R05 SET-3

Code No : 37148

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
IV.B.TECH - I SEMESTER REGULAR EXAMINATIONS NOV/DEC, 2009
THEORY OF VIBRATIONS AND AEROELASTICITY
(AERONAUTICAL ENGINEERING)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

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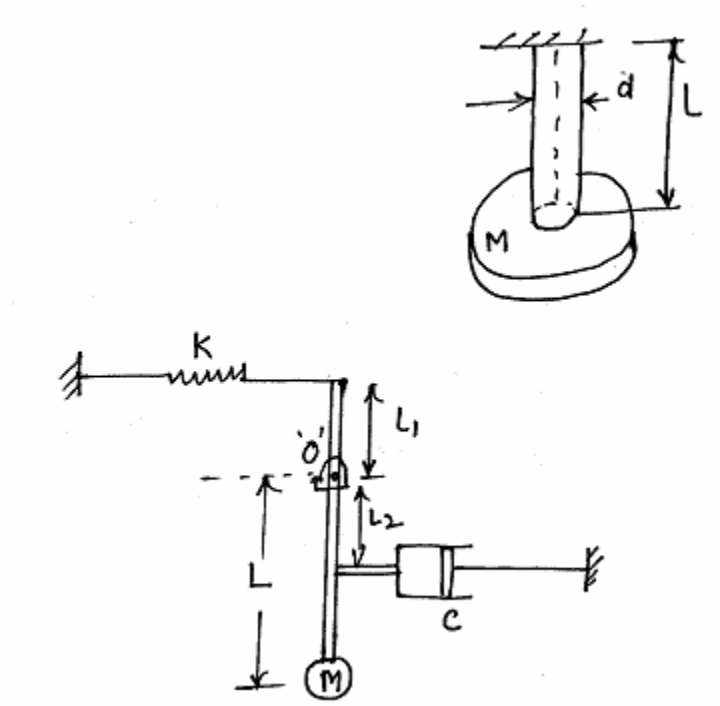
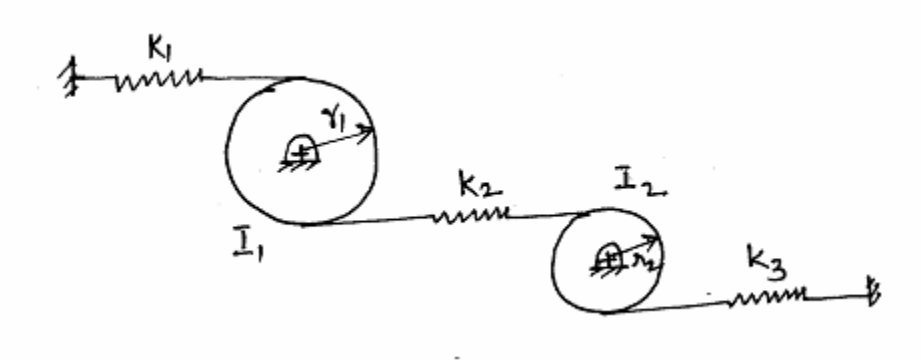
1. a) Determine the torsional vibrations of the disc connected to a shaft as shown in figure below.



b) For the pendulum show in the figure above, pivoted at point 'O' if the mass of the rod is neglected, find the damped natural frequency of the pendulum. [6+10]

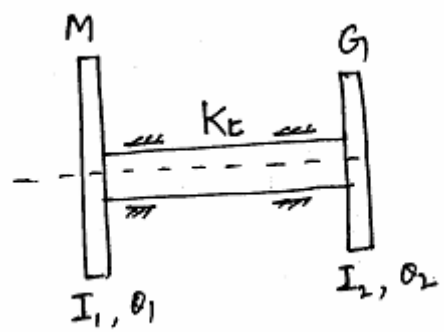
2. a) Derive the equation for amplitude of forced vibration with damping
b) Draw the characteristic curves for the following cases
i) Amplitude ratio versus frequency ratio for various damping ratios.
ii) Phase angle versus frequency ratio for various damping ratios. [8+8]

3.



Determine the natural frequency of the system shown. [16]

4.



Electrical Motor – generator set is shown in the figure. Determine the natural frequencies and amplitude ratios of principal modes. [16]

5. a) Derive the Wave propagation equation for longitudinal vibration of bars of continuous system.
   b) Determine the natural frequency of bar when both the ends are fixed. [8+8]

6. a) What are the various reasons for whirling of a shaft.
   b) Derive the equation for a lateral deflection of a shaft due to the mounting of a disc with eccentricity 'e' when running at uniform speed. [8+8]

7. Prove that $w^2 = \frac{EI}{m} \frac{\int_O^L \left(\frac{\partial^2 y}{\partial x^2} \right)^2 dx}{\int_o^l y^2 dx}$ by Rayleigh's Energy method for the transverse vibration of a beam
   m – Mass of the beam, E – Young's modulus, I – Moment of Inertia. [16]

8. What is flutter instability in aircraft wings? Describe briefly the objective and approach of the classical flutter analysis. [16]

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