

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2021****Subject Code:2151902****Date:20/09/2021****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 the characteristics of good friction material for clutch.	03
	(b) What are the factors on which capacity of brake depends?	04
	(c) Describe with a neat sketch a centrifugal clutch and derive an equation for the total torque transmitted.	07
Q.2	(a) Explain concept of gyroscopic couple.	03
	(b) Discuss the effect of the gyroscopic couple on a two wheeled vehicle when taking a turn.	04
	(c) Explain the application of gyroscopic principles to aircrafts.	07
OR		
	(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:	07
	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.	
Q.3	(a) State the function of a governor and differentiate between governor and flywheel.	03
	(b) Define and explain the following terms relating to governors : 1. Stability, 2. Sensitiveness, 3. Isochronism, and 4. Hunting.	04
	(c) Explain with neat sketches the Bevis-Gibson flash light dynamometer.	07
OR		
Q.3	(a) Distinguish between brakes and dynamometers.	03
	(b) Describe the construction and operation of a rope brake absorption dynamometer.	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
Q.4	(a) Explain various applications of flywheel.	03
	(b) Explain the turning moment diagram of a four stroke cycle internal combustion engine.	04
	(c) Derive the expression of maximum fluctuation of energy for multi-cylinder engine and coefficient of fluctuation of energy.	07

OR

- Q.4** (a) Explain the term 'turning moment diagram', 'Coefficient of fluctuation of speed' and 'Coefficient of fluctuation of energy'. **03**
- (b) Draw the turning moment diagram of a single cylinder double acting steam engine. **04**
- (c) A machine punching 38 mm holes in 32 mm thick plate requires 7 N-m of energy per sq. mm of sheared area, and punches one hole in every 10 seconds. Calculate the power of the motor required. The mean speed of the flywheel is 25 metres per second. The punch has a stroke of 100 mm. Find the mass of the flywheel required, if the total fluctuation of speed is not to exceed 3% of the mean speed. Assume that the motor supplies energy to the machine at uniform rate. **07**
- Q.5** (a) Define and explain the superposition theorem as applicable to a system of forces acting on a mechanism. **03**
- (b) State Lami's theorem and give suitable example. **04**
- (c) What do you mean by free body diagrams? How are they useful in finding various forces acting on the various members of the mechanism? **07**

OR

- Q.5** (a) Explain the principle of virtual work. **03**
- (b) Explain Centroid and Center of mass. **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 parts 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**
