[Total No. of Questions - 9] [Total No. of P. ted Pages - 3]
(2126)

16180(D) - 0 DEC 2016

B. Tech 7th Semester Examination

Mechanical Vibrations (NS)

ME-412

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

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : (i) Assume any data if necessary.

(ii) Attempt one question from each section A, B, C and D.

(iii) Section E is compulsory.

SECTION - A

1. (a) Define the following terms:-

(i) Frequency.

(ii) Degree of freedom.

(iii) Resonance.

(iv) Transverse vibrations.

(v) Deterministic vibrations. (10)

(b) An instrument has a natural frequency of 10 Hz. It can stand a maximum acceleration of 10 m/sec^2. Find the maximum displacement amplitude. (10)

2. Add the following harmonic motions analytically and check the solution graphically.

$x_1 = 6\cos(\omega t + 10^\circ)$

$x_2 = 4\cos(\omega t + 60^\circ)$ (20)

SECTION - B

3. (a) A cantilever shaft of 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. (12)

(b) What is critical damping? Discuss its importance. (8)

4. A 75 kg machine is mounted on springs of stiffness 11.76×10^5 N/m with an assumed damping factor of 0.20. A 2 kg piston within the machine has a reciprocating motion with a stroke of 0.08 m and a speed of 3000 cycles per minutes. Assuming the motion of the piston to be harmonic, determine the amplitude of vibration of the machine and the vibratory force transmitted to the foundation. (20)

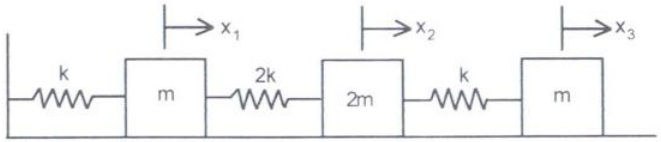
SECTION - C

5. What are vibration absorbers? Explain the working principle of a torsional vibration absorber with help of neat sketch. (20)

6. Two identical rotors are attached to the two ends of a stepped shaft. Each rotor weighs 450 kg and has a radius of gyration of 0.38 m. The diameter of the shaft is 0.75 m for the first 0.25 m length; 0.1 m for the next 0.1 m length and 0.0875 m for the remaining length. If the total length of the shaft is 0.6 m, find the frequency of free torsional vibrations of the system and the position of the node from either masses. Assume modulus of rigidity as 80×10^9 N/m^2. (20)

SECTION - D

7. Use free body diagram method to derive the differential equations governing the motion of the system as shown in figure below using x_1, x_2, x_3 as generalized coordinates. (20)



[P.T.O.]

8. A uniform string is tightly stretched between $x = 0$ and $x = 1$ and is plucked at $x = 1/4$, through a distance h and then released from rest, find its subsequent displacement. (20)

SECTION - E

9. Attempt the following questions.

   (a) Define Mechanical Vibrations.

   (b) Explain periodic and harmonic vibrations.

   (c) What is difference between discrete system and continuous system?

   (d) What is difference between free and forced vibration?

   (e) Define logarithmic decrement.

   (f) What is structural damping?

   (g) What do you mean by torsionally equivalent shaft?

   (h) What is orthogonality principle?

   (i) Define the flexibility and stiffness influence coefficient.

   (j) Define D'Alemberts Principle. (2×10=20)