Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 151902 **Date: 08/05/2017**

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.**

Q.1	**(a)**	What is a function of a governor? How does it differ from that of a flywheel? Also explain the terms sensitiveness, hunting and stability relating to governors.	**07**
	(b)	Describe the working of a band and block brake with the help of a neat sketch. Deduce the relation for ratio of tight and slack side tensions.	**07**
Q.2	**(a)**	Explain gyroscopic couple and discuss its effect on an aero plane taking turns when viewed from rear.	**07**
	(b)	In a Hartnell governor, the extreme radii of rotation of the balls are 40 mm and 60 mm, and the corresponding speeds are 210 rpm and 230 rpm. The mass of each ball is 3 kg. The lengths of the ball and the sleeve arms are equal. Determine the initial compression and the constant of the central spring.	**07**
		OR	
	(b)	Derive the equation for the height of Watt governor.	**07**
Q.3	**(a)**	Explain the term ‘turning moment diagram’, ’Coefficient of fluctuation of speed and ‘’Coefficient of fluctuation of energy’.	**07**
	(b)	Each arm of a Porter governor is 200 mm long and is pivoted on the axis of the governor. The radii of rotation of the balls at the minimum and the maximum speeds are 120 mm and 160 mm respectively. The mass of the sleeve is 24 kg and each ball is 4 kg. Find the range of speed if the friction at the sleeve is 18N.	**07**
		OR	
Q.3	**(a)**	What is a flywheel? What is its use? Derive a relationship for the coefficient of fluctuation of speed in terms of maximum fluctuation of energy and the kinetic energy of the flywheel at mean speed.	**07**
	(b)	The turbine of rotor of a ship has mass of 2.2 tonnes and radius of gyration of 320 mm, rotates at speed of 1800 r.p.m. clockwise when looking from aft. Determine gyroscopic couple and its effect when the (i) ship turns right at a radius of 250 m with a speed of 25 km/hr (ii) ship pitches with the bow rising at an angular velocity of 0.8 rad/sec (iii) ship rolls at an angular velocity of 0.1 rad/sec	**07**
Q.4	**(a)**	What do you understand by type synthesis, number synthesis and dimensional synthesis? Describe the classification of the synthesis problem with suitable examples.	**07**

	(b)	The crank and connecting rod of a petrol engine, running at 1800 r.p.m. are 50 mm and 200 mm respectively. The diameter of the piston is 80 mm and the mass of the reciprocating parts is 1 kg. At a point during the power stroke, the pressure on the piston is 0.7 N/mm^2, when it has moved 10 mm from the inner dead centre. Determine: 1. Net load on the gudgeon pin, 2. Thrust in the connecting rod, 3. Reaction between the piston and cylinder, and 4. The engine speed at which the above values become zero.	**07**
		OR	
Q.4	**(a)**	Explain dynamically equivalent two mass systems.	**07**
	(b)	A single cylinder double acting steam engine develops 150 kW at a mean speed of 80 r.p.m. The coefficient of fluctuation of energy is 0.1 and the fluctuation of speed is ± 2% of mean speed. If the mean diameter of the flywheel rim is 2 metre and the hub and spokes provide 5% of the rotational inertia of the flywheel, find the mass and cross-sectional area of the flywheel rim. Assume the density of the flywheel material (which is cast iron) as 7200 kg/m^3.	**07**
Q.5	**(a)**	Prove the Freudenstein's equation for Four Link Mechanism.	**07**
	(b)	Explain three position synthesis of Slider Crank mechanism.	**07**
		OR	
Q.5	**(a)**	Explain the Chebychev spacing and structural error in brief.	**07**
	(b)	Explain three position synthesis for Four Bar Mechanism.	**07**

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