

Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering - SEMESTER - V EXAMINATION - WINTER 2025

Subject Code: 2151902

Date: 27-11-2025

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) List all experimental methods used for finding out the radius of gyration of components.	03
(b) Explain the effect of gyroscopic couple on a ship during steering.	04
(c) Derive an expression for angle of heel of a two-wheeler taking turn.	07
Q.2 (a) Distinguish between a brake and a clutch.	03
(b) Write the function of a clutch and Classify clutches.	04
(c) Describe the construction and operation of a rope brake absorption dynamometer.	07
OR	
(c) A simple band brake is applied to a rotating drum of diameter 500 mm. The lap angle of the band on the drum is 250° . The one end of the lever has the fulcrum pin to which is attached, the one end of the band. Another end of the band is attached to a pin 110 mm from the fulcrum. The co-efficient of friction between the band and drum is 0.2. A braking force of 100 N is applied at a distance of 800 mm from the fulcrum. Determine the brake torque for (i) Counter-clockwise rotation of the drum and (ii) clockwise rotation of drum.	07
Q.3 (a) List out all characteristics of friction lining material used for clutch.	03
(b) Explain various applications of flywheel.	04
(c) Derive expression for frictional torque for centrifugal clutch.	07
OR	
(a) Explain the term 'turning moment diagram', 'Coefficient of fluctuation of speed and 'Coefficient of fluctuation of energy'.	03
(b) Draw and explain turning moment diagram of a 4-Stroke single cylinder Engine.	04
(c) A centrifugal clutch is to be design to transmit 20kW at 100 rpm. The shoes are four in number. The speed at which the engagement begins is $\frac{3}{4}$ th of the running speed. The inside radius of the pulley rim is 200 mm. The shoes are lined with the material of coefficient of friction of 0.2. Determine 1. Mass of the shoes 2. Size of the shoes.	07
Q.4 (a) Write the function of a governor and explain how it differs from flywheel.	03

- (b) Write the difference between inertia and centrifugal governor. 04
- (c) The turning moment diagram for a petrol engine is drawn to a vertical scale of 1mm = 5 N.m and a horizontal scale of 1 mm = 10. The turning moment repeats itself after every half revolution of engine. The areas above and below the mean torque line are 305, 710, 50, 350, 980 and 275 mm². The rotating parts amount to a mass of 40 kg at a radius of gyration of 140 mm. Calculate the coefficient of fluctuation of speed if the speed of the engine is 1400 rpm. 07

OR

- (a) Define the following terms” impulse” and “momentum”. 03
- (b) Define the following terms in context of governor: (i) Sensitiveness, (ii) Hunting, (iii) Isochronism, (iv) Stability. 04
- (c) Derive a relation for the coefficient of fluctuation of speed in terms of maximum fluctuation of energy and the kinetic energy at mean speed. 07
- Q.5** (a) Define Centroid and Centre of gravity. Give difference between two. 03
- (b) Explain the concept of Free body diagram with proper example. 04
- (c) Prove for Watt governor, height of the governor $h = 895/ N^2$, where N is speed of rotation of sleeve. 07

OR

- (a) Define applied and constraint forces. 03
- (b) State and explain parallel axis theorem. 04
- (c) Explain shaking forces and shaking moments. Derive their expressions for a four bar linkage. 07
