Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– III • EXAMINATION – SUMMER 2015

Subject Code: 734703 **Date: 02/05/2015**

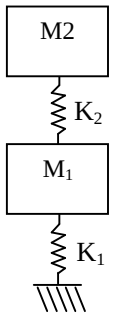
Subject Name: Dynamics of Machines

Time: 02:30 pm to 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q:1 Consider a 3 ton forging hammer (M_2) mounted on a 15 ton concrete block (M_1). The mass of the hammer alone is 500 kg, which drops on the workpiece from height 1.5 m. the static deflection in spring K_1 is found to be 2 cm while in K_2 it is 0.2 cm. Analyse the resulting motion of the forging hammer and concrete block. **14**

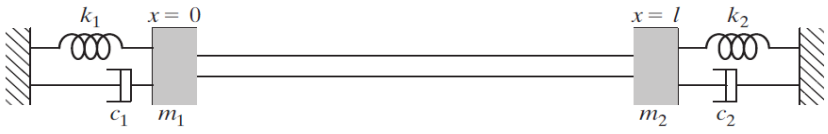


Q:2 **(a)** Explain the concept of modal analysis to determine the vibration response of multi degree of freedom system. **07**

(b) Derive the equations of motion for the transverse vibration of a string. **07**

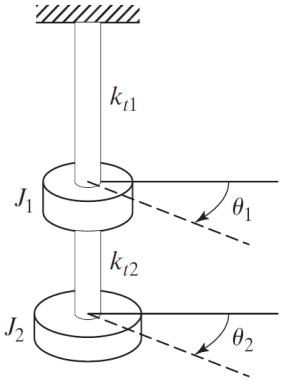
OR

(b) A uniform bar of cross-sectional area *A,* length *l,* and Young s modulus *E* is connected at both ends by springs, dampers, and masses, as shown in following Figure. State the boundary conditions. **07**



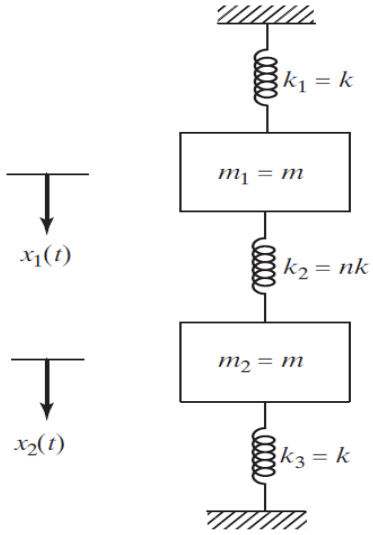
Q:3 **(a)** A steam turbine blade of length *l* can be considered as a uniform cantilever beam mass *m* per unit length, with tip mass *M*. The flexure rigidity of the blade is EI. Determine the fundamental frequency by Rayleighôs method. Assume appropriate mode shape. **07**

(b) Find the natural frequencies and mode shapes for the torsional system shown in following Figure for $j_1 = j_0$, $j_2 = 2j_0$, $k_{t1} = k_{t2} = k_t$ **07**



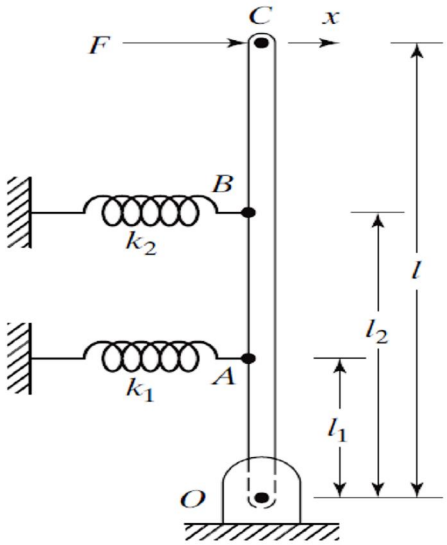
OR

Q:3 **(a)** Find the natural frequencies and mode shapes of a spring-mass system, shown in following Figure, which is constrained to move in the vertical direction only. Take n =1. **07**



(b) Find the total response of a viscously damped single-degree-of-freedom system subjected to a harmonic base excitation for the following data: m = 10 kg, c = 20 N-s/m, k = 4000 N/m, y(t) = 0.05 sin 5t m, x_0 = 0.02 m, $\dot{x}_0 = 10$ m / s **07**

Q:4 **(a)** A hinged rigid bar of length l is connected by two springs of stiffnesses and is subjected to a force F as shown in following Figure. Assuming that the angular displacement of the bar is small, find the equivalent spring constant of the system that relates the applied force F to the resulting displacement x. **07**



(b) What do you understand by coulomb damping? Explain the effect coulomb damping in single degree of freedom system. **07**

OR

Q:4 **(a)** Derive the equations for the stiffness in following cases: **07**

1. Rubber mounts for linear stiffness
2. Rubber coupling

(b) Explain the vibration isolation and force transmissibility. **07**

Q:5 **(a)** Explain the Logarithmic decrement. The successive amplitudes from free vibration rap test for a structure are 0.69, 0.362, 0.190, 0.0099 units respectively. Determine the damping ratio of the system. **07**

(b) What do you understand by close coupled systems? Explain the use of Eigen value problem to determine vibration response of close coupled system. **07**

OR

Q:5 **(a)** Explain the different types of instruments that are used in conducting the vibration tests. **07**

(b) Derive the Equation of motion for the lateral vibration of the beams.

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