

Ganpat University
M.Tech I SEM Mechanical Engineering (CAD/CAM)
Regular Examination DEC 2013
3ME114 - Advanced Machine Design and Dynamics

Total Marks: 70

Duration: 3 hrs

Instructions:

1. Assume suitable data if necessary
2. Use of Design data book is permitted.
3. Write your answer precisely and to the point.

SECTION I

1. (a) Derive equation for under damped vibration system with figure. Also draw and explain phase plane diagram for all damped type vibration system. [08]
- (b) How many arbitrary constants must a general solution to a second-order differential equation have? How are those constants determined? [04]

OR

1. (a) The foundation of a reciprocating engine is subjected to harmonic motion in x and y direction: [08]

$$x(t) = X \cos \omega t, \quad y(t) = Y \cos(\omega t + \phi)$$

Where X and Y are the amplitudes, ω is the angular velocity, and ϕ is the phase difference. Verify that the resultant of the two motions satisfies the equation of the ellipse given by

$$\frac{x^2}{X^2} + \frac{y^2}{Y^2} - \frac{2xy}{XY} \cos \phi = \sin^2 \phi$$

- (b) Write a short note on Beat Phenomena. [04]
2. (a) What is the difference between the vibration isolation and vibration absorber? Explain effect of undamped vibration absorber on the response of the machine with equation. [05]
- (b) A section of pipe pertaining to a certain machine vibration with large amplitude of a compressor speed of 220 r.p.m. for analyzing this system a spring mass system was suspended from the pipe to act as an absorber. A 1 kg absorber mass tuned to 220 r.p.m resulted into two resonant frequencies of 188 and 258 r.p.m. What must be the mass and spring stiffness of the absorber if the resonant frequencies are to lie outside the range of 150 to 310 r.p.m.? [06]

OR

2. (a) What is two degree of freedom in vibration? How equation of motion is derived? Explain it with sample example. [05]
- (b) Find the trajectories of a non linear spring-mass system governed by equation $\ddot{x} + \omega_0^2(x - 2\alpha x^3) = 0$ [06]
3. **Attempt all questions.** [12]
 - (a) Write a short note on Critically damped system.
 - (b) Explain the following terms:
 - (1) Attractors
 - (2) Pointcare section

- (3) Bifurcations
 (4) Strange attractors.
 (c) Write a short note on jump phenomena

SECTION II

4. A flat plate subjected to tensile force of 10 kN is shown in figure-1. The plate material is gray cast iron FG 300 and the factor of safety is 2. Determine the thickness of plate. [12]

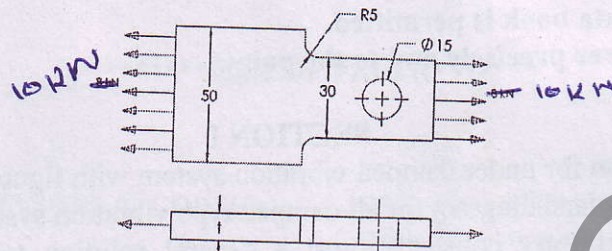


Figure - 1

OR

4. (a) A rectangle plate with transverse hole at center. Width of plate is 50 mm. the plate is subjected to a tensile load of 12 KN. The plate material is FG250. Take factor of safety is 1.75. Determine the thickness of plate. [08]
 (b) Explain contact stress between two semi circular discs. [04]

5. Let the two semicircular disc is to be made of steel ($E_1 = E_2 = 200 \text{ GPa}$ and $\nu_1 = \nu_2 = 0.29$). The radii of curvature of the two surfaces at the point of contact are $R_1 = 60 \text{ mm}$, $R'_1 = 130 \text{ mm}$, $R_2 = 80 \text{ mm}$ and $R'_2 = 200 \text{ mm}$. The angle α between the planes of minimum curvature is $\pi/3 \text{ rad}$. If the load $P = 4.50 \text{ KN}$, determine the maximum principal stress, minimum shear stress, and maximum octahedral shear stress in the disks and state the location of the point where each of these stresses occur. Determine the approach δ for the two disks because of load P . [11]

OR

5. Explain Geometry of the contact stress in Railway wheel and rail [11]

6. Attempt following questions

- (a) Explain Creep with parameters affect on it. [04]
 (b) Explain different technique for reduction of stress concentration effect. [04]
 (c) Explain effect of temperature on short time properties and long time properties. [04]