

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2023****Subject Code:2151902****Date:15-12-2023****Subject Name: Theory of Machines****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) Distinguish Clutch and brake.	03
	(b) Explain Sensitivity and Isochronisms with respect to governor.	04
	(c) Evaluate the ratio of tension in the tight side to tension in the slack side for Band and block brake.	07
Q.2	(a) State the function of a governor and differentiate between governor and flywheel.	03
	(b) Define and explain coefficient of fluctuation of energy and coefficient of fluctuation of speed for flywheel.	04
	(c) Explain the concept of controlling force with controlling force diagram for spring controlled governors.	07
OR		
	(c) Derive an equation for stability of four wheeler taking turn.	07
Q.3	(a) Explain briefly Hartnell governor.	03
	(b) Differentiate between absorption and transmission dynamometers.	04
	(c) The turning moment diagram for a petrol engine is drawn to the following scales: Turning moment, 1 m m = 5 N-m ; crank angle, 1 m m = 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 ² . 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.3	(a) Explain the effect of gyroscopic couple on a ship during steering.	03
	(b) What is the function of a clutch? Classify clutches	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
Q.4	(a) Explain various applications of flywheel.	03
	(b) Enlist the factors on which capacity of a break depends.	04

- (c) A band brake acts on the 3/4th of circumference of a drum of 450 mm diameter Which is keyed to the shaft? The band brake provides a braking torque of 225 N-m. One end of the band is attached to a fulcrum pin of the lever and the other end to a pin 100 mm from the fulcrum. If the operating force is applied at 500 mm from the fulcrum and the coefficient of friction is 0.25, find the operating force when the drum rotates in the (a) anticlockwise direction, and (b) clockwise direction. **07**

OR

- Q.4** (a) Define applied and constraint forces. **03**
(b) Prove that the maximum fluctuation of energy, $\Delta E_{\max} = 2.E.C_s$ with usual notations. **04**
(c) A band and block brake, having 14 blocks each of which subtends an angle of 15° at the centre, is applied to a drum of 1 m effective diameter. The drum and flywheel mounted on the same shaft has a mass of 2000 kg and a combined radius of gyration of 500 mm. The two ends of the band are attached to pins on opposite sides of the brake lever at distances of 30 mm and 120 mm from the fulcrum. If a force of 200 N is applied at a distance of 750 mm from the fulcrum, Find: **1.** Maximum braking torque, **2.** Angular retardation of the drum, and **3.** time taken by the System to come to rest from the rated speed of 360 r.p.m. The coefficient of friction between blocks and drum may be taken as 0.25. **07**

- Q.5** (a) State Newton's second and third laws of motion. **03**
(b) Explain impulse and momentum. **04**
(c) Explain velocity analysis of a link by complex algebra approach. **07**

OR

- Q.5** (a) Explain D'Alembert's principle. **03**
(b) Describe free body diagram. **04**
(c) Analyze of dynamics force analysis of four bar mechanism. **07**
