PVP 14

Code: ME7T4C

IV B.Tech - I Semester – Regular/Supplementary Examinations
March 2021

MECHANICAL VIBRATIONS
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

Answer ***all*** the questions. All questions carry equal marks
11 x 2 = 22 M

1.

a) What are the types of vibrations?
b) Name any two vibration problems in machines.
c) Define critical speed.
d) Differentiate the vibration isolation and transmissibility.
e) Define Eigen values and Eigen vectors.
f) Draw any two DOF systems.
g) Differentiate flexibility and stiffness.
h) Name any two methods of deriving the equations of motion of two DOF systems.
i) Write the equation to find the natural frequency of simply supported beam.
j) Differentiate node and element in FEM.
k) What is critical damping?

PART – B

Answer any ***THREE*** questions. All questions carry equal marks. 3 x 16 = 48 M

2. a) Derive the equation of motion of spring-mass system by energy method. 6 M

b) A cantilever shaft 50 mm diameter and 300 mm long has a disc of mass 100 kg at its free end. The Young's modulus for the shaft material is 200 GN/m^2. Determine the frequency of longitudinal and transverse vibrations of the shaft. 10 M

3. a) Find the frequency ratio, $r = \frac{\omega}{\omega_n}$ at which the amplitude of single degree of freedom damped system attains the maximum value. Also find the value of the maximum amplitude. 8 M

b) A heavy machine, weighing 3000N, is supported on a resilient foundation. The static deflection of the foundation due to weight of the machine is found to be 7.5cm. It is observed that the machine vibrates with an amplitude of 1cm when the base of the foundation is subjected to harmonic oscillation at undamped natural frequency of the system with an amplitude of 0.25cm. Find 8 M

i) the damping constant of the foundation

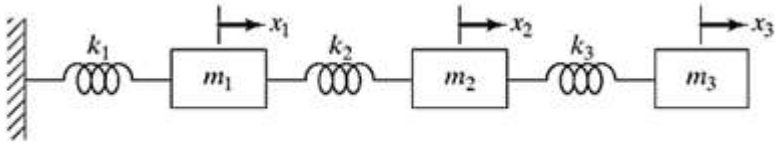
ii) the dynamic force amplitude on the base, and

iii) the amplitude of the displacement of the machine relative to base

4. Derive an expression for undamped dynamic vibration absorber. Discuss the effect of resonant frequencies on dynamic vibration absorber system. 16 M

5. Calculate the fundamental natural frequency of vibration of the system using any method. 16 M

$m_1 = m_3 = m, m_2 = 2m \; and \quad k_1 = k, k_2 = 2k, k_3 = 3k;$



6. Derive the wave equations for lateral vibrations of a string. Obtain general expression for the lateral vibrations of string. 16 M