CBCS SCHEME

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18MDE12

# First Semester M.Tech. Degree Examination, Dec.2019/Jan.2020
## Advanced Theory of Vibrations

Time: 3 hrs. Max. Marks: 100

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



### Module-1

1 a. Explain the term degree of freedom and classify the different types of vibration. **(08 Marks)**

b. The cylinder mass m and Radius 'r' rolls without slipping on a cylindrical surface of radius 'R'. Find the natural frequency for small oscillation about the lowest point. **(12 Marks)**

**OR**

2 a. Explain :
i) Vibration isolation
ii) Vibration absorbers. **(10 Marks)**

b. By using the isolator designed if any mass should be added to the machine to limit its steady state amplitude to 3 mm? **(10 Marks)**

### Module-2

3 a. With a neat schematic diagram, explain seismic instrument as a vibrometer. **(10 Marks)**

b. Explain briefly Frahm's reed tachometer. **(10 Marks)**

**OR**

4 a. Explain briefly the different machine maintenance techniques. **(10 Marks)**

b. Explain the experimental modal analysis with reference to basic idea and necessary equipment. **(10 Marks)**

### Module-3

5 a. Define and explain :
i) Laplace transformation
ii) Shock spectrum. **(10 Marks)**

b. Find the Laplace transform of step function : i) Au(t) ii) Au(t – a). **(10 Marks)**

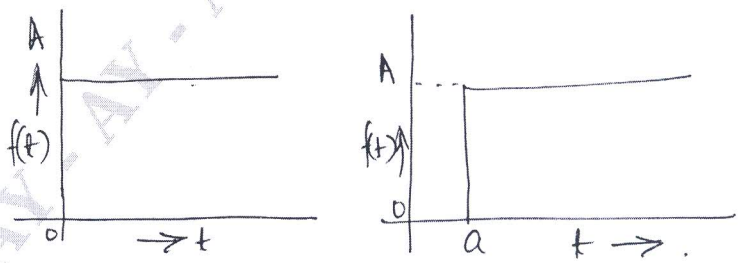


Fig.Q5(b)

**OR**

6 a. Define and explain : i) Correlation ii) Power spectral density. **(10 Marks)**

b. Consider the simplified single degree of freedom version of the system as show in Fig.Q6(b). Let m = 1200kg, k = 68.22 kN/m and C = 3.62kN-s/m. The ground motion $X_g(t)$ is assumed to be represented by white noise with constant one sided PSD function given by $S_g = 2 \times 10^{-5} m^2/rad/s$.

Determine

i) PSD response x(t)

ii) Mean square value of response. **(10 Marks)**

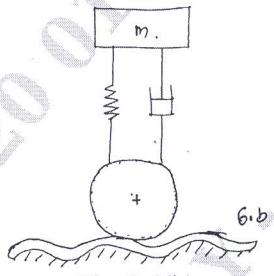


Fig.Q6(b)

## Module-4

7 a. Define and explain phase plane. **(10 Marks)**

b. For the system as shown in Fig. Q7(b) find the time period per cycle as a function of amplitude of vibration. **(10 Marks)**

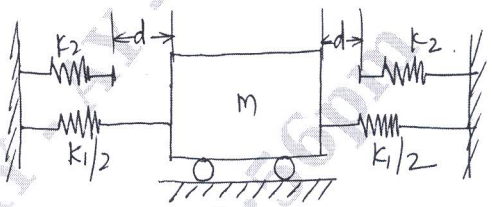


Fig.Q7(b)

**OR**

8 a. Explain Perturbation method. **(10 Marks)**

b. Explain self excited vibration. **(10 Marks)**

## Module-5

9 a. Determine the equation for longitudinal vibration of rod. **(10 Marks)**

b. Find the frequency equation for longitudinal free vibration of a stepped bar as shown in Fig.Q9(b). **(10 Marks)**

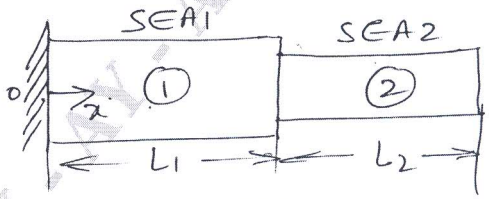


Fig.Q9(b)

**OR**

10 a. Determine the steady state amplitude of the shaft. **(10 Marks)**

b. Determine the natural frequencies and mode shapes of torsional oscillation of a uniform shaft of length $L_1$, mass density $\rho$ and cross sectional polar moment of inertia J the shaft is fixed at one end and free at the other end. **(10 Marks)**