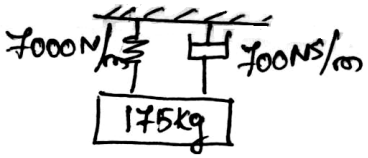


Fig Q4(b) **(08 Marks)**

## Module-3

5 a. What is Transmissibility? Explain its significance. **(10 Marks)**

b. A Machine of Total mass 17kg is mounted on springs having stiffness K = 11.000N/cm. A piston within the machine has a mass of 2kg has a reciprocating motion with stroke 7.5cm and speed 6000rpm. Assuming the motion to be SHM. Determine : i) Amplitude of Machine ii) Transmissibility iii) Force-transmitted to the Ground. Take $\xi = 0.2$ **(10 Marks)**

**OR**

6 a. Explain with neat sketch i) Vibrometer ii) Frahm Tachometer. **(10 Marks)**

b. A rotor of mass 12kg is mounted midway on a 25mm diameter horizontal shaft supported at the ends of two bearing. The spas between the bearings is 900mm. Because of some manufacturing defect. The $C_g$ of the rotor is 0.02mm away from geometric centre of rotor. If the system rotates at 3000rpm, determine the amplified of steady state vibrations and dynamic force on the bearing. Take E = 200GPa. **(10 Marks)**

## Module-4

7 a. A shaft 180mm diameter is supported in two bearing 2.5m apart. It carries 3 discs of weight 2500N, 5000N and 2000N at 0.6m, 1.5m and 2m form the left end. Assume the shaft weight to be 1900N/m length. Determine the natural frequency of transverse vibration by Dunkerley's method. **(10 Marks)**

b. Find the lowest natural frequency of vibration for the system shown in Fig Q7(b) by Rayleigh's method. $E = 1.96 \times 10^{11} N/m^2$, $I = 4 \times 10^{-7} m^4$.

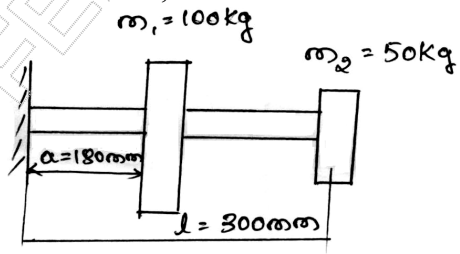


Fig Q7(b) **(10 Marks)**

**OR**

8 Using Stodola's method, determine the lowest natural frequency of the torsional system shown in Fig Q8.

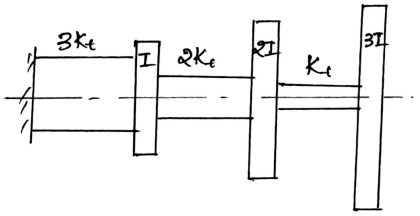


Fig Q8 **(20 Marks)**

## Module-5

9 a. Write a short note on Dynamic testing machines and structures. **(10 Marks)**

b. Explain the following: i) Microphones ii) Sound level meters. **(10 Marks)**

**OR**

10 a. Sketch and explain the arrangement for experimental model analysis. **(10 Marks)**

b. Explain the various techniques for machine condition monitoring. **(10 Marks)**

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