Student Exam No: _____

Ganpat University
M.Tech (CAD/CAM) - I SEM
Regular January 2012 Examination
3ME114 Advanced Machine Design and Dynamics

Time: 3 Hours **Total Marks: 70**

Instruction:

1. Attempt all questions.
2. Assume suitable data if necessary.
3. Use of Design data book is permissible.
4. Figure to the right indicate full marks.

SECTION – I

Q.1 **Attempt following questions** **[12]**

(a) Derive equation for under damped vibration system with figure. Also draw and explain phase plane diagram for all damped type vibration system.

(b) Give the significance of logarithmic decrement in damped vibration and prove following equation.

$$\xi = \frac{\delta}{\sqrt{4\pi^2 + \delta^2}}$$, where ξ is damping factor and δ is logarithmic decrement.

OR

Q.1 **Attempt following questions** **[12]**

(a) Find the natural frequency of a half solid cylinder shown in figure **(A)** of mass 'm' and radius 'r' when it is slightly displaced from the equilibrium position and released

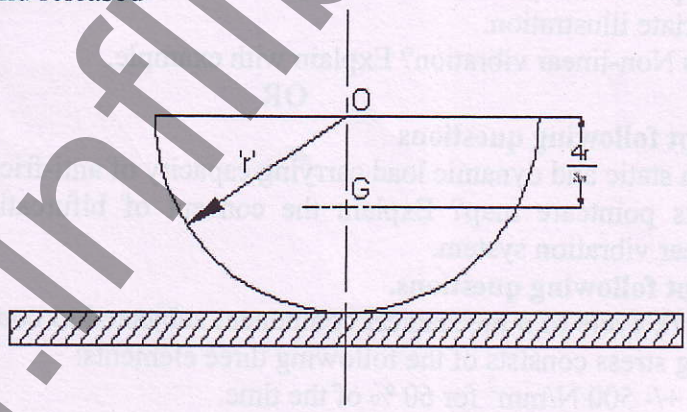

Figure (A)

(b) How many arbitrary constants must a general solution to a second-order differential equation have? How are those constants determined?

Q.2 **Attempt following questions.** **[11]**

(a) Following are the data found by test results for Creep Design
Strain Rates per hour :
0.008E-05 at 35 Mpa
0.018E-05 at 28 Mpa
0.040E-05 at 21 Mpa
Determine the limiting stress for component which is subjected to 950 °F

continuously and a constant load if the creep is limited to 1.5% in 10000 hrs.

(b) What is the concept of Vibration Absorber? Derive the equation for Undamped Dynamic Vibration Absorber with figure.

OR

Q.2 **Attempt following questions.** [11]

(a) The pipe carrying feed water to a boiler in a thermal power plant has been found to vibrate violently at a pump speed of 800 rpm. In order to reduce the vibrations, an absorber consisting of a spring of stiffness k2 and a trial mass m2 of 1 kg is attached to the pipe. This arrangement is found to give the natural frequencies of the system as 750 rpm and 1000 rpm. The desired to keep the natural frequencies of the system outside the operating speed range of the pump, which is 700 rpm to 1040 rpm. Determine the values of k_2 and m_2 that satisfy the requirement.

(b) What is creep or rupture in Design? Explain the procedure to design the mechanical component based on the creep.

Q.3 **Attempt following questions** [12]

(a) Write a short note on Beat Phenomena with figure.

(b) Draw the plot of amplitude ratio and phase angle vs. frequency ratio. Also briefly explain for different value of damping factor.

(c) Explain two degree freedom torsional system.

SECTION – II

Q.4 **Attempt following questions** [12]

(a) In two degree of freedom system, draw first and second mode of vibration with equivalent system, mode shape and displacements time plot with appropriate illustration.

(b) What is Non-linear vibration? Explain with example.

OR

Q.4 **Attempt following questions** [12]

(a) Explain static and dynamic load carrying capacity of anti-friction bearing?

(b) What is pointcare map? Explain the concept of bifurcation and orbit in nonlinear vibration system.

Q.5 **Attempt following questions.** [11]

(a) The work cycle of a mechanical component subjected to completely reversed bending stress consists of the following three elements:

1. +/- 500 N/mm^2 for 60 % of the time.
2. +/- 450 N/mm^2 for 30 % of the time.
3. +/- 400 N/mm^2 for remaining time.

The material for the component has 650 MPa ultimate strength and corrected endurance limit is 385 MPa. Determine the life of the component.

(b) Discuss the selection of type of the bearing for particular application.

OR

Q.5 **Attempt following questions.** [11]

(a) A single row deep groove ball bearing is subjected to a 1 min. work cycle that consists of the following two parts.

If the expected life of the bearing is 10,000 hrs, calculate the dynamic load

rating of the bearing.

Duration(s)	Part I (45 sec.)	Part II (15 sec)
Radial Load (N)	4000	8000
Axial Load (N)	800	3000
Speed RPM	900	600

(b) Write a short-note on cumulative damage in fatigue.

Q.6 **Attempt following questions** **[12]**

(a) Write a short note on design of component based on reliability.

(b) Two semi-circular disks be made of E1=E2= 200 Gpa and $\mu 1 = \mu 2 = 0.29$. At the point of contact radii of curvature are R1= 60 mm, R1'=130 mm, R2=80 mm, R2'=200mm. The angle $\alpha = \pi/3$ rad. If the load P=4.5KN, determine the maximum principal stress, maximum shear stress, and maximum octahedral shear stress in the disks and state the location of the point where each of these stresses occur. Values of coefficient for maximum stress, shear stress, oct. stress and zs are 0.70, 0.25, 0.20 and 0.53 respectively.

(c) Write down the Matlab script to plot response of damped single degree vibration system

END OF PAPER