

Code: 9D15203

M.Tech II Semester Supplementary Examinations February 2018

MECHANICAL VIBRATIONS

(Machine Design)

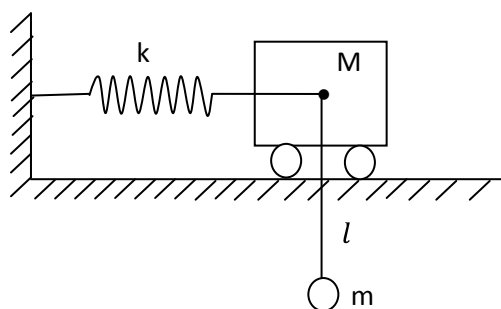
(For students admitted in 2012, 2013, 2014, 2015 & 2016 only)

Time: 3 hours

Max. Marks: 60

Answer any FIVE questions
All questions carry equal marks

- 1 (a) Define transmissibility and derive an expression for the transmissibility ratio and the phase angle for transmitted force.
(b) A machine of total mass 68 kg mounted on spring of stiffness $k = 1100$ kN/m with an assumed damping factor of 0.2. A piston within the machine has a mass of 2 kg has a reciprocating motion with stroke of 75 mm and speed of 3000 rev/min. Assuming the motion of piston to be SHM. Determine: (i) Amplitude of machine.
(ii) Phase angle with respect to exciting force.
(iii) Transmissibility and force transmitted to foundation.
(iv) Phase angle of transmitted force.
- 2 (a) Show that the response to a unit step function, designated by $g(t)$, is related to impulsive response $h(t)$ by the equation $h(t) = g(t)$.
(b) A force $F(t)$ is suddenly applied to a mass m which is supported by a spring with a constant stiffness k N/m. After a short period of time T , the force is suddenly removed. During the time the force is active, it is constant, T . Determine the response of the system if $t > T$. The spring and mass are initially at rest before the force $F(t)$ is applied.
- 3 (a) A vibrometer gives a reading relative displacement 0.5 mm. The natural frequency of vibration is 600 rev/min and the machine runs at 200 rev/min. Determine the magnitude of displacement, velocity and acceleration of the vibrating machine part.
(b) Explain the working principle of seismic instrument when it measures displacement and acceleration.
- 4 (a) Determine the differential equation, natural frequency and the amplitude ratio of the system shown in figure below:

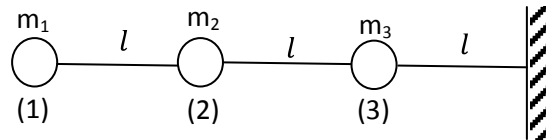


- (b) Explain the working principle of dynamic vibration absorber.

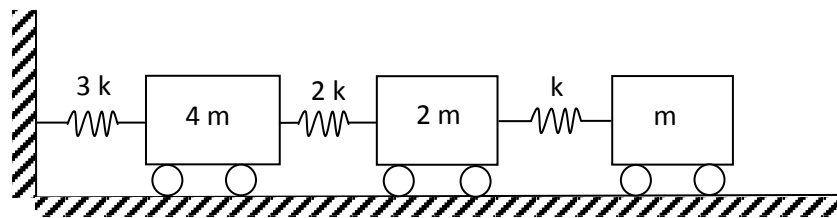
Contd. in page 2

Code: 9D15203

- 5 (a) Determine the flexibility influence coefficients for stations 1, 2, 3 of the uniform cantilever beam shown in figure below:



- (b) Explain the Eigen values and Eigen vectors and orthogonal properties of Eigen vectors.
- 6 Determine the natural frequencies of the system shown in figure below by Holzer's method.



- 7 (a) Derive suitable expression for longitudinal vibrations for a rectangular uniform cross-section bar of length l fixed at one end and free at the other end.
- (b) Determine the normal functions in transverse vibration for a simply supported beam of length l and having uniform cross section.
- 8 (a) The rotor of a turbo super charger of mass 9 kg is keyed to the centre of a 25 mm diameter steel shaft 400 mm long between bearing. Determine: (i) The critical speed of shaft. (ii) The amplitude of vibration of the rotor at a speed of 3200 rpm if the eccentricity is 0.015 mm . (iii) The vibratory force transmitted to the bearing at this speed. Assume the shaft to be simply supported.
- (b) Explain the term whirling or critical speed of a shaft. Prove that the whirling speed for a rotating shaft with damping is same as the natural frequency of the natural transverse vibration.
