Roll No ....

ME - 505
B.E. V Semester
Examination, December 2012
Dynamics of Machines

Time : Three Hours

Maximum Marks : 70/100

Note : 1. *Attempt five questions.*
2. *All questions carry equal marks.*

1. a) Find an expression for the torque exerted on the crank - shaft when friction and inertia of moving parts are neglected.

   b) The lengths of crank and connecting rod of a horizontal reciprocating engine are 100mm and 500mm respectively. The crank is rotating at 400 rpm. When the crank has turned 30^0 from the inner dead centre, find analytically i) acceleration of the piston, ii) velocity of the piston, iii) angular velocity of the connecting rod. iv) angular acceleration of the connecting rod.

2. a) Define the terms:

   i) Co-efficient of fluctuation of energy.

   ii) Co-efficient of fluctuation of speed.

b) The turning moment diagram for a multi cylinder engine has been drawn to a scale of 1mm = 325 N-m vertically and 1mm = 3° horizontally. The area above and below the mean torque line are –26, +378, –256, +306, –302, +244, –380, +261 and –225mm². The engine is running at a mean speed of 600 rpm. The total fluctuation of speed is not exceed ± 1.8% of the mean speed. If the radius of flywheel is 0.7m, find the mass of the flywheel.

3. a) Define the terms:

   i) Sensitivity of a Governor

   ii) Hunting

   iii) Stability of Governor

   b) Each arm of a porter governor is 250mm long. The upper and lower arms are pivoted to links of 40mm and 50mm respectively from the axis of rotation. Each ball has a mass of 5 kg and the sleeve mass is 50 kg. The force of friction on the sleeve of the mechanism is 40N. Determine range of speed of the governor for extreme radii of rotation of 125mm and 150mm.

4. a) Define following terms:

   i) Hammer blow

   ii) Tractive force

   iii) Swaying couple

   b) A single cylinder reciprocating engine has the following data:

   Speed of engine = 120 rpm, stroke 320mm mass of reciprocating parts = 45 kg and mass of revolving parts = 35 kg at crank radius. If 60% of the reciprocating parts and all the revolving parts are to be balanced, then find:

   i)   The balance mass required at a radius of 300mm.

   ii) The unbalanced force when the crank has rotated 60° from the top dead centre.

5. a) Find the power lost in friction assuming i) uniform pressure and ii) Uniform wear when a vertical shaft of 100mm diameter rotating at 150 rpm rests on a flat end foot step bearing. The coefficient of friction is equal to 0.05 and shaft carries a vertical load of 15 kN.

    b) Calculate the power transmitted by a single plate clutch at a speed of 2000 rpm., if the outer and inner radii of friction surfaces are 150mm and 100mm respectively. The maximum intensity of pressure at any point of contact surface should not exceed 0.8×10^{5} N/m². Take both sides of the plate as effective and coefficient of friction as 0.3. Assume uniform wear.

6. a) The power is transmitted from a pulley 1m diameter running at 200 rpm. to a pulley 2.5m diameter by means of a belt. Find the speed lost by the driven pulley as a result of the creep. If the stress on the tight and slack side of the belt is 1.44 N/mm² and 0.45 N/mm² respectively. The Young's modulus for the material of the belt is 100 N/mm².

    b) With a neat sketch, describe the principles and working of an internal expanding shoe-brake. Derive the expression for the braking torque.

7. a) Differentiate between absorption dynamometer and transmission dynamometer.

    b) The following data refer to a laboratory experiment with rope brake:

ME - 505   PTO

Diameter of the flywheel = 1m, Diameter of the rope = 10mm, dead weight on the brake = 50 kg, speed of the engine 180 rpm, spring balance reading = 120 N, find the power of the engine.

c) What is difference between brakes and dynamometer.

8. Write short notes on following (any three):

   i) Dynamically equivalent system.

   ii) Partial balancing of primary force.

   iii) Friction torque in pivots and collar by uniform pressure.

   iv) Cone clutch.

   v) Response of un-damped cam mechanism.

******

ME - 505