

Code: ME5T1

**III B.Tech - I Semester – Regular Examinations - November 2014**

**DYNAMICS OF MACHINERY  
(MECHANICAL ENGINEERING)**

Duration: 3 hours

Marks: 5x14=70

Answer any **FIVE** questions. All questions carry equal marks

1. a) What are uniform pressure and uniform wear theories?  
Deduce expressions for the friction torque considering both the theories for a flat collar. 10 M
- b) Explain the working principle of centrifugal clutch. 4 M
2. In a winch, the rope supports a load  $W$  and is wound round a barrel 450 mm diameter. A differential band brake acts on drum 800 mm diameter which is keyed to the same shaft as the barrel. The two ends of the bands are attached to pins on opposite sides of the fulcrum of the brake lever and at distances of 25 mm and 100 mm from the fulcrum. The angle of lap of the brake band is  $250^\circ$  and the coefficient of friction is 0.25. What is the maximum load  $W$  which can be supported by the brake when a force of 750 N is applied to the lever at a distance of 3000 mm from the fulcrum? 14 M
3. a) What is the condition of isochronisms in governors? In what type of governors can it be achieved? 6 M

- b) A simple Watt governor in which the arms intersect on the axis is running at 100 rpm. Find the percentage variation of its height if the speed changes  $\pm 5\%$ . 8 M
4. a) Explain in what way the gyroscopic couple affects the motion of an aircraft while taking a turn. 4 M
- b) A disc of 5 kg mass with radius of gyration 70 mm is mounted at span on a horizontal shaft spins at 720 rpm in clockwise direction when viewed from the right hand bearing. If the shaft precesses about the vertical axis at 30 rpm in clockwise direction when viewed from the top, determine the reactions at each bearing due to mass of the disc and gyroscopic effect. 10 M
5. The connecting rod of a reciprocating compressor is 2 m long and has a weight of 300 kg. The mass center is 825 mm from big end bearing. The radius of gyration of the connecting rod is 0.7 m. The crank is 420 mm long and rotates at 250 rpm. When the crank has turned through 225 degree from the inner dead center and the piston is moving towards left, find the torque acting at the crankshaft. Consider mass of crank, connecting rod and piston to be 5 kg, 4 kg and 2 kg respectively. 14 M
6. A single-cylinder, four- stroke oil engine develops 25 kW at 300 rpm. The work done by the gases during expansion stroke is 2.5 times the work done on the gases during compression stroke and the work done during the suction and exhaust strokes is negligible. If the turning moment diagram during expansion is assumed to be triangular in

shape and the speed is to be maintained within 1% of the mean speed, find the moment of inertia of the flywheel.

14 M

7. A mass of 100 kg is fixed to a rotating shaft so that distance of its mass centre from the axis of rotation is 228 mm. Find balancing masses in following two conditions : 14 M

a) Two masses – one on left of disturbing mass at a distance of 100 mm and radius of 400 mm, and other on right at a distance of 200 mm and radius of 150 mm.

b) Two masses placed on right of the disturbing mass respectively at distances of 100 and 200 mm and radii of 400 and 200 mm.

The masses are placed in the same axial plane

8. A four crank engine has the two outer cranks set at  $120^\circ$  to each other and their reciprocating masses are each 400 kg. The distance between the planes of rotation of adjacent cranks are 450 mm, 750 mm and 600 mm. 14 M

a) If the engine is to be in complete primary balance, find the reciprocating mass and the relative angular position for each of the inner cranks.

b) If the length of each crank is 300 mm, the length of each connecting rod is 1.2 m and the speed of rotation is 240 rpm, what is the maximum secondary unbalanced force?