Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(NEW) EXAMINATION – SUMMER 2022

Subject Code:3151911 Date:07/06/2022

Subject Name:Dynamics of Machinery

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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define inertia force and inertia couple. State D′ Alembert principle.	**03**
	(b)	Draw the turning moment diagram for I). Four stroke Cycle Internal Combustion engine. II). Multi-cylinder Engine.	**04**
	(c)	Explain the effect of gyroscopic couple and centrifugal couple on the reaction of the four wheels of a vehicle negotiating a curve.	**07**
Q.2	**(a)**	Define following terms. I). Over damped system II). Logarithmic decrement III). Under damped system	**03**
	(b)	Differentiate between static balancing and dynamic balancing system.	**04**
	(c)	Explain briefly the balancing of several mass in same plane.	**07**
		OR	
	(c)	In a slider crank mechanism, the length of the crank and connecting rod are 150 mm and 600 mm respectively. The crank position is 60^o from the dead center. The crank shaft speed is 450 r.p.m. (clock wise). Using analytical method, determine: I). Velocity and acceleration of the slider. And II). Angular velocity and angular acceleration of the connecting rod.	**07**
Q.3	**(a)**	What do you understand by gyroscopic couple? Derive a formula for its magnitude.	**03**
	(b)	Classify types of vibration.	**04**
	(c)	The turning moment diagram for a multi-cylinder engine has been drawn to a scale 1mm = 600 N-m vertically and 1 mm = 3^o horizontally. The intercepted areas between the output torque curve and the mean resistance line, taken in order from one end, are as +52,-124,+92,-140,+85,-72 and +107 mm^2 , when the engine is running at a speed of 600 r.p.m. If the total fluctuation of speed is not to exceed ± 1.5% of the mean, find the necessary mass of the flywheel of the radius 0.5 m.	**07**
		OR	
Q.3	**(a)**	Write the short note on primary and secondary balancing.	**03**
	(b)	Explain in what way the gyroscopic couple affects the motion of an aircraft while taking a turn.	**04**
	(c)	Discuss the method of Balancing of v- engines and determine the expression for magnitude and direction of resultant primary force.	**07**
Q.4	**(a)**	Define: I). Natural frequency, II). Damping, III). Forced Vibration.	**03**
	(b)	Explain partial balancing of reciprocating engine.	**04**
	(c)	For the system in Fig 1. If K_1= 2800 N/m, K_2= 1400 N/m, K_3= 3800 N/m, K_4 = K_5 = 700 N/m; find the mass m such that the system will have a natural frequency of 15 Hz.	**07**

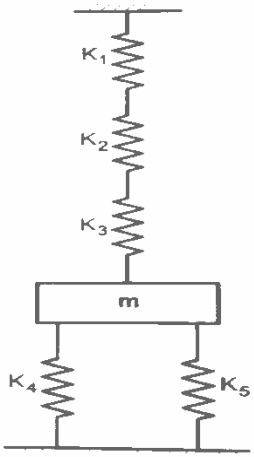

Fig 1.

OR

Q.4	**(a)**	Explain the term magnification factor and obtain expression for it.	**03**
	(b)	Define logarithmic decrement and derive an expression for it.	**04**
	(c)	Explain briefly forced vibrations due to rotating unbalance.	**07**
Q.5	**(a)**	Classify the vibration measuring instruments.	**03**
	(b)	Clearly explain the working principle of vibrometer and accelerometer.	**04**
	(c)	A damped vibration system consisting of 40 kg mass executes 20 oscillations in 5 sec. amplitude of vibration decreases to one-eighth of the initial value after 8 complete oscillations. Determine: Logarithmic decrement, Damping factor, Damping co-efficient and spring stiffness.	**07**

OR

Q.5	**(a)**	Why balancing of rotating and reciprocating masses is necessary? What are effects of unbalancing?	**03**
	(b)	Write 250 words on Torsionally Equivalent Shaft.	**04**
	(c)	Two rotors A and B are attached to the ends of a shaft 1.6 m long. The mass of rotor A is 2500 kg and it radius of gyration is 0.8m. The corresponding values for rotor B are 500 kg and 0.5 m respectively. The diameter of shaft is 180 mm for first 0.5 m, 220 mm for next 0.4 m and 100 mm for the remaining length, measuring length, measuring from rotor A. Assuming $G = 0.8 \times 10^5$ MPa. For the shaft material, find position of node and natural frequency of torsional vibration.	**07**

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