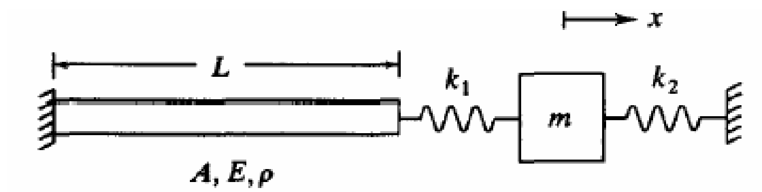
Code.No: **07A72101** | R07 | SET-1

IV B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010
VIBRATIONS AND STRUCTURAL DYNAMICS
(AERONAUTICAL ENGINEERING)

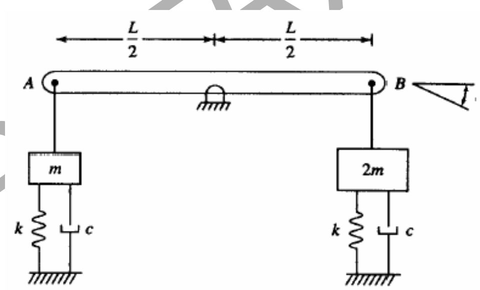
Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks
- - -

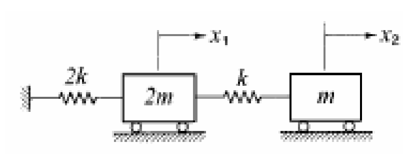
1. Find the equivalent stiffness, frequency and time period for the system shown in figure below, If k_1= 200 N/m k_2 = 100 N/m, m = 20 Kg L = 2000 mm, A = 100 mm^2 density is 7200 kg/mm^3. [16]



2. Derive the governing differential equation of motion for the system shown in figure below. [16]



3. Obtain the modes of vibrations for the system shown in figure below. [16]



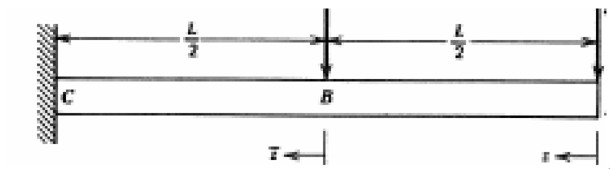
4. Show that the equation of transverse vibrations of a beam at a distance 'x' with deflection 'y' is given by $D^4y/d^4x + \rho A/ EI \quad d^2y/dt^2 = 0$ [16]

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

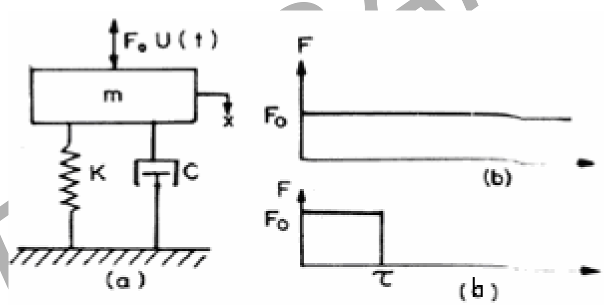
b) Explain the phenomenon of synchronous whirl with a supported sketch. [10+6]

6. A fixed beam AB of length 1.2 m carries transverse loads of 200N, 800 N and 400 N respectively at distances of 30 cm, 60 cm, and 90 cm from the left hand support. Find the natural frequency of the transverse vibrations using dunker leys method E = 19.6 x10^6 N/cm^2 and I = 40 cm^4 [16]

7. Derive global stiffness matrix and lumped mass matrix for the three nodded cantilever beam shown in figure below. [16]



8. Using Laplace transform method, obtain the response of a second-order damped system shown in Figure (a), and step impulsive force, for shown in figure (b). Where U(t) is the unit function. Also find the response of this system for a rectangular pulse of magnitude, F_0, and duration T. [16]



*****

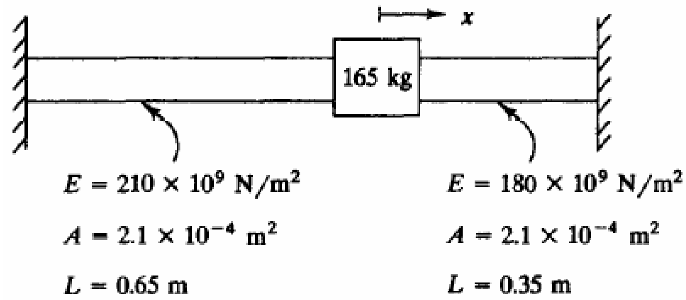
Code.No: **07A72101**	R07	SET-2

IV B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010
VIBRATIONS AND STRUCTURAL DYNAMICS
(AERONAUTICAL ENGINEERING)

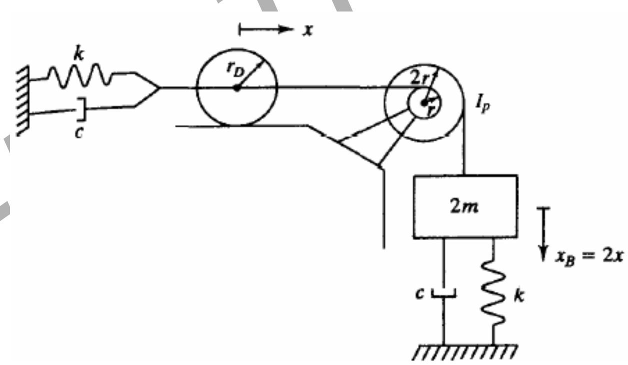
Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks
- - -

1. Determine the equivalent stiffness of the system and obtain the natural frequency and time period of oscillations for the system shown in figure below. [16]



2. Derive the governing equation of vibrations and determine the damped frequency for the system with damper shown in figure below. [16]



3. A vibratory system performs the motions as expressed by the following equations:

$$\ddot{x} + 800x + 900\theta = 0$$
$$\ddot{\theta} + 800\theta + 90x = 0$$

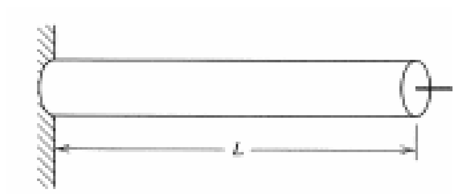
If the system is turned through 1.5 radians and released, find the frequencies and mode shapes. [16]

4. Define the Euler beam and mention the conditions. Derive the Euler equation of beam vibration. [16]

5. A disc of mass 5 kg is mounted midway between bearings which may be assumed to be simple supports. The bearing span is 48 cm. the steel shaft, which is horizontal, is 9 mm in diameter. The C.G of the disc is placed 3 mm from the geometric center. The equivalent viscous damping at the center of the disc – shaft may be taken as 48 N-s/m. if the shaft rotates at 675 rpm, find the maximum stress in the shaft and compare it with dead load stress in the shaft. Also find the power required to drive the shaft at this speed. [16]

6. Explain the procedure to find out natural frequency of vibrations by Dunker leys method for simple supported beam subjected to three point loads at equidistance along the span. [16]

7. Find the natural frequencies of vibrations of a simple axial bar of length L dividing into two equal elements of area A and density (ρ) using consistent mass matrix by FEM approach [16]



8. Find the Laplace transform of the derivative of a function. [16]

*****

Code.No: **07A72101**

R07

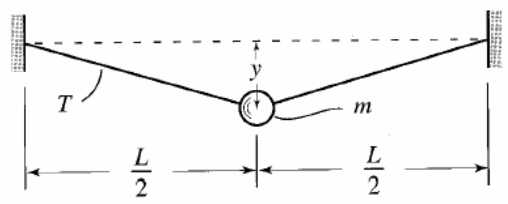
SET-3

IV B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010
VIBRATIONS AND STRUCTURAL DYNAMICS
(AERONAUTICAL ENGINEERING)

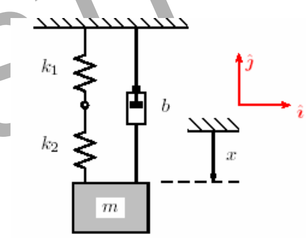
Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks
- - -

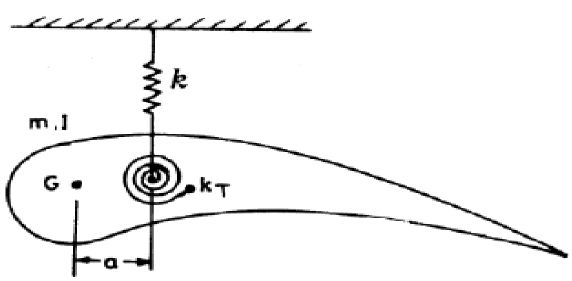
1. a) What are the types of vibrations.
   b) A bead of mass m is suspended on a mass less string as shown in fig. below. Assume that the string is subjected to the tension T and that the tension remains constant throughout the vertical motion of the bead and derive the equation for small motions y (t) from equilibrium, as well as the natural frequency of oscillation. [16]



2. Find the response of the system shown to the right if the block is pulled down by 14 cm and released from rest. m = 2.0 kg , b = 0.5 N/ (m/s) , k_1 = 0.5 N/m, k_2 = N/ (m/s). [16]



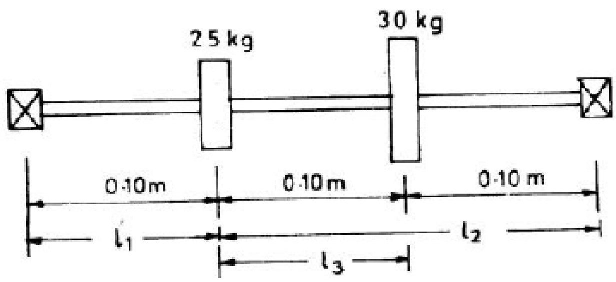
3. An aerofoil using in its first bending and torsional modes can be represented schematically as shown in figure connected through a translational spring of stiffness k and a torsional spring of stiffness k_T. Write the equations of motion for the system and obtain the two natural frequencies. Assume the following data. m = 5kg , I = 0.12 kg m^2, k = 5 X 10^3 N/m, k_T = 0.4 X 10^3 Nm/rad, a = 0.1 m [16]



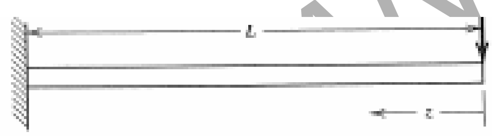
4. Derive the governing equation of continues torsional vibrations when shaft of length L, polar moment of inertia J and density ρ is subjected to torque. [16]

5. A power shaft has a diameter of 30 mm and 900 mm long , and a simply supported. The shaft carries a rotor of 4 kg at its mid span. The rotor has an eccentricity of 0.5 mm. calculate the critical speed of shaft and deflection of the shaft at mid span at 1000 r/min. neglect mass of shaft take E = 2X 10^{5} MPa. [16]

6. Determine the frequency of vibrations for the system shown in figure using stodola method. [16]



7. For the single element cantilever beam, determine the fundamental frequency of oscillation. [16]



8. Determine the response of spring mass damper system to a step input and the plot the system response for different amounts of damping. [16]

*****

Code.No: **07A72101**

R07

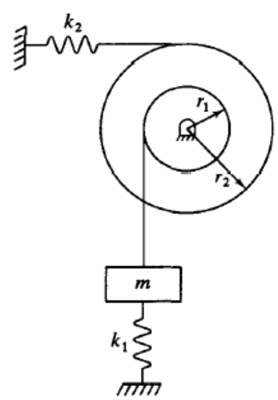
SET-4

IV B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010
VIBRATIONS AND STRUCTURAL DYNAMICS
(AERONAUTICAL ENGINEERING)

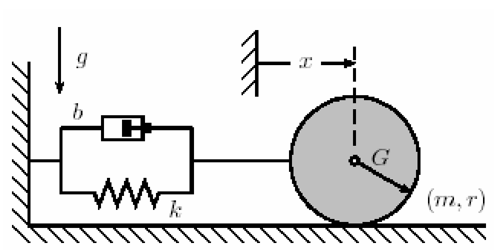
Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks
- - -

1. Explain the Energy method of determining the frequency of vibrating system. Calculate the total K.E and P.E for the system and obtain the frequency if k_1=k_2= 10 N/m.
Mass of the rotor is M = 8 kg, m = 4 kg , $r_{1\ =\ 20\ mm,}$ r_2 = 80 mm. [16]



2. In the figure, the disk has mass m, radius r, and moment of inertia I_G = mr^2 /2 about the mass center G.
   a) Find the equations of motion for this system assuming that the disk rolls without slip.
   b) What value of '*b*' corresponds to critical damping?
   c) Find the displacement of the center of the disk when the system is critically damped and released from rest with x(o) = x_0. [16]



3. Describe the concept of vibration absorber with the help of neat sketches. [16]

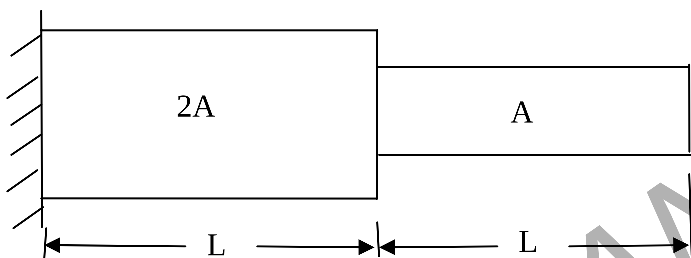
4. Derive the governing equation for continues vibration of a slender axial bar of length L, cross-sectional area A and density ρ. [16]

5. a) Find the whirling speed of a 50 mm diameter steel shaft simply supported at the ends in bearings 1.6 m apart, carrying masses of 75 kg at 0.4 m from one end, 100 kg at the center and 125 kg at 0.4 m from the other end. Ignore the mass of the shaft. Assume the required data.

b) Describe the whirling speed of light vertical shaft with single disc of without damping with a supported diagram. [8+8]

6. The vibrations of a cantilever are given by $y=y_l(1 - \cos \frac{\pi x}{2l})$. Calculate the frequency with following data for the cantilever using Rayleigh's method. Modulus of elasticity of the material is 2×10^{11} N/m^2 Second moment of area about bending axis 0.02m^4 Mass=6×10^4 Kg, Length=30 m. [16]

7. Find the natural frequencies of longitudinal vibrations of the cantilevered stepped shaft of areas A and 2A and of equal lengths (L), as shown below using consistant mass matrix approach. [16]



8. An arbitrary force f(t) is applied to an oscillator without damping having non-zero initial conditions, prove that the solution of the problem is of the form.

$$x(t) = x_0 \cos \omega_n t + \frac{v_0}{\omega_n} \sin \omega_n t + \frac{1}{m\omega_n} \int_0^t f(\xi) \sin \omega_n (t - \xi_1)\, d\xi$$ [16]

*****