Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VI (New) EXAMINATION – WINTER 2019

Subject Code: 2160109 **Date: 09/12/2019**

Subject Name: Theory of Vibration

Time: 02:30 PM TO 05:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	Define Vibration. Which organs of human body are having low frequency oscillations? Which organs of human body are having high frequency oscillations?	**03**
	(b)	Derive the equation to calculate natural frequency of Simple pendulum.	**04**
	(c)	Find the sum of two harmonic motions of equal amplitude but of slightly different frequencies. Discuss the beats phenomenon that results from this sum.	**07**
Q.2	**(a)**	Define: Degree of freedom. What is DOF for cantilever beam? Why?	**03**
	(b)	Derive the equation of natural frequency for a disc of mass moment of inertia I suspended on shaft of length L with diameter d, when the disc is given an angular twist of Θ.	**04**
	(c)	Show that for finding natural frequency of a spring mass system, the mass of the spring can be taken into account by adding one-third its mass to the main mass.	**07**
		OR	
	(c)	A vibrating system consists of a mass of 50 kg, a spring of stiffness of 30 kN/m and a damper. The damping provided is only 20 % of the critical value. Determine: i) Damping factor ii) Critical damping coefficient iii) Natural frequency of damped vibration iv) Logarithmic decay v) Ratio of two consecutive amplitudes	**07**
Q.3	**(a)**	Why are soldiers ordered to break their marching steps while crossing a bridge?	**03**
	(b)	Explain vibration isolation. Name the various materials for the same.	**04**
	(c)	Write down the equation of motion for damped free vibration. Derive the solution for that equation.	**07**
		OR	
Q.3	**(a)**	Represent 3+ i6 in exponential form.	**03**
	(b)	Define Transmissibility. Briefly explain the concept of support motion.	**04**
	(c)	Derive the solution: $m\ddot{x} + c\dot{x} + kx = F \sin \omega t$.	**07**
Q.4	**(a)**	Define: Overshooting. Why guns are designed based on critical damping?	**03**

	(b)	Write short note on Torsionally equivalent shaft.	**04**
	(c)	Write a short note on Lagrange's equation.	**07**

OR

Q.4	**(a)**	Give the difference between vibration isolation & vibration absorber.	**03**
	(b)	A vibrometer indicates 2% error n measurement and its natural frequency is 5 Hz. If the frequency that can be measured is 40 Hz. Find the value of damping factor.	**04**
	(c)	For Two rotor system prove that angular displacements of the rotors are inversely proportional to their moment of inertia with neat sketch.	**07**
Q.5	**(a)**	Define: 1. Fundamental mode of vibration 2. Principal mode of vibration 3. Normal mode of vibration	**03**
	(b)	Define: Whirling Speed of shaft. Explain critical speed of shaft carrying single rotor (Without damping).	**04**
	(c)	What is the working principle of vibration measuring instruments? Explain the working of anyone instrument designed on low natural frequency.	**07**

OR

Q.5	**(a)**	Define: Multi degree of freedom system. Name the various methods used to analyze these systems.	**03**
	(b)	Explain the working of vibration absorber with respect to electricity transmission lines.	**04**
	(c)	What is the working principle of Frequency measuring instruments? With neat sketch explain working of Frahm tachometer.	**07**

****