

GUJARAT TECHNOLOGICAL UNIVERSITY

BACHELOR OF ENGINEERING – SEMESTER 6 – EXAMINATION – SUMMER 2026

Subject Code: 3160109

Date: 26/05/2026

Subject Name: Theory of Vibration

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**
- 4. Simple and non-programmable scientific calculators are allowed.**

- Q.1**
- (a) Define the terms: Natural Frequency, Damped Natural Frequency, Periodic Motion. **03**
 - (b) Derive a relation to determine equivalent stiffness when two springs are in parallel. **04**
 - (c) Derive differential equation of motion using D'Alembert's Principle **07**
- Q.2**
- (a) Define the Terms: Damping Ratio, Damping Coefficient, Critical Damping Coefficient. **03**
 - (b) Explain the types of vibrations in brief. **04**
 - (c) Find the natural frequency of the system as shown in figure 1 **07**

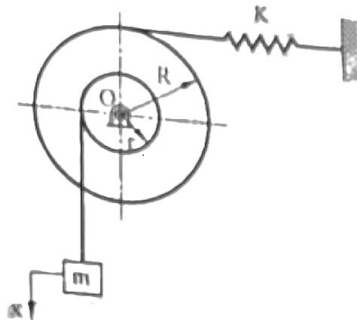


Figure 1

OR

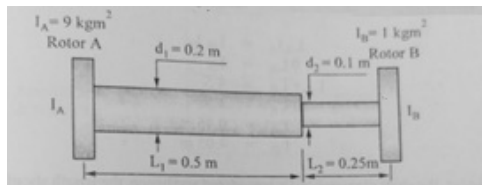
- Q.2**
- (c) Find the natural frequency of a simple pendulum by Energy Method. Neglect the mass of rod. **07**
- Q.3**
- (a) Explain Critical speed or Whirling speed of shaft. **03**
 - (b) Explain Transmissibility. **04**
 - (c) Define logarithmic decrement. Also Derive the expression for logarithmic decrement. **07**
- OR
- Q.3**
- (a) Write a short note on Vibration Isolation. **03**
 - (b) Explain the behaviour of overdamped, underdamped, and critically damped systems using a clean sketch. **04**
 - (c) A body of mass 5 kg is supported on a spring of 1960 N/m and has a dashpot connected to it, which produces a resistance of 1.96 N at a velocity of 1 m/sec. In what ratio will the amplitude of vibrating be reduced after 5 cycles. **07**
- Q.4**
- (a) What is the difference between single degree and double degree of freedom? **03**

- (b) A machine of mass 1000 kg rests on four spring each having stiffness of 3.5×10^6 N/m². The damping factor of the dashpot is 0.2. The machine runs at 2000 rpm. Under these operating condition, the machine is found to deflected by 0.06 mm. Find the magnification factor for the system. 04
- (c) Write a note on Co-ordinate Coupling. 07

OR

- Q.4 (a) What is Resonance? How it can be avoided? 03
- (b) With neat sketch explain the working of Vibration Absorber. 04
- (c) Find the solution of equation of motion with harmonic force. 07

- Q.5 (a) Explain Continuous systems. 03
- (b) What do you understand by a torsionally equivalent shaft? 04
- (c) For a rotor system shown in figure, find the natural frequency and the position of the node by considering the d_1 as the diameter of equivalent shaft. Assume $G=80 \times 10^9$ N/m² 07



OR

- Q.5 (a) Explain different types of Damping. 03
- (b) In a vibrating system, what do you understand by the meaning of a node? 04
- (c) Explain Rayleigh's method for finding natural frequency of transverse vibration of beams. 07
