

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2019

Subject Code: 2151902

Date: 17/06/2019

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.

		MARKS
Q.1	(a) Explain the gyroscopic effect with suitable example.	03
	(b) Explain Sensitivity and Isochronism with respect to governors.	04
	(c) Derive an equation for an Aeroplane taking turn with usual notations.	07
Q.2	(a) State the function of governor. Distinguish between flywheel and governor.	03
	(b) Explain any one type of dynamometer with neat sketch.	04
	(c) Derive an equation for stability of four wheeler taking turn.	07
OR		
Q.3	(c) The ship is propelled by a turbine rotor having mass of 6000 kg and speed of 2400 rpm. The direction of rotation of the rotor is clockwise when viewed from the stern. The radius of gyration of the rotor is 450 mm. Determine the gyroscopic effect when	07
	1. The ship steers the left in curve of 60 m radius at a speed of 33.48 km/hr.	
	2. The ship pitches 7.5 degree above and 7.5 degree below the normal position and the bow is descending with its maximum velocity. The pitching motion is simple harmonic with periodic time of 18 seconds.	
	3. The ship rolls and at the instant, its angular velocity is 0.035 rad/sec counter clockwise when viewed from the stern.	
Q.3	(a) Explain various applications of flywheel	03
	(b) Derive an expression for the frictional torque acting on a centrifugal clutch.	04
	(c) A differential band brake has a drum with a diameter of 400 mm. The two ends of the band are fixed to the pins on the opposite sides of the fulcrum of the lever at distances of 20 mm and 100 mm from the fulcrum. The angle of contact is 270° and the coefficient of friction is 0.2. Determine the brake torque when a force of 600 N is applied to the lever at a distance of 400 mm from fulcrum	07
OR		
Q.3	(a) Enlist the factors affecting capacity of brakes.	03
	(b) What are the materials for friction clutches? State the characteristics of good friction material.	04
	(c) Derive the expression of maximum fluctuation of energy for multi-cylinder engine and coefficient of fluctuation of energy.	07
Q.4	(a) State and explain parallel axis theorem.	03

- (b) Explain the concept of Free body diagram with suitable example. **04**
- (c) A machine is coupled to a two-stroke engine which produces a torque of $(800 + 180 \sin 3\theta)$ N-m, where θ is the crank angle. The mean engine speed is 400 rpm. The flywheel and the other rotating parts attached to the engine have a mass of 350 kg at a radius of gyration of 220 mm. Calculate; **07**
1. Power of the engine, and
 2. Total fluctuation of the speed of the flywheel in percentage when
 - (i) the resisting torque is constant, and
 - (ii) the resisting torque is $(800 + 80 \sin \theta)$ N-m.

OR

- Q.4** (a) What is a clutch? Explain with neat sketch, the working of single-plate clutch. **03**
- (b) Differentiate between brakes and dynamometer. **04**
- (c) For the static equilibrium of the quick-return mechanism shown in Fig.1, determine the input torque T_2 to be applied on the link AB for a force of 300 N on slider D. The dimensions of the various links are; OA = 400 mm, AB = 200 mm, OC = 800 mm and CD = 300 mm. **07**

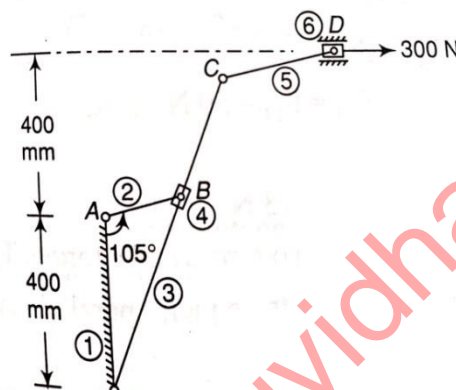


Fig. 1

- Q.5** (a) Define and explain the superposition theorem as applicable to a system of forces acting on a mechanism. **03**
- (b) State and explain D'Alembert's principle. **04**
- (c) Describe the working of band and block brake with the help of neat sketch and derive the equation for ratio of tight and slack side tensions. **07**

OR

- Q.5** (a) Explain the principle of virtual work. **03**
- (b) State and explain Lami's theorem with suitable example. **04**
- (c) The crank and connecting rod of a vertical petrol engine, running at 1800 rpm are 60 mm and 270 mm respectively. The diameter of piston is 100 mm and the mass of the reciprocating parts is 1.2 kg. During expansion stroke when the crank has turned 20° from T.D.C., the gas pressure is 650 kN/m^2 . Determine the find; **07**
- (i) Net force on piston
 - (ii) Net load on gudgeon pin
 - (iii) Thrust on the cylinder walls
 - (iv) Speed at which the gudgeon pin load is reversed in direction.
