PVP 14

Code: ME5T1

III B.Tech - I Semester – Regular/Supplementary Examinations
October 2017

DYNAMICS OF MACHINERY
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

Answer ***all*** the questions. All questions carry equal marks

11 x 2 = 22 M

1. a) Which of the two assumptions-uniform intensity of pressure or uniform rate of wear, would you make use of in designing friction clutch and why?
   b) Define the principle of operation of an internal expanding shoe.
   c) Explain the application of gyroscopic principles to aircrafts.
   d) What is the difference between piston effort and crank effort?
   e) Explain precisely, the uses of turning moment diagram of reciprocating engines.
   f) State the different types of governors.
   g) Explain why only a part of the unbalanced force due to reciprocating masses is balanced by revolving mass.
   h) State the necessary conditions to achieve 'static balancing' and 'dynamic balancing'.
   i) Define, in short, free vibrations, forced vibrations and damped vibrations.
   j) Define: i) degrees of freedom ii) natural frequency

k) Derive the equation of motion of a spring mass system using energy method.

PART – B

Answer any ***THREE*** questions. All questions carry equal marks. 3 x 16 = 48 M

2. a) A leather faced conical clutch has a cone angle of 30º. If the intensity of pressure between the contact surfaces is limited to 0.35 N/mm^2 and the breadth of the conical surface is not to exceed one-third of the mean radius, find the dimensions of the contact surfaces to transmit 22.5 kW at 2000 r.p.m. Assume uniform rate of wear and take coefficient of friction as 0.15. 8 M

b) A differential band brake is shown in Figure 1. The diameter of the drum is 800 mm. The coefficient of friction between the band and the drum is 0.3 and the angle of embrace is 240°. When a force of 600 N is applied at the free end of the lever, find for clockwise and anticlockwise rotation of the drum: (i) the maximum and minimum forces in the band; and (ii) the torque which can be applied by the brake. 8 M

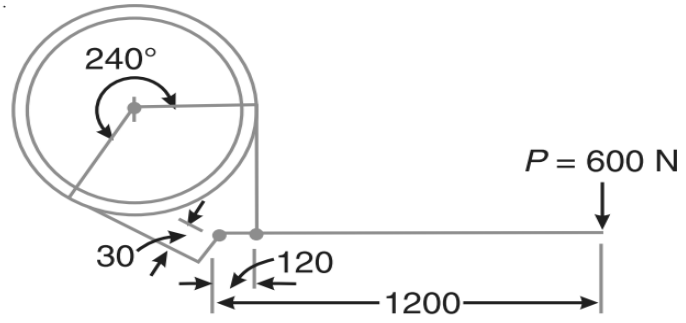

Figure 1. (All dimensions are in mm)

3. a) Describe the gyroscopic effect on sea going vessels. 8 M

b) The following data refer to a steam engine: Diameter of piston = 240 mm; stroke = 600 mm; length of connecting rod = 1.5 m; mass of reciprocating parts = 300 kg; speed = 125 r.p.m. Determine the magnitude and direction of the inertia force on the crankshaft when the crank has turned through 30° from inner dead centre. 8 M

4. a) The equation of the turning moment diagram for the three crank engine is given by:
T (N-m) = 25000 - 7500* sin 3θ
where θ in radians is the crank angle from inner dead centre. The moment of inertia of the flywheel is 400 kg-m^2 and the mean engine speed is 300 r.p.m. Calculate the power of the engine and the total percentage fluctuation of speed of the flywheel, if
i) The resisting torque is constant, and
ii) The resisting torque is (25000 + 3600 sin θ) N-m. 8 M

b) Explain the terms and derive expressions for 'effort' and 'power' of a Porter governor. 8 M

5. a) A single cylinder horizontal engine runs at 120 r.p.m. The length of stroke is 400mm. The mass of the revolving parts assumed concentrated at the crank pin is 100 kg and mass of the reciprocating parts is 150 kg. Determine the magnitude of the balancing mass required

to be placed opposite to the crank at a radius of 150mm which is equivalent to all the revolving and 2/3rd of the reciprocating masses. If the crank turns 30° from the inner dead centre, find the magnitude of the unbalanced force due to the balancing mass. 10 M

b) Discuss how a single revolving mass is balanced by two masses revolving in different planes. 6 M

6. a) A shaft 12.5 mm diameter rotates in long bearings and a disc of mass 16 kg is secured to a shaft at the middle of its length. The span of the shaft between the bearings is 0.5 m. The mass centre of the disc is 0.5 mm from the axis of the shaft. Neglecting the mass of the shaft and taking E = 200 GN/m^2, find: i) critical speed of rotation in r.p.m., and ii) the range of speed over which the stress in the shaft due to bending will not exceed 120 MN/m^2. Take the static deflection of the shaft for a beam fixed at both ends, *i.e.* $\delta = (W\ l^3)/(192\ EI\ )$. 10 M

b) What is meant by torsionally equivalent length of stepped shaft? Derive the expression for the equivalent length of stepped shaft. 6 M