Roll No. | | | | | | | | | | | | |

Total No. of Pages : 03

Total No. of Questions : 09

B.Tech. (ME) (Sem.–7)

MECHANICAL VIBRATIONS

Subject Code : ME-408

M.Code : 59077

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) Compare longitudinal vibrations and transverse vibrations with the help of diagrams.

b) Differentiate between Coulomb damping and Viscous damping.

c) What is the equivalent stiffness of spring connected in parallel having stiffness $k1$ and $k2$.

d) Why viscous damping is preferred for analyzing vibration system?

e) Define static and dynamic coupling.

f) What is the difference between a discrete and continuous system? Is it possible to solve any vibration problem as a discrete one?

g) What is Rayleigh's energy method, Explain?

h) The natural frequency of spring mass system is 10Hz. When the spring stiffness is reduced by 800 N/m the frequency is altered by 50%. Find the mass and stiffness of the original system.

i) Define Eigen vector.

j) Define periodic motion and phase difference.

SECTION-B

2. Split $x(t) = 5 \sin(\omega t = 30°)$ into two harmonic motions one with 60° phase lead and other with 45° phase lag.

3. Explain the whirling of shaft.

4. In a spring mass system, the mass of 10 kg makes 40 oscillations in 20 seconds without damper. With damper, the amplitude decreases to 0.20 of the original value after 5 oscillations. Find out :

   a) Stiffness of the spring

   b) Logarithmic decrement

   c) Damping factor.

5. A 5kg mass is placed at the end of a 30 cm steel beam as shown in Fig. Q5. When excited by a harmonic excitation of magnitude 150 N, a vibration amplitude of 0.5mm is observed. Determine the frequency of excitation.

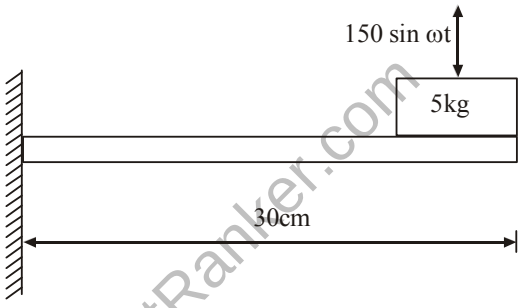

Fig.1

6. Determine the natural frequency of the system shown in Fig. Q6.

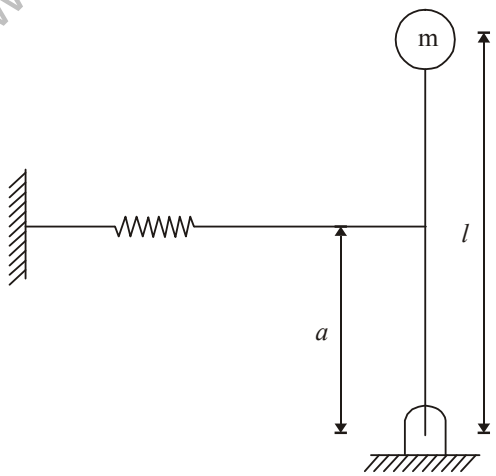

Fig.2

SECTION-C

7. Derive the frequency equation of torsional vibrations for a free-free shaft of length *l*.

8. A single degree of freedom viscously damped system has a spring stiffness of 600N/m, critical damping constant of 0.3 N-s/mm. and a damping ratio of 0.3, if the system is given an initial velocity of 1 m/s, determine the maximum displacement of the system.

9. Mention the conditions of Euler's beam. Derive Eulers's equation of motion for beam vibration. Determine the natural frequencies and mode shapes for simply supported end conditions.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.