PVP 12

Code: ME5T1

III B.Tech - I Semester – Regular Examinations – November 2015

DYNAMICS OF MACHINERY
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Answer any FIVE questions. All questions carry equal marks

1. a) A single plate clutch both sides effective is required to transmit 27 kW at 1600 rpm. The outer diameter of the plate is limited to 30 cm, and the intensity of pressure between the plates is not to exceed 6.87 N/cm^2. Assuming uniform wear and a coefficient of friction of 0.3, find the required inner diameter of the plates, and the axial force necessary to engage the clutch. 10 M

   b) Derive the expression for the friction torque of a flat collar bearing by uniform wear theory. 4 M

2. A band and block brake having 12 blocks, each of which subtends 15° at the centre, is applied to a rotating drum of 600 mm diameter. The blocks are 75 mm thick. The drum and the flywheel mounted on the same shaft have a mass of 1800 kg and have combined radius of gyration of 600 mm. The two ends of the band are attached to pins on the opposite sides of the brake fulcrum at distances of 40 mm and 150 mm from the fulcrum, if a force of 250N is applied at a distance

of 700mm from the fulcrum, calculate
(i) the maximum braking torque,
(ii) the angular retardation of the drum,
(iii) the time taken by the system to be stationary from the rated speed of 300 r.p.m. Take coefficient of friction is 0.3.

14 M

3. a) Distinguish the differences between centrifugal governor and inertia governor. 4 M

b) In a spring controlled governor, the controlling force is found to vary linearly with the radius of rotation of the balls. The balls are 420 mm apart when the controlling force is 1540 N and 240 mm when it is 800 N. The mass of each ball is 10.5 kg. Calculate the speed of the governor when the balls are 300 mm apart. Determine by how much the initial tension is increased to make the governor isochronous. Calculate, also, this isochronous speed.

10 M

4. a) Explain the principle of gyroscope. Describe one device where the gyroscopic principle is used. 4 M

b) The turbine rotor of a ship has a mass of 2.2 t and rotates at 1800 rpm clockwise when viewed from the aft. The radius of gyration of the rotor is 320 mm. Determine the

gyroscopic couple and its effect when (i) ship turns right at a radius of 250 m and a speed of 25 kmph (ii) the ship pitches with the bow rising at an angular velocity of 0.5 rad/s (iii) the ship rolls at an angular velocity 0.1 rad/s.

10 M

5. a) Define the terms Piston effort and crank effort. 4 M

b) The crank and connecting rod of a petrol engine, running at 1800 rpm 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 0.65 MPa, when it has moved 10 mm from the inner dead center. Determine

(i) Net load on the gudgeon pin

(ii) thrust in the connecting rod

(iii) reaction between the piston and the cylinder and

(iv) the speed at which the above values become zero.

10 M

6. a) What is Turning Movement diagram? Mention its uses.

4 M

b) A certain machine requires a torque of $(1500+200 \sin\theta)$ N-m to drive it where θ is the angle of rotation of shaft. The machine is directly connected to an engine which produces a torque $(1500+250 \sin\theta)$ N-m.

The flywheel and other rotating parts has a mass 300 kg at radius of gyration 200 mm. Mean speed is 200 rpm. Find:
(i) Kinetic Energy of flywheel
(ii) Percentage coefficient of fluctuation of speed
(iii) Crank angle at Maximum Turning Moment. 10 M

7. a) Explain role of reference plane in balancing masses of rotation in different planes. 4 M

b) A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5 kg and 4 kg respectively. Find the required mass A and relative angular settings of the four masses so that the shaft shall be in complete balance. 10 M

8. The three cylinders of an air compressor have their axes at 120^0 to one another, and their corresponding rods are coupled to a single crank. The stroke is 10 cm and the length of each connecting rod is 15 cm. The mass of the reciprocating parts per cylinder is 1.5 kg. Determine the maximum primary and secondary forces of the engine running at 3000 rpm. Describe clearly a method by which these forces may be balanced.
14 M