

**GUJARAT TECHNOLOGICAL UNIVERSITY**

**BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2024**

**Subject Code:2151902**

**Date:27-05-2024**

**Subject Name:Theory of Machines**

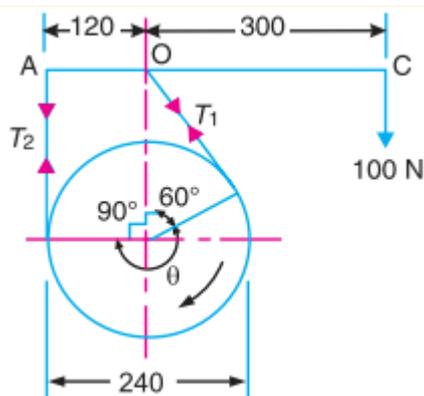
**Time:02:30 PM TO 05:00 PM**

**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
<b>Q.1</b>	(a) What are the materials for friction clutches? State the characteristics of good friction material.	<b>03</b>
	(b) Differentiate between brakes and dynamometer.	<b>04</b>
	(c) Describe with a neat sketch the working of a single plate friction clutch.	<b>07</b>
<b>Q.2</b>	(a) Explain internal expanding shoe brake.	<b>03</b>
	(b) What is the function of dynamometer. Classify Dynamometers.	<b>04</b>
	(c) The simple band brake, as shown in Figure, is applied to a shaft carrying a flywheel of mass 400 kg. The radius of gyration of the flywheel is 450 mm and runs at 300 r.p.m. If the coefficient of friction is 0.2 and the brake drum diameter is 240 mm, find :	<b>07</b>
	1. the torque applied due to a hand load of 100 N, 2. the number of turns of the wheel before it is brought to rest, and 3. the time required to bring it to rest, from the moment of the application of the brake.	



**OR**

	(c) Describe with sketches one form of torsion dynamometer	<b>07</b>
<b>Q.3</b>	(a) Explain the concept of gyroscopic couple.	<b>03</b>
	(b) Explain the application of gyroscopic principles to 2 wheelers.	<b>04</b>
	(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:	<b>07</b>
	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.

**OR**

- Q.3** (a) Explain Sensitivity and Isochronism with respect to governors. **03**  
(b) Explain the application of gyroscopic principles to aircrafts. **04**  
(c) Explain the effect of the gyroscopic couple on the reaction of the four wheels of a vehicle negotiating a curve. **07**

- Q.4** (a) What is the function of a flywheel? How does it differ from that of a governor? **03**  
(b) Define: (1) flywheel (2) Maximum fluctuation of speed **04**  
(3) coefficient of fluctuation of speed  
(c) The turning moment diagram for a petrol engine is drawn to the following scales : Turning moment, 1 mm = 5 N-m ; crank angle, 1 mm = 1°. The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270 mm<sup>2</sup>. The rotating parts are equivalent to a mass of 36 kg at a radius of gyration of 150 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800 r. p . m. **07**

**OR**

- Q.4** (a) State and explain parallel axis theorem. **03**  
(b) What is free body diagram. **04**  
(c) Explain the following **07**  
(i) principle of virtual work.  
(ii) impulse and momentum.

- Q.5** (a) Compare Centroid and Center of mass. **03**  
(b) State and explain Lami's theorem with suitable example. **04**  
(c) Analyze of dynamics force analysis of slider crank mechanism. **07**

**OR**

- Q.5** (a) Define and explain the superposition theorem as applicable to a system of forces acting on a mechanism. **03**  
(b) Explain D'Alembert's Principle. **04**  
(c) Analyze of dynamics force analysis of four bar mechanism. **07**

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