Seat No.: ________ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2018

Subject Code:2151902 **Date:07/12/2018**

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.**

Q.1	**(a)**	Explain the effect of gyroscopic couple on a ship during steering.	**03**
	(b)	What is the function of a clutch? Classify clutches.	**04**
	(c)	An aeroplane makes a complete half circle of 50 meters radius, towards left, when flying at 200 km per hr. The rotary engine and the propeller of the plane has a mass of 400 kg and a radius of gyration of 0.3 m. The engine rotates at 2400 r.p.m. clockwise when viewed from the rear. Find the gyroscopic couple on the aircraft and state its effect on it.	**07**
Q.2	**(a)**	Enlist the factors on which capacity of a break depends.	**03**
	(b)	Differentiate between absorption and transmission dynamometers.	**04**
	(c)	A car moving on a level road at a speed 50 km/h has a wheel base 2.8 metres, distance of C.G. from ground level 600 mm and the distance of C.G. from rear wheels 1.2 metres. Find the distance travelled by the car before coming to rest when brakes are applied, 1.) To the front wheels and 2.) To all four wheels. The coefficient of friction between the tyres and the road may be taken as 0.6.	**07**
		OR	
	(c)	A band brake acts on the 3/4th of circumference of a drum of 450 mm diameter which is keyed to the shaft. The band brake provides a braking torque of 225 N-m. One end of the band is attached to a fulcrum pin of the lever and the other end to a pin 100 mm from the fulcrum. If the operating force is applied at 500 mm from the fulcrum and the coefficient of friction is 0.25, find the operating force when the drum rotates in the (a) anticlockwise direction, and (b) clockwise direction.	**07**
Q.3	**(a)**	State the function of a governor and differentiate between governor and flyheel.	**03**
	(b)	Prove that the maximum fluctuation of energy, ΔE_{max} = 2.E.Cs with usual notations.	**04**
	(c)	A torsion dynamometer is fitted to a propeller shaft of a marine engine. It is found that the shaft twists 2° in a length of 20 metres at 120 r.p.m. If the shaft is hollow with 400 mm external diameter and 300 mm internal diameter, find the power of the engine. Take modulus of rigidity for the shaft material as 80 GPa.	**07**
		OR	
Q.3	**(a)**	List advantages and applications of centrifugal clutch.	**03**
	(b)	Define and explain coefficient of fluctuation of energy and coefficient of fluctuation of speed for flywheel.	**04**
	(c)	Explain the concept of controlling force with controlling force diagram for spring controlled governors.	**07**

Q.4	**(a)**	Explain hunting phenomena in governors.	**03**
	(b)	What are the characteristics of good friction materials? State different friction materials used in friction clutches.	**04**
	(c)	A horizontal cross compound steam engine develops 300 kW at 90 r.p.m. The coefficient of fluctuation of energy as found from the turning moment diagram is to be 0.1 and the fluctuation of speed is to be kept within ± 0.5% of the mean speed. Find the weight of the flywheel required, if the radius of gyration is 2 metres.	**07**

OR

Q.4	**(a)**	Define applied and constraint forces.	**03**
	(b)	Find the inertia force for the following data of an I.C. engine: Bore = 175 mm, stroke = 200 mm, engine speed = 500 r.p.m., length of connecting rod = 400 mm, crank angle = 60° from T.D.C and mass of reciprocating parts = 180 kg.	**04**
	(c)	Explain velocity analysis of a link by complex algebra approach.	**07**
Q.5	**(a)**	Explain D'Alembert's principle.	**03**
	(b)	What do you mean by free body diagrams? How are they useful in finding various forces acting on the various members of the mechanism?	**04**
	(c)	A wheel rotates for 5 seconds with constant angular acceleration and describes 100 radians during this time. It then rotates with a constant angular velocity and during the next 5 seconds describes 80 radians. Find the initial angular velocity and the angular acceleration.	**07**

OR

Q.5	**(a)**	State Newton's second and third laws of motion.	**03**
	(b)	Explain impulse and momentum.	**04**
	(c)	A rectangular RCC column is centrally cast over a concrete bed. RCC (as shown in Fig. 1) column is of section 30 x 45 cm and height 4 m. The concrete bed is of size 3 x 4.5 m and thickness 30 cm. Find the mass moment of inertia of the column and bed combination about its vertical centroidal axis. Mass density of concrete = 2500 kg/m^3.	**07**

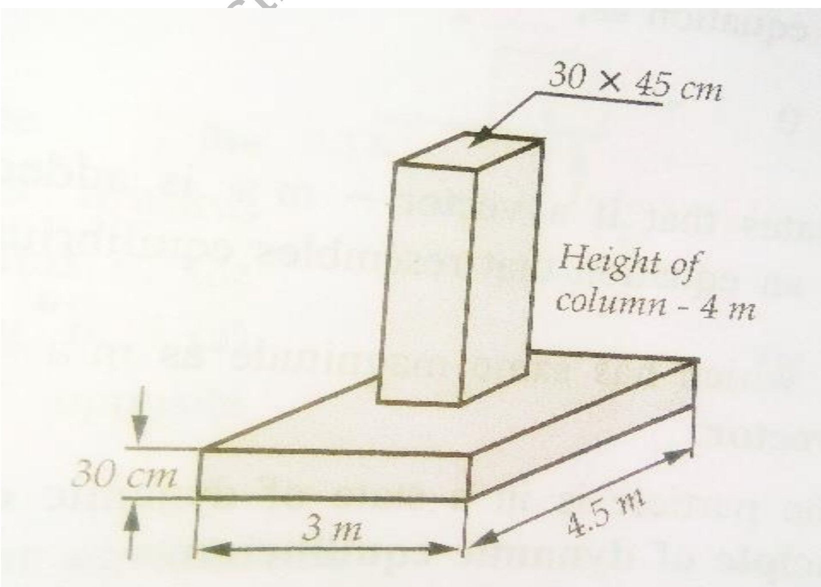

Fig. 1

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