Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3151911 Date:09-01-2023

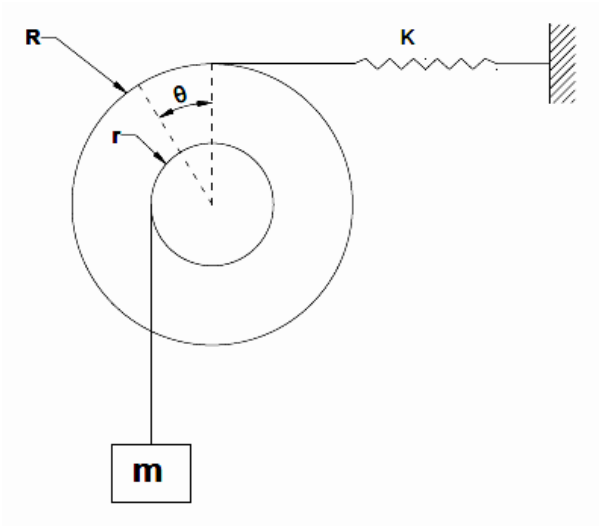
Subject Name:Dynamics of Machinery

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)**	Define following terms i) Maximum Fluctuation of Energy ii) Coefficient of Fluctuation of Speed iii) Coefficient of Fluctuation of Energy	**03**
	(b)	Explain effect of gyroscopic couple on Ship during Pitching.	**04**
	(c)	A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions.	**07**
Q.2	**(a)**	What are the requirements of an equivalent dynamically system?	**03**
	(b)	Define the terms i) Periodic motion ii) Free Vibrations iii) Natural Frequency iv) Resonance	**04**
	(c)	Find the natural frequency of the system as shown in figure.	**07**



OR

	(c)	Derive an expression for equation of motion of Critical-damped system	**07**

Q.3	**(a)**	Explain why only a part of the unbalanced force due to reciprocating masses is balanced by revolving mass.	**03**
	(b)	Draw & explain the response curves for Overdamped, Underdamped, and Critical damped systems.	**04**
	(c)	What do you mean by piston effort and crank effort? Derive the expression of turning moment at crankshaft in terms of piston effort and angle turn by the crank.	**07**

OR

Q.3	**(a)**	Explain vibration isolation in detail.	**03**
	(b)	Explain the following terms with neat sketch, i) Active Gyroscopic Couple ii) Reactive Gyroscopic Couple	**04**
	(c)	A single cylinder, single acting, four stroke gas engine develops 20 kW at 300 r.p.m. The work done by the gases during the expansion stroke is three times the work done on the gases during the compression stroke, the work done during the suction and exhaust strokes being negligible. If the total fluctuation of speed is not to exceed ± 2 per cent of the mean speed and the turning moment diagram during compression and expansion is assumed to be triangular, find the moment of inertia of the flywheel.	**07**

Q.4	**(a)**	Why is balancing of rotating parts necessary for high-speed engines?	**03**
	(b)	Discuss the balancing of V-engines.	**04**
	(c)	A ship propelled by a turbine rotor which has a mass of 5 tonnes and a speed of 2100 r.p.m. The rotor has a radius of gyration of 0.5 m and rotates in a clockwise direction when viewed from the stern. Find the gyroscopic effects in the following conditions: 1. The ship sails at a speed of 30 km/h and steers to the left in a curve having 60 m radius. 2. The ship pitches 6 degree above and 6 degree below the horizontal position. The bow is descending with its maximum velocity. The motion due to pitching is simple harmonic and the periodic time is 20 seconds. 3. The ship rolls and at a certain instant it has an angular velocity of 0.03 rad/s clockwise when viewed from stern. Determine also the maximum angular acceleration during pitching. Explain how the direction of motion due to gyroscopic effect is determined in each case.	**07**

OR

Q.4	**(a)**	Write a short note on Vibrometer.	**03**
	(b)	Explain the force Transmissibility in detail.	**04**
	(c)	A vibrating system is defined by the following parameters: m (mass) = 3 kg, k (spring stiffness) = 100 N/m, c (viscous damping coefficient) = 3 N.s/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 a 20 percent.	**07**

Q.5	**(a)**	Classify types of vibration.	**03**
	(b)	Describe critical speed of shaft carrying single rotor and having no damping.	**04**
	(c)	Explain the torsional vibration of one and two rotor system.	**07**

OR

Q.5 **(a)** Define inertia force and inertia couple. State D′ Alembert principle. **03**

(b) Define damping. Explain different ways of providing the damping for reducing vibrations. **04**

(c) A machine having a mass of 100 kg and supported on spring of total stiffness 7.84 X 10^5 N/m has an unbalanced rotating element which results in a disturbing force 392 N at a speed of 3000 rpm. Assuming a damping factor of 0.20, Determine **07**

i) The amplitude of motion due to unbalance
ii) The transmissibility, and
iii) The transmitted force.