# GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2024

Subject Code:3160109   **Date:20-05-2024**
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.**

			MARKS
Q.1	**(a)**	What does vibration mean to you? Which are the most likely reasons vibration occurs?.	**03**
	(b)	Describe the Energy vibration analysis method.	**04**
	(c)	Define: Natural Frequency, Damped natural frequency, Time period, Periodic motion, Amplitude, Degree of freedom, Resonance.	**07**
Q.2	**(a)**	Define: logarithmic decrement, damping ratio and critical damping coefficient.	**03**
	(b)	Explain different types of Damping.	**04**
	(c)	Derive the equation for calculating the natural frequency of a simple pendulum.	**07**
		OR	
	(c)	Find the solution to the equation of motion for forced vibration in a spring mass damper system under the effect of harmonic force.	**07**
Q.3	**(a)**	Write a short note on Vibration Isolation.	**03**
	(b)	Explain with neat sketch measurement of natural frequency of given system using Frham's single reed tachometer.	**04**
	(c)	With neat sketch explain working of Vibration measuring instruments.	**07**
		OR	
Q.3	**(a)**	What is Resonance? How can this be avoided?	**03**
	(b)	Explain the behaviour of overdamped, underdamped, and critically damped systems using a clean sketch.	**04**
	(c)	An electric motor is supported on a spring and a dashpot. The spring has the stiffness 6400 N/m and the dashpot offers resistance of 500 N at 4.0 m/sec. The unbalanced mass 0.5 kg rotates at 5 cm radius and the total mass of vibratory system is 20 kg. The motor runs at 400 rpm. Determine a) damping factor (b) amplitude of vibration and phase angle (c) resonant speed and resonant amplitude, and (d) forces exerted by the spring and dashpot on the motor.	**07**
Q.4	**(a)**	Define Degree of Freedom. Give one example of single degree, two degrees and multi degree of freedom systems	**03**
	(b)	With neat sketch explain the working of Vibration absorber	**04**
	(c)	Explain Rayleigh's method for finding natural frequency of transverse vibration of beams.	**07**
		OR	
Q.4	**(a)**	Explain Continuous systems.	**03**
	(b)	Derive an expression for natural frequency for undamped single degree of freedom spring mass system	**04**

(c) The shaft shown in figure carries two masses. The mass A is 300 kg with a **07** radius of gyration of 0.75 m and the mass B is 500 Kg with a radius of gyration of 0.9 m. Determine the frequency of the torsional vibrations. It is desired to have the node at the mid-section of the shaft of 120 mm diameter by changing the diameter of the section having a 90 mm diameter. What will be the new diameter?

(mm)
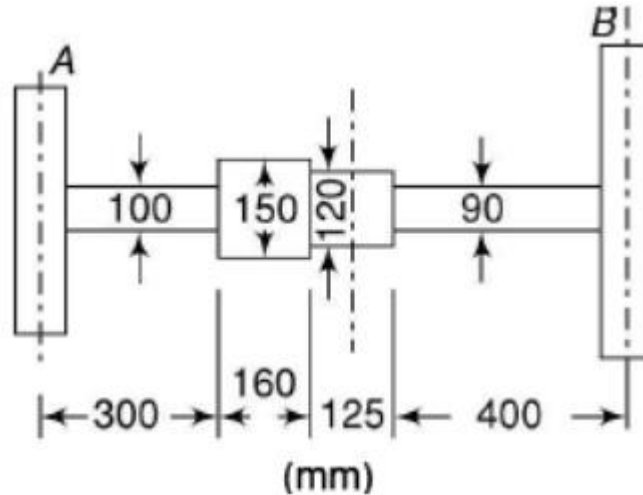
Q.5 **(a)** Differentiate between Steady state and Transient vibration **03**
(b) What's the difference between single and double degrees of freedom? **04**
(c) Derive solution for Spring mass damper system with harmonic force. **07**

OR

Q.5 **(a)** Explain Critical speed or Whirling speed of shaft. **03**
(b) Classify different types of vibration. **04**
(c) Derive the expression for the length of torsionally equivalent shaft. **07**

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