Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V EXAMINATION – SUMMER 2025

Subject Code:2151902 Date:22-05-2025

Subject Name:Theory of Machines

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)**	Explain the basic term of gyroscope with suitable sketch.	**03**
	(b)	Define the following terms with related to governors. 1. Stability, 2. Sensitiveness, 3. Isochronism, and 4. Hunting	**04**
	(c)	Derive a formula for the maximum torque transmitted by a single plate clutch of external and internal radii R1 and R2, if the limiting coefficient of friction is μ and the axial spring load is W. Assume that the pressure intensity on the contact faces is uniform.	**07**
Q.2	**(a)**	Explain the gyroscopic effect in an aero plane with neat sketch.	**03**
	(b)	Distinguish between Brake, Clutch and Dynamometer.	**04**
	(c)	The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45 m and a speed of 3000 r.p.m. clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship: 1. When the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/h. 2. When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees.	**07**
		OR	
	(c)	Evaluate the ratio of tension in the tight side to tension in the slack side for Band and block brake.	**07**
Q.3	**(a)**	Define: (1) Flywheel (2) Maximum fluctuation of energy (3) Co-efficient of fluctuation of speed	**03**
	(b)	Differentiate between simple band brake and differential band brake	**04**
	(c)	A Porter Governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the minimum and maximum speeds and range of speed of the governor.	**07**
		OR	
Q.3	**(a)**	Discuss various applications of flywheel	**03**
	(b)	Explain impulse and momentum.	**04**

	(c)	A horizontal cross compound steam engine develops 300 kW at 90 r.p.m. The coefficient of fluctuation of energy as found from the turning moment diagram is to be 0.1 and the fluctuation of speed is to be kept within ± 0.5% of the mean speed. Find the weight of the flywheel required, if the radius of gyration is 2 metres.	**07**
Q.4	**(a)**	Define and Explain D'Alembert's Principle.	**03**
	(b)	Explain the turning moment diagram for 4 cylinder four stroke cycle internal combustion engine.	**04**
	(c)	Describe with the help of a neat sketch the principles of operation of an internal expanding shoe brake. Derive the expression for the braking torque.	**07**

OR

Q.4	**(a)**	Give the classification of brake in detail.	**03**
	(b)	Describe shaking force and shaking moment.	**04**
	(c)	A vertical double acting steam engine has a cylinder 300 mm diameter and 450 mm stroke and runs at 200 r.p.m. The reciprocating part has a mass of 225 kg and the piston rod is 50 mm diameter. The connecting rod is 1.2 m long. When the crank has turned through 125° from the top dead centre, the steam pressure above the piston is 30 kN/m^2 and below the piston is 1.5 kN/m^2. Calculate the effective turning moment on the crank shaft.	**07**
Q.5	**(a)**	Explain the principle of virtual work.	**03**
	(b)	Classify clutches. What is the function of a clutch?	**04**
	(c)	A single plate clutch is required to transmit 8 kW at 1000 RPM. The axial pressure is limited to 70 kN/m^2. The mean radius of the plate is 4.5 times the radial width of the friction surface. If both the sides of the plate are effective and coefficient of friction is 0.25. Determine inner and outer radii of the plate and mean radius and width of the friction lining.	**07**

OR

Q.5	**(a)**	Describe equilibrium of two force and three force system.	**03**
	(b)	What is the function of a flywheel? How does it differ from that of a governor?	**04**
	(c)	Explain static force analysis with friction in turning pairs in detail.	**07**

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