Seat No.: ________ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VI (NEW) EXAMINATION – WINTER 2020

Subject Code:2161901 **Date:03/02/2021**

Subject Name:Dynamics of Machinery

Time:02:00 PM TO 04:00 PM **Total Marks: 56**

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	'A statically balanced system needs not to be dynamically balanced always'. Justify the statement.	**03**
	(b)	Justify the statement 'Reciprocating masses are partially balanced'.	**04**
	(c)	Derive the following expressions, for an uncoupled two cylinder locomotive engine: 1) Variation in tractive force; 2) Swaying couple; and 3) Hammer blow.	**07**
Q.2	**(a)**	What are inline engines? How these engines are balanced?	**03**
	(b)	Describe the function of a pivoted-cradle balancing machine with the help of a neat sketch.	**04**
	(c)	A four cylinder engine has the two outer cranks at 120^0 to each other and their reciprocating masses are each 400 kg. The distance between the planes of rotation of adjacent cranks are 0.4 m, 0.7 m and 0.5 m, find the reciprocating mass and the relative angular position for each of the inner cranks, if the engine is to be in complete primary balance. Also find the maximum unbalanced secondary force, if the length of each crank is 350 mm, the length of each connecting rod 1.7m and the engine speed is 500 R.P.M.	**07**
Q.3	**(a)**	Define the terms: Resonance, Simple harmonic motion and Phase difference.	**03**
	(b)	What are the causes of vibrations in machines?	**04**
	(c)	A vibrating system is defined by the following parameters: Mass m = 3kg, Spring Stiffness k = 100 N/m, Damping Coefficient c = 3 N-sec/m. Determine (i) Damping factor (ii) Natural frequency of damped vibration (iii) Logarithmic decrement (iv) Ratio of two consecutive amplitudes (v) Number of cycles after which the original amplitude is reduced to 20%.	**07**
Q.4	**(a)**	Define the terms 1.Under-damping 2. Over-damping 3. Critical- damping system.	**03**
	(b)	Derive the equation for natural frequency of a spring mass vibrating system by using equilibrium and energy method.	**04**
	(c)	Determine the natural frequency of spring mass pulley system shown in **Fig. Q.4(c).**	**07**

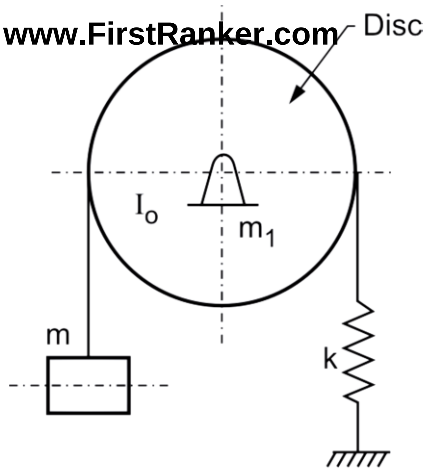

Fig. Q.4(c)

Q.5	**(a)**	Define and state the significance of logarithmic decrement.	**03**
	(b)	Give the difference between viscous damping and coulomb damping.	**04**
	(c)	A single degree of freedom system consists of a mass of 20 kg and a spring of stiffness 4000 N/m. The amplitude of successive cycles are found to be 50, 45 40, 35 … mm. Determine the nature and magnitude of damping force and frequency of damped vibrations.	**07**
Q.6	**(a)**	What is vibration isolation? What are its objectives and its materials?	**03**
	(b)	How do you find the response of a viscously damped system under rotating unbalanced?	**04**
	(c)	A gun barrel of mass 500 kg has a recoil spring of stiffness 300 KN/m. If the barrel recoils 1.2 meters on firing, determine, (a) initial velocity of the barrel (b) Critical damping coefficient of the dashpot which is engaged at the end of the recoil stroke (c) Time required for the barrel to return to a position 50 mm from the initial position.	**07**
Q.7	**(a)**	Obtain expression for the natural frequency of the beam by using Rayleigh's method.	**03**
	(b)	What do you mean by whirling of shaft? Why and where it is necessary to check the whirling speeds of shaft?	**04**
	(c)	A shaft of 50 mm diameter and 3 m length has a mass of 10 kg per meter length. It is simply supported at the ends and carries three masses of 70 kg, 90 kg and 50 kg at 1 m, 2 m and 2.5 m respectively from the left support. Find the natural frequency of transverse vibrations by using Dunkerley's method. Consider value of E = 200 GPa.	**07**
Q.8	**(a)**	How does a continuous system differ from a discrete system in the nature of its equations of motion?	**03**
	(b)	Obtain expression an expression for length of torsionally equivalent shaft system.	**04**
	(c)	Two rotors A and B are attached to the end of a shaft 50 cm long. Weight of the rotor A is 300 N and its radius of gyration is 30 cm and the corresponding values of B are 500 N and 45 cm respectively. The shaft is 7 cm in diameter for the first 25 cm, 12 cm for the next 10 cm and 10 cm diameter for the remaining of its length. Modulus of rigidity for the shaft material is 8×10^{11} N/m^2. Find: (i) the position of the node (ii) the frequency of torsional vibration.	**07**

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