Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech. winter 2019 - 2020 Examination

Semester: 5 **Date: 07/12/2019**
Subject Code: 03101301 **Time: 10:30 am to 1:00 pm**
Subject Name: Elements of Balancing and Vibration **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions - (All are compulsory) (Each of one mark) **(15)**

1. The variation in tractive effort in a locomotive is caused by
   (a) Unbalanced force in a direction perpendicular to line of action
   (b) Unbalanced force in a direction parallel to line of action
   (c) Unbalanced force in any direction
   (d) both (a) and (b)
2. Natural frequency of a system, which has spring stiffness of K N/m and mass of m kg is
   a)√K/m Hz
   b) √m/K Hz
   c) $\frac{1}{2\pi}$ √K/m Hz
   d) $\frac{1}{2\pi}$ √m/K Hz
3. Node is defined as a
   (a) Point where torsional vibration is maximum
   (b) Point where torsional vibration is zero
   (c) Point where transverse vibration is minimum
4. Beam vibrating in transverse direction is
   a) 1 dof system
   b) 2 dof system
   c) 6 dof system
   d) ∞ dof system
5. A simple pendulum kept in vacuum which is displaced by θ degrees is performing SHM,
   a) Will stop after t seconds
   b) Will never stop
   c) None of the above
6. What is the function of the Stroboscope?
7. Define “Degrees of Freedom” (D.O.F).
8. Define Resonance? When it occurs.
9. Give one Example of three degree of freedom system.
10. Define Principal mode of vibration
11. Define Transmissibility
12. What is whirling speed of the shaft?
13. Name any two methods for analysis of multi degree of freedom systems.
14. Define damping ratio.
15. Write any two examples of critical damped system?

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Derive the frequency and time period of compound pendulum system

B) Four masses A, B, C and D are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m

C) What are different approaches to get equations of motion of a vibratory system? Explain any one in brief

D) Derive the expression for equivalent stiffness of the spring for the following condition

1) Springs connected in series

2) Springs connected in parallel

Q.3 A) The disc of a torsional pendulum has a moment of inertia of 600 kg-cm^2 and is immersed in a viscous fluid. The brass shaft attached to it is of 10 cm diameter and 40 cm long. When the pendulum is vibrating, the observed amplitudes on the same side of the rest position for successive cycles are 9^0, 6^0, 4^0. Determine **(07)**

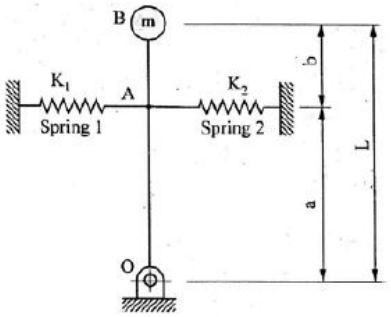
1) logarithmic decrement

2) Damping torque at unit velocity

3) The periodic time of vibration

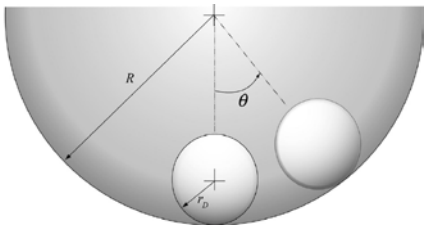
Assume for the brass shaft G= 4.4 * 10^{10} N/m^2

B) Find out the natural frequency of the given system. **(08)**



OR

B) A uniform rigid disk of mass m and radius r_D is released from rest from some initial position along a circular track segment of radius R as shown. Determine the resulting small amplitude motion if the disk rolls without slipping. **(08)**



Q.4 A) Derive the expression for natural frequency of two rotor system? Also find out distance of Node from any rotor.

OR

A) Write a short note on Seismometer **(07)**

B) A 75 kg machine is mounted on springs of stiffness of 11.76 * 10^5 N/m with an assumed damping factor of 0.20. A 2 kg piston within the machine has a reciprocating motion with a stroke of 0.08 m and a speed of 3000 c.p.m. Assuming the motion of the piston to be harmonic , determine the amplitude of vibration of the machine and vibratory force transmitted to the foundation. **(08)**