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

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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.

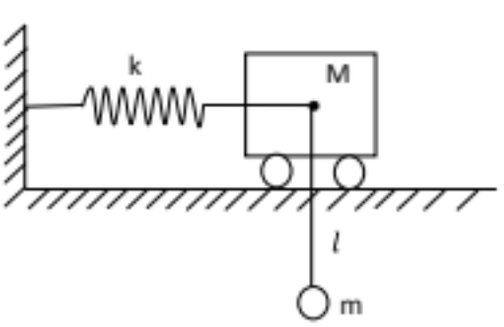
2 (a) Show that the response to a unit step function, designated by g(t), is related to impulsive response h(t) by the equation h(t) = g(t).

(b) A force F(t) us 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 measure 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.

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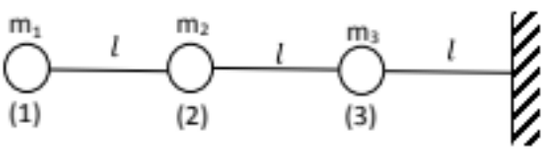
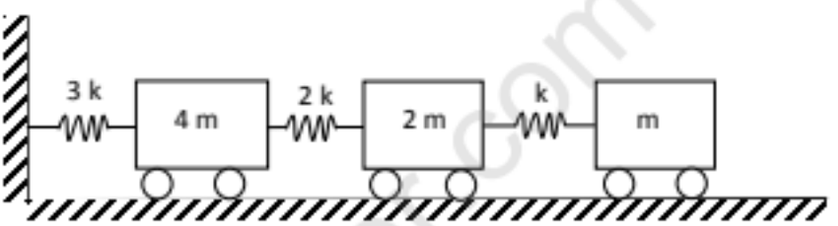
5 (a) Determine the flexibility influence coefficients for stations 1, 2, 3 of the uniform cantilever beam shown in figure below:



(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.

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