Code No: RR412101 **Set No. 1**

IV B.Tech I Semester Supplementary Examinations, February 2007
THEORY OF VIBRATIONS AND AEROELASTICITY
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Prove that the harmonic functions of frequencies p and 2p when added will give a periodic function of frequency p. Generalize it with n harmonic function of frequencies p, 2p, 3p, np etc. [16]

2. What is Bifilar suspension, derive the expression to find out the moment of inertia of an object by this method. [16]

3. Analysis of the oscilloscopic record of a rap test on a machine mounted on isolators reveal that the rate of decay of the amplitude is 2.5% per cycle when the amplitude is 1.5 cm and 4 % when the amplitude is 0.4 cm. Assume both coulomb as well as the viscous damping are present in the system. Determine the magnitude of the damping ratios. [16]

4. An electric motor of mass 200 kg with an unbalance of 15 Kg is mounted on four rubber isolators, which have a material loss factor of 0.5. The rubber isolator deflects by 3.5 mm due to self-load of the motor. Determine the amplitude of the motor at the operating speed of 1000 rpm. And the force transmitted to the ground. [16]

5. Find the natural frequency of vibration for the system shown in Figure 1. [16]

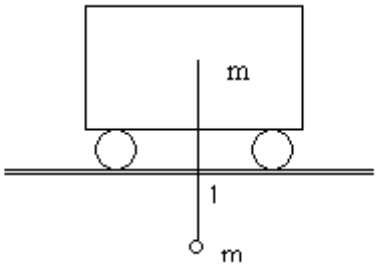

Figure 1:

6. How are the natural boundary conditions caused? Give an example.
   (a) Write the frequency equation?
   (b) Draw the curve for string in lateral vibration in x-y plane? [16]

7. Using the Dunker ley's method find the natural frequency of transverse vibrations for the system shown in fig 2. [16]

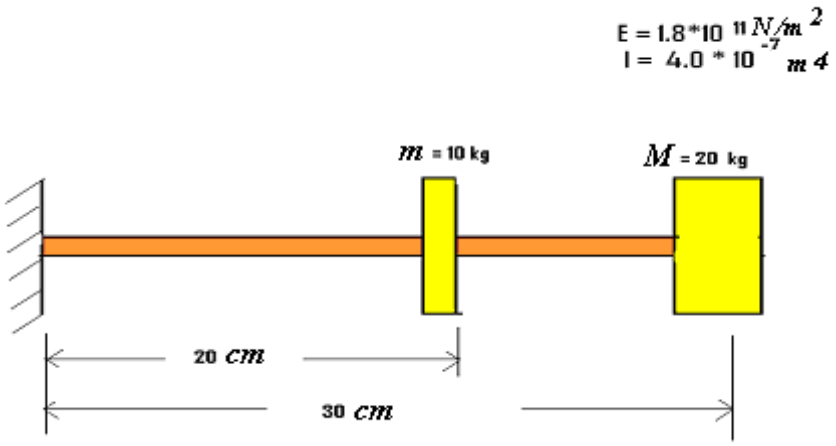

Figure 2:

8. How many types of control reversal can happen in the flying airplane? Discuss the different types and suggest remedies. [16]

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Code No: RR412101 **Set No. 2**

IV B.Tech I Semester Supplementary Examinations, February 2007
THEORY OF VIBRATIONS AND AEROELASTICITY
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Define the various terms associated with the vibrations of the systems. If a machine is vibrating with frequency 150Hz. Determine its frequency in rad/s and time period of the oscillations. [16]

2. An unknown weight W lb attached to the end of an unknown spring k has a natural frequency of 94 c.p.m. When a 1 Kg weight is added to W, the natural frequency is lowered to 76.7 c.p.m. Determine the unknown weight W Kg and the spring constant k. [16]

3. Analysis of the oscilloscopic record of a rap test on a machine mounted on isolators reveal that the rate of decay of the amplitude is 2.5% per cycle when the amplitude is 1.5 cm and 4 % when the amplitude is 0.4 cm. Assume both coulomb as well as the viscous damping are present in the system. Determine the magnitude of the damping ratios. [16]

4. Derive an expression steady state and transient displacement for forced harmonic motion. [16]

5. Two uniform rods AB and CD are pivoted at their upper ends as shown in figure1. Their lower ends are at the same level and are connected by a spring. Each rod weighs 5 kg/m and is vertical in equilibrium position with the spring unstrained. The spring has a stiffness of 2940 N/m. The spring is now compressed slightly and released. Find the frequency of the resulting vibrations if the effect of gravity is neglected. If AB moves through 1 degree on either side of the vertical, find the corresponding angular amplitude of CD and the maximum force in the spring. [16]

6. A uniform string of length l fixed at its ends has a large in initial tension. It is plucked at x=l/6 through a distance ao and released. Determine the subsequent motion. [16]

7. Write short notes on

   (a) Reyleigh's method

   (b) Dunkerley's method

   (c) Holzer's method [16]

8. (a) Explain the phenomenon of galloping of the transmission lines.

   (b) What is control reversal? Discuss the factors affecting it. [16]

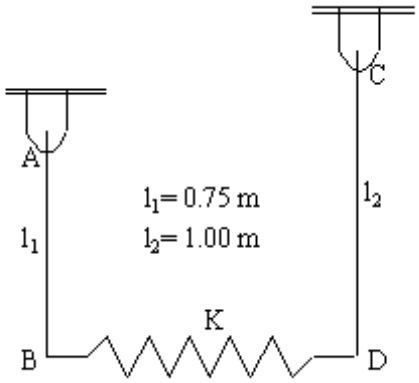

Figure 1:

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Code No: RR412101 **Set No. 3**

IV B.Tech I Semester Supplementary Examinations, February 2007
THEORY OF VIBRATIONS AND AEROELASTICITY
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Expalin the phenomenon of beats.
   (b) Describe the method of finding the frequency of SHM with Rayleigh's Method? [16]

2. A steel wire (E=1.96 $\times 10^{11}$ N/m^2)is of 2mm dia and is 30 meters long. It is fixed at the upper end and carries a mass M kg at its lower end. Find M so that the freq of longitudinal vibrations is 4 cycles/second. [16]

3. A spring mass dashpot system consists of a spring of stiffness 500 N/m. the mass is 5.0 kg the system is displaced 2 cm beyond the equilibrium position and released. Find the equation of motion for the system if the damping coefficient of the dashpot is 200.0 N-sec/m, [16]

4. An electric motor of mass 200 kg with an unbalance of 15 Kg is mounted on four rubber isolators, which have a material loss factor of 0.5. The rubber isolator deflects by 3.5 mm due to self-load of the motor. Determine the amplitude of the motor at the operating speed of 1000 rpm. And the force transmitted to the ground. [16]

5. A torsional system has an inertia of 1.176 kg-m^2 and a torsional stiffness 235 N-m/rad. It is acted upon by a torsional excitation at 150 cpm. Determine the parameters of the absorber to be fixed to the main system if it is desired to keep the natural frequencies at least 20% away from the impressed frequency. [16]

6. (a) Derive the differential equation of motion for the flexural vibration of a beam of uniform cross section
   (b) Hence show that the frequency equation of such a cantilever beam of length L is given by cos k_i L . cosh k_iL = -1 where $k_i = (\omega/a)^{1/2}$ and a= $(EI/\rho A)^{1/2}$ [16]

7. An aircraft wing is educed to a series of discs & shafts for the Holzer's analysis. Determine the first tow torsional natural frequencies i.e. anti-symmetric & symmetric torsional vibrations of the wing. Plot the corresponding mode shapes? as shown in fig1

(in Kg.m^2)	(in Nm/rad)
I1=6.2	K1=2.7
I2=17.5	K2=4.5
I3=22	K3=5.3
I4=27	K4=5.4
I5=39	K5=18
I6=10000	

[16]

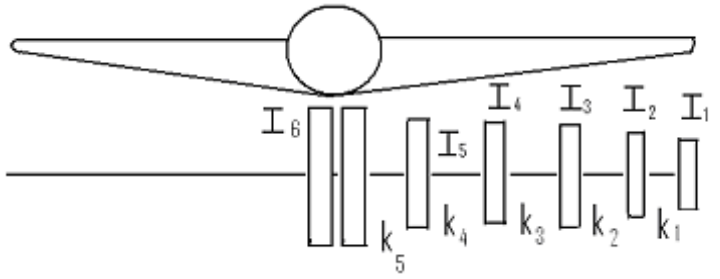

Figure 1:

8. How many types of control reversal can happen in the flying airplane? Discuss the different types and suggest remedies. [16]

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Code No: RR412101 **Set No. 4**

IV B.Tech I Semester Supplementary Examinations, February 2007
THEORY OF VIBRATIONS AND AEROELASTICITY
(Aeronautical Engineering)

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

Answer any FIVE Questions
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1. What will be the frequency of excitation present in the reciprocating machinery due to inertia forces? Discuss with the help of single cylinder engine. [16]

2. Find the frequency of vibration for the system shown in fig 1. What is the frequency of vibration in the following special cases:

   (a) K=0

   (b) A=0 [16]

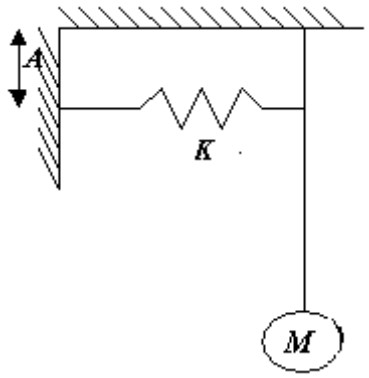

Figure 1:

3. Derive the equation of motion of a single degree of freedom system with viscous damping and find the solution for an under damped system. [16]

4. What do you mean by vibration absorber. A vibrometer having a natural frequency of 5 Hz is engaged to measure the vibration of a machine part. If it gives the amplitude of 18 mm., what is the amplitude of vibration of the part? Operating frequency is 35 Hz. Assume no damping. [16]

5. Shown in the fig2. string with tension T. Determine the principle coordinates. Two masses 'm' are attached with distances L. [16]

6. Determine the equation for the natural frequencies of a uniform rod in torsional oscillation with one end fixed and the other end free?

   (a) Mention the conditions of Euler beam?

   (b) Derive Euler's equation of motion for beam vibration?

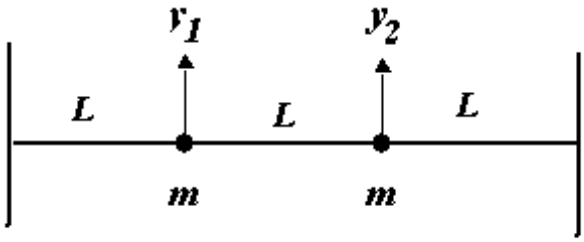

Figure 2:

(c) Hence determine the natural frequencies and mode shapes for end conditions.
   i. Simply supported
   ii. Cantilever [16]

7. Use Holzer's method to find the natural frequencies of the system shown in fig3

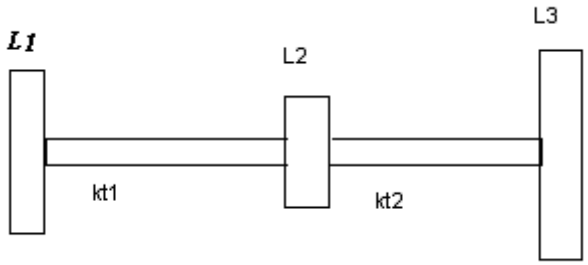

Figure 3:

Take $I_1=I_2=I_3=I$ and $k_{t1}=k_{t2}=1$ [16]

8. (a) Explain the phenomenon of galloping of the transmission lines.
   (b) What is control reversal? Discuss the factors affecting it. [16]

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