Roll No. | | | | | | | | | | | | **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech.(ME) (Sem.–7,8)

MECHANICAL VIBRATIONS

Subject Code : ME-408

Paper ID : [A0841]

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Write briefly :

a) Define fundamental mode of vibrations.

b) What is orthogonality principle?

c) Define critical speed.

d) Draw a displacement *vs.* time graph for all type of damping.

e) What are the reasons of unbalance in the system?

f) Define resonance.

g) What is the difference between vibration isolation and absorber?

h) Define forced vibrations.

i) What do you mean by continuous systems?

j) What do you mean by compound pendulum?

SECTION-B

2. Split the harmonic motion $x = 10 \sin (\omega t + \pi/6)$ into two harmonic motions one having a phase angle of zero and other of 45 degrees.

3. A steel shaft 6 cm diameter and 50 cm long fixed at one end carries a flywheel of weight 1000 kgf and radius of gyration 30 cm at its free end. Find the frequency of free longitudinal transverse and torsional vibrations. $E = 2 \times 10^6$ kgf/cm^2 and $C = 3.8 \times 10^6$ kgf/cm^2.

4. A body of 5 kg is supported on a spring of stiffness 200 N/m and has dashpot connected to it which produces a resistance of 0.002N at a velocity of 1 cm/sec. In what ratio will the amplitude of vibration be reduced after 5 cycles?

5. The vibrations of railway station are periodic at the frequency range of 12-50 Hz. A vibration measuring instrument is to be installed on some foundation independent of the platform. The small foundation is supported by four identical springs resting on the platform. The total mass of the instrument and foundation is 50 kg. What is the maximum value of spring stiffness, if the amplitude of transmitted vibration is to be less than 10% of the platform vibration over the given frequency range. Take $\varepsilon = 0.20$. System is treated as single degree of freedom.

6. Write short note on beat phenomenon.

SECTION-C

7. Calculate the natural frequency of a shaft of diameter 10 cm and length 300 cm carrying two discs of diameter 125 cm and 200 cm respectively at its ends and weighing 480 N and 900 N respectively. Modulus of rigidity of shaft may be taken as 1.96×10^{11} N/m^2.

8. Three rail bogies are connected by springs of stiffness 40×10^5 N/m each. The mass of each bogey is 20×10^3 kg. Determine the frequencies of vibration. Neglect friction between the wheels and rails.

9. Explain matrix iteration method by taking suitable example of three masses connected by springs in series.