 Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(New) • EXAMINATION – WINTER 2016

Subject Code:2151902 Date:24/11/2016

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.**

			MARKS
Q.1		**Short Questions**	**14**
	1	For any flywheel what is more important, mass or mass moment of inertia?	
	2	Define Free body diagram.	
	3	In which type of clutch no pedal is required for engagement or disengagement of drive?	
	4	Governor is used with which type of engines only.	
	5	In a rope brake dynamometer why cooling water is required?	
	6	Are we using flywheels with electric motors in mixer grinder? Why?	
	7	Which are the various types of brakes?	
	8	What is the meaning of "Stern" for naval ship?	
	9	For which engine the size of flywheel will be small, either 2 cylinder engine or 4 cylinder engine producing same power. Why?	
	10	Define Precession axis.	
	11	Hunting of governor is useful or not? Why?	
	12	Give one advantage of Gyroscopic couple.	
	13	Illustrate constraint force with proper fig.	
	14	Give statement of D'alembert's principle.	
Q.2	**(a)**	Give only two differences and one similarity between Brake and Dynamometer.	**03**
	(b)	Explain basic terms used for gyroscopic with proper diagram.	**04**
	(c)	Discuss the gyroscopic effect and stability of a four wheel vehicle moving along a curved path.	**07**
		OR	
	(c)	A car is of total mass 1800 kg has the track width 160 cm. Each wheel having an effective diameter 60 cm and the mass moment of inertia 2.5 kg m^2. The mass moment of inertia of rotating parts of the engine is 1.4 kg m^2. The engine axis is parallel to the rear axle and the crankshaft rotates in the same sense as the road wheels. The gear ratio of the engine to the rear wheel is 3. The centre of mass of the car is 50 cm above the road level. If the car is rounding a curve of 60 m radius at a speed of 110 km/h, determine the load distribution on the inner and outer wheels.	**07**
Q.3	**(a)**	Short note on Flywheel material.	**03**
	(b)	Explain various applications of flywheel.	**04**
	(c)	What is the function of a dynamometer? List various types of dynamometers. Explain any one with neat sketch.	**07**
		OR	
Q.3	**(a)**	For a rope brake dynamometer with flywheel dia. of 1 m, speed of the engine 180 rpm, dia. of rope is 10 mm, dead weight 50 kg, reading of spring balance is 120 N, then find the brake power of the engine.	**03**
	(b)	Give advantages and disadvantages of hydraulic dynamometer.	**04**
	(c)	The T-θ diagram of an engine consists of intercepted areas which are +40, -85, +79, -68, +96 and -62 mm^2 in one cycle taken in the given order. The torque axis scale is 1 mm = 75 N-m and crank angle scale is 1 mm = 5^0. Mean speed of the engine is 500 rpm. Design the rim of the flywheel for the following data: (a) Limiting rim speed at mean radius = 30 m/s. (b) The fluctuation of speed = 2 % around mean speed.	**07**

(c) Width to thickness ratio for rectangular rim section is 1.5 which contributes 100% of MI of flywheel.

(d) Material density is 7200 kg/m^3. Neglect the flywheel effect of hub and arms.

Q.4 **(a)** Define Centroid and centre of gravity. Give difference between two. **03**

(b) Explain working principle of centrifugal governor with suitable diagram. **04**

(c) 100 kW is transmitted at 3000 rpm by a multiplate disk friction clutch. The plates are having friction surface with coefficient as 0.07 and the axial intensity of pressure should not exceed 1.5 bar. External radius is 1.25 times the internal radius and the external radius is 12.5 cm. Determine the number of plates needed to transmit the required torque assuming uniform wear. **07**

OR

Q.4 **(a)** State and explain parallel axis theorem. **03**

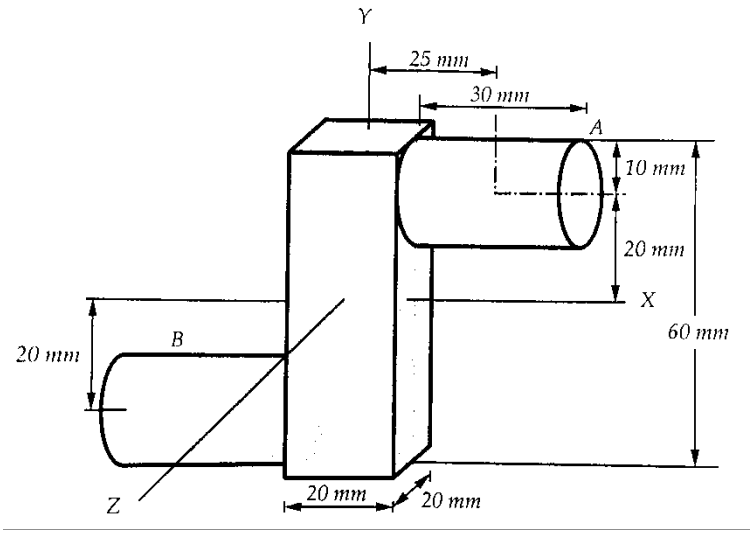
(b) What is a function of a governor? How does it differ from that of a flywheel? Also explain the terms sensitiveness, hunting and stability relating to governors. **04**

(c) Determine the time required to accelerate a counter shaft of rotating mass 500 kg and radius of gyration of 200 mm to the full speed of 250 rpm from rest through a single plate clutch of internal and external radii 125 mm and 200 mm, taking coefficient of friction as 0.3 and axial spring force of 600 N. Assume that only one side of clutch is working. **07**

Q.5 **(a)** State Newton's three laws of motion. **03**

(b) Explain the concept of Free body diagram with proper example. **04**

(c) A steel forging consists of a 60 x 20 x 20 mm rectangular prism and two cylinders of 20 mm diameter and 30 mm length as shown in Fig. Determine the moments of inertia of the forging with respect to the co-ordinate axes passing from centroid of prism. Density of steel is 7850 kg/m^3. **07**



OR

Q.5 **(a)** State Lami's theorem and give suitable example. **03**

(b) A wheel rotates with constant angular acceleration and describes 100 radians during time of 5 seconds. After that it has constant angular velocity for 5 seconds and it describes 80 radians. Find the initial angular velocity and the angular acceleration. **04**

(c) In slider crank mechanism, the crank is 300 mm long and connecting rod 850 mm long. The piston is of 90 mm in diameter and gas pressure acting on the piston is 5 MPa. When the crank has moved through 45^0 from I.D.C. find **07**

(a) Thrust in connecting rod

(b) Reaction from guide (side thrust on piston)

(c) Torque acting on the crankshaft and

(d) Radial load on main bearing

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