TME-501 1139

Odd Semester Examination 2018-19

B.TECH. (ME) (SEMESTER-V)

MECHANICAL VIBRATION

Time: 03:00 Hours **Max Marks : 100**

Note: Attempt **all** the questions. Assume any missing data suitably.

1. Attempt any **four** of the following : (5x4=20 Marks)

   (a) Explain different types of free vibrations.

   (b) Derive an expression for the natural frequency of free transverse vibrations.

   (c) Discuss Seismic instrument with help of a sketch

   (d) Derive the Dunkerley's equation to find out fundamental frequency of structure.

   (e) Derive an expression for vibration response of a single degree of freedom system if the damping provided is under damped system.

   (f) What is the difference between energy method and Rayleigh method?

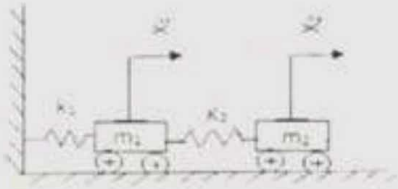
2. Attempt any **four** of the following : (5x4=20 Marks)

   (a) 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.

   (b) Damped vibration of spring mass dashpot system gives the following information: amplitude of second cycle =1.2cm, amplitude of third cycle is = 1.05cm, spring constant = 8Kg/cm and weight of the spring= 2Kg. Determine the damping constant, assume it to be viscous.

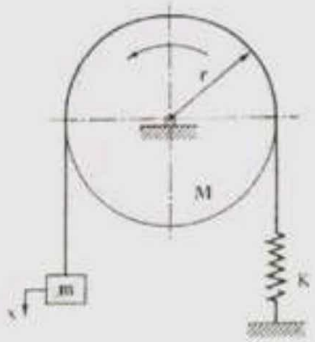
   (c) What is critical speed of shafts? With usual notations, obtain an expression for the dynamic amplitude of vibrations due to eccentricity of a rotating shaft.

(c) Find the natural frequencies and first two normal mode shapes of the system shown in Fig. Assume $k_1=k_2=k$ and $m_1=m_2=m$.



(d) What do you understand by transmissibility

(e) Write the equation of the system of the fig. shown and find its natural frequency



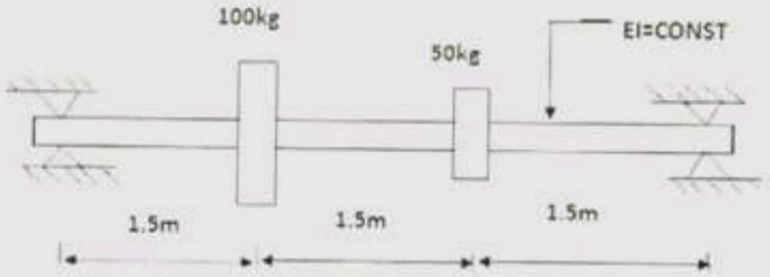
(f) Determine Free Torsional Vibrations of a Two Rotor System.

3. Attempt any **two** of the following: (10x2=20 Marks)

(a) A shaft 40mm diameter and 2.5 m long has a mass of 15kg per meter length. It is simply supported at the ends and carries three masses 90kg, 140kg and 60kg at 0.8m, 1.5m, 2m respectively from the left support. Take E = 200GN/m^2, find the frequency of the transverse vibrations.

(b) A gun barrel with mass 600 kg has a recoil spring of 350 kN/m. If the barrel recoils one meter on firing, find: (i) initial recoil velocity of the gun. (ii) The critical damping coefficient of a dashpot which is engaged at the end of the recoil stroke.

(c) Find the lowest natural frequency of vibration of system shown in Fig.4 by Rayleigh's method. Assume E= 1.96X 210^{11} N/mt^2, I=4X 10^{-7} m^4



4. Attempt any **two** of the following (10x2=20 Marks)

(a) The time of free vibration of a mass hung from the end of a helical spring is 0.8 second. When the mass is stationary, the upper end is made to move upwards with a displacement y metre such that

$y = 0.018 \sin 2\pi t$, where t is the time in seconds measured from the beginning of the motion. Neglecting the mass of the spring and any damping effects, determine the vertical distance through which the mass is moved in the first 0.3 second.

(b) A flywheel of mass 10Kg and radius of gyration 0.3m, makes torsional rotation under a spring of stiffness 5Nm/rad. A viscous damper is fitted and it is found that the amplitude is reduced by a factor 100 over any two cycles, find: (i) Damping Factor (ii) Damping coefficient (iii) Periodic time of damped oscillations.

(c) Using matrix iteration method, determine the natural frequencies of the system shown in fig.

5. Write short notes on any FOUR of the following (5x4=20 Marks)

(a) Vibrometer and an accelerometer

(b) Logarithmic decrement and its significance

(c) Force Transmissibility and Transmissibility Curve

(d) Causes and effects of vibrations

(e) Coulomb Damping

(f) Stodola's methods

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