

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2535

Roll No.

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B. Tech.

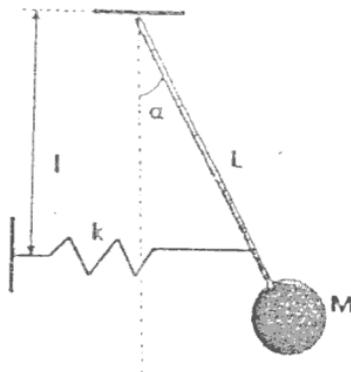
(SEM. VI) THEORY EXAMINATION 2010-11
MECHANICAL VIBRATIONS

Time : 2 Hours

Total Marks : 50

- Note :— (1) Attempt all questions.
 (2) Assume any missing data suitably.
 (3) Be precise in your answer.

1. Attempt any **two** parts of the following :— (7×2=14)
- (a) Define harmonic motion. A harmonic motion has a frequency of 18 cps and its maximum velocity is 5 m/s, determine its amplitude, period and maximum acceleration.
- (b) Explain the vector representation of harmonic motion. What are average and root mean square amplitude ?
- (c) For small oscillation, determine the natural frequency of the system shown in figure. Neglect the mass of the slender rod.



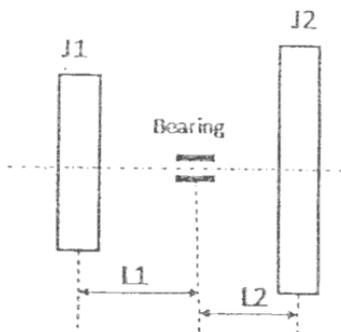
Attempt any two parts of the following :—

- (a) A heavy machine weighing 3000 N is mounted on a flexible foundation. The static deflection of the foundation due to machine is 75 mm. The measured vibration level on the machine are 10 mm when the foundation is subjected to harmonic oscillation at the undamped natural frequency with an amplitude of 2.5 mm. Find the damping constant, dynamic force at the base and amplification of displacement at the machine relative to base.
- (b) Determine the natural frequency and period of vibration of a simply supported beam with a point load W at its mid point.
- (c) Briefly discuss about energy dissipation in viscous damping. Determine the time in which a mass under damped vibration would settle to $1/50^{\text{th}}$ of its initial deflection and number of oscillations to reach this value for the following data :

$$m = 200 \text{ kg}, k = 40 \text{ N/mm}^2, \zeta = 0.22.$$

3. Attempt any two parts of the following :— (6×2=12)

- (a) Determine the natural frequencies and mode shapes of the given torsional vibration system.

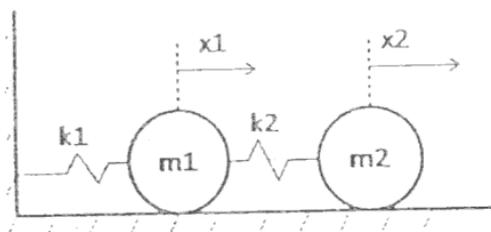


that the natural frequency of a centrifugal pendulum absorber is proportional to the speed of rotating body.

- (c) A gas engine has a mass of 50 kg and runs at a constant speed of 3000 rpm. It vibrates with large amplitude of vibration at operating speed. Design a dynamic vibration absorber to be coupled to the engine so that the nearest resonant frequency of the combined system should be at least 30% away from operating speed.

4. Attempt any **two** parts of the following :— (6×2=12)

- (a) Define influence coefficient for a multi degree of freedom system. Determine the influence coefficient for a rectilinear system shown in figure.



- (b) Briefly discuss the following :—
- Generalized coordinates
 - Coordinate coupling.
- (c) Explain the role of critical speed of machine performance. Find the critical speed a light shaft with single disc without damping.