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**

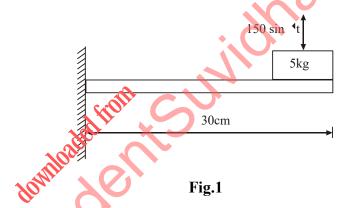
# 1. Write briefly:

- 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.

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## **SECTION-B**

- 2. Split  $x(t) = 5 \sin(t^4 t) = 30^\circ$  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.



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

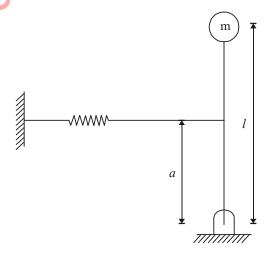
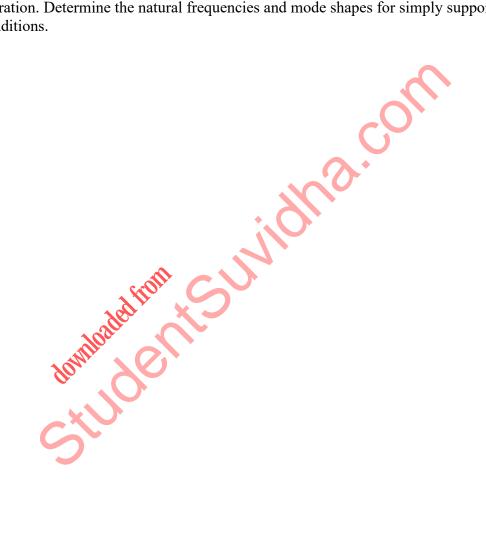


Fig.2

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### **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.

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