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B. TECH.
THEORY EXAMINATION (SEM–VI) 2016-17
MECHANICAL VIBRATION

Time : 3 Hours ***Max. Marks : 100***

Note : *Be precise in your answer. In case of numerical problem assume data wherever not provided.*

SECTION – A

1. Attempt all parts of the following question: 10 x 2 = 20

(a) What are the causes and effects of vibration?

(b) Explain the term logarithmic decrement as applied to damped vibration.

(c) What do you understand by transmissibility?

(d) What are the basic elements of vibratory system? What is degree of freedom?

(e) What do you mean by the steady-state response of the system in case of forced vibration?

(f) What do you mean by the whirling of shaft? What is whirling or critical speed?

(g) What is multifilar system? Where are they used?

(h) Find the natural frequency of vibratory system having a mass suspended from the free end of a massless spring.

(i) What do you mean by under damping, over damping and critical damping

(j) What do mean by vibration isolation?

SECTION – B

2. Attempt any five of the following questions: 5 x 10 = 50

(a) Find the steady-state amplitude as a function of damping factor and frequency ratio as a result of forcing due to unbalance in machinery. Explain with the help of plots.

(b) The measurements on a mechanical vibrating system show that it has a mass of 8 kg and that the springs can be combined to give an equivalent spring of stiffness 5.4 N/mm. If the vibrating system have a dashpot attached which exerts a force of 40 N when the mass has a velocity of 1 m/s, find: 1. Critical damping coefficient, 2. Damping factor, 3. logarithmic decrement, and 4. Ratio of two consecutive amplitudes.

(c) Derive the expression for frequency of free damped vibrations.

(d) In a spring mass vibrating system, the natural frequency of vibration is 3.56 Hz. When the amount of the suspended mass is increased by 5 kg, the natural frequency is lowered to 2.9 Hz. Determine the original unknown mass and the spring constant.

(e) Establish an expression for the natural frequency of free transverse vibration for a simply supported beam carrying a number of point loads, by (a) Energy method; (b) Dunkerley's method.

(f) How the natural frequency of torsional vibrations for a two rotor system is obtained?

(g) A shaft of 100 mm diameter and 1 meter long has one of its end fixed and the other end carries a disc of mass 500 kg at a radius of gyration of 450 mm. The modulus of rigidity for the shaft material is 80 GN/m^2. Determine the frequency of torsional vibration.

(h) A gun barrel weight 300 kg and has a recoil spring of stiffness 250 N/mm. The barrel recoils 0.8 m on firing. Determine the (i) critical recoil velocity of the gun, (ii) critical damping coefficient of the dashpot engaged at the end of the recoil stroke.

SECTION – C

Attempt any two of the following questions: 2 x 15 = 30

3. A shaft 1.5 m long, supported in flexible bearings at the ends carries two wheels each of 50 kg mass. One wheel is situated at the centre of the shaft and the other at a distance of 375 mm from the centre towards left. The shaft is hollow of external diameter 75 mm and internal diameter 40 mm. The density of the shaft material is 7700 kg/m^3 and its modulus of elasticity is 200 GN/m^2. Find the lowest whirling speed of the shaft, taking into account the mass of the shaft.

4. A mass of 7.5 kg hangs from a spring and makes damped oscillations. The time for 60 oscillations is 35 seconds and the ratio of the first and seventh displacement is 2.5. Find (a) the stiffness of the spring, and (b) the damping resistance in N/m/s. If the oscillations are critically damped, what is the damping resistance required in N/m/s.

5. Describe a three-rotor vibratory system and find the ratio of their amplitude.