

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-V EXAMINATION – WINTER 2015

Subject Code: X51901**Date: 10/12/2015****Subject Name: Theory of Machine****Time: 10:30pm to 1:00pm****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)** Distinguish between brakes and dynamometer. **07**
(b) Describe the construction and operation of a rope brake absorption dynamometer. **07**

- Q.2 (a)** Define Governor and give its classification. Derive the expression for Watt Governor to find the height of the governor neglecting weight of the arms. **07**
(b) The arms of a Porter Governor are each 250 mm long and pivoted on the governor axis. The mass of each ball is 5 kg and the mass of the central sleeve is 30 kg. The radius of rotation of the ball is 150 mm when the sleeve begins to rise and reaches a value of 200 mm for maximum speed. Determine the speed range of the governor. If the friction at the sleeve is equivalent of 20 N of load at the sleeve, determine how the speed range is modified **07**

OR

- (b)** Define the following terms in respect of governor : **07**
1) Hunting;
2) Sensitiveness ;
3) Sleeve lift ;
4) Isochronisms ;
5) Stability ;
6) Coefficient of insensitiveness ; and
7) Effort.
- Q.3 (a)** Define the following terms in respect of Gyroscope : **07**
1) Spin axis;
2) Precession axis;
3) Gyroscopic axis;
4) Spin plane;
5) Precession plane;
6) Gyroscopic plane ; and
7) Bow.
- (b)** An aeroplane makes a complete half circle of 50 metres 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**

OR

- Q.3 (a)** Explain the principle of gyroscopic action and determine the magnitude and direction of gyroscopic couple **07**

- (b) The turbine rotor of a ship has a mass of 8 tonnes and a radius of gyration 0.6 m. It rotates at 1800 r.p.m. clockwise, when looking from the stern. Determine the gyroscopic couple, if the ship travels at 100 km/hr and steer to the left in a curve of 75 m radius. **07**
- Q.4 (a)** Explain the following terms : **07**
- 1) Function generation ;
 - 2) Path generation ;
 - 3) Body guidance.
- (b) 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**
- OR**
- Q.4 (a)** Explain Freudenstein's method of three point synthesis of mechanisms. **07**
- (b) 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**
- Q.5 (a)** Define the flywheel and state its importance. What are the functions of a flywheel? **07**
- (b) Explain the turning moment diagram for 4 cylinder four stroke cycle internal combustion engine. **07**
- OR**
- Q.5 (a)** State and explain D'Alembert's principle. **07**
- (b) Draw and explain Klien's construction for determining the velocity and acceleration of the piston in a slider crank mechanism. **07**
