B

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2015

Mechanical Engineering

(Machine Design)

01ME6101: Advanced Theory of Vibration

Max. Marks : 60 Duration: 3 Hours

Answer any two full questions from each module.

Part A (Modules I & II) – Max marks: 18

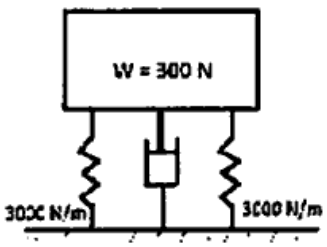
1. (a) Determine the response of a single degree spring mass system subjected to unit impulsive force. ***(5 marks)***

   (b) Define 'Transmissibility' and discuss its variation with frequency ratio. ***(4 marks)***

2. (a) Explain with neat sketch, the basic working principle of a dynamic vibration absorber. ***(5 marks)***

   (b) A machine of 500 kg mass is supported on a spring of 10^6 N/m stiffness. if the machine has a rotating unbalance of 0.25kg-m, determine (i) the force transmitted to the floor at 1200 rev/min, and (ii) the amplitude at this speed. ***(4 marks)***

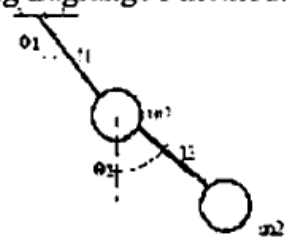
3. (a) A weight of 300N is resting on two springs of 3000 N/m stiffness each and a dashpot of damping co. efficient 150N. s/m as shown in figure. if an initial velocity of 10 cm/s is given to the mass at its equilibrium position, what will be the displacement from the equilibrium position at the end of first second. ***(5 marks)***



   (b) Explain the terms Coordinate coupling and Principal coordinates. ***(4 marks)***

Part B (Modules III & IV) – Max marks: 18

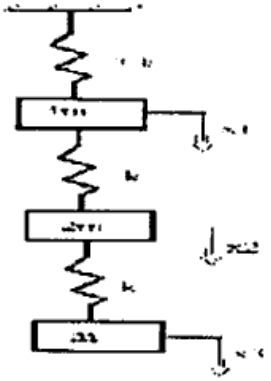
4. (a) Determine the equation of motion of the double pendulum of length l_1 and l_2 as shown in figure for small oscillation using Lagrange's method. ***(5 marks)***



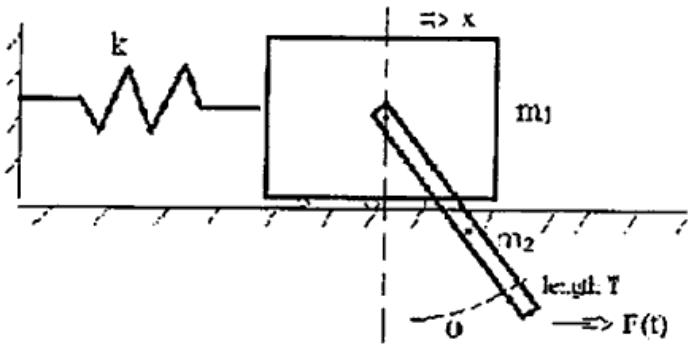
Turn over

(b) Explain the Stodla method for analyzing multi degree freedom system. *(4 marks)*

5. (a) Explain the Orthogonality property of Eigen Vectors *(4 marks)*
(b)Determine the natural frequency and principal modes of vibration for the 3 DOF system shown in figure by using matrix iteration method. *(5 marks)*

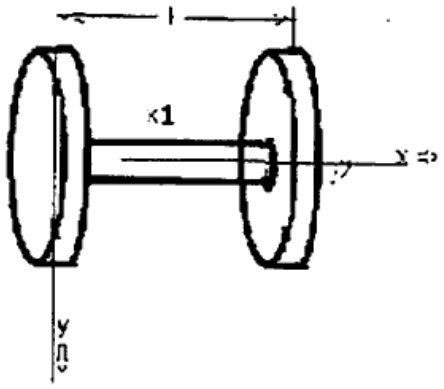


6. (a) Determine the equation of motion for the system shown in figure using virtual work method. *(9 marks)*



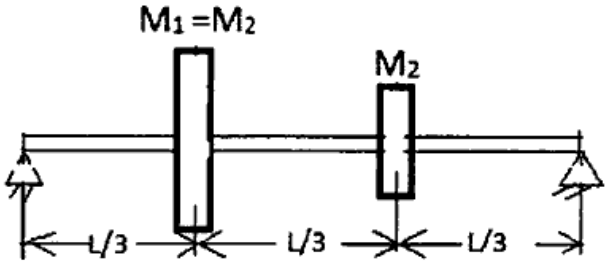
Part C (Modules V & VI) – Max marks:24

7. (a) Explain Holzers method of analyzing multi degree freedom vibrating system. *(5 marks)*
(b) Derive the frequency equation for the torsional vibration of a uniform circular shaft with rotors attached rigidly at the ends as shown in figure. *(7 marks)*

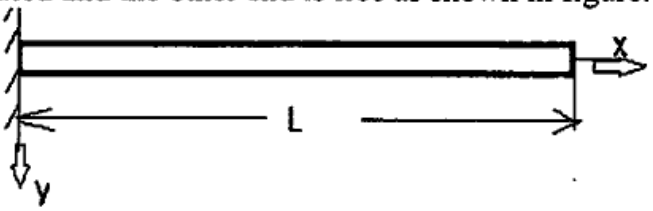


8. (a) Derive the expression for frequency of a uniform beam is fixed at one end and simply supported at the other end is having transverse vibrations. *(5 marks)*

(b) Using Rayleigh's method, estimate the fundamental frequency of lumped mass system shown in figure. ***(7marks)***



9. (a) Derive the expression for free longitudinal vibration of a uniform bar of length 'L' , one end of which is fixed and the other end is free as shown in figure. ***(6 marks)***



(b) Find the natural frequency of vibration for the system shown in figure by using Dunkerley's method. Take E= 1.96 x 10^{11} N/m^2 and I = 4 x 10^{-7} m^4. ***(6 marks)***