Total No. of Questions : 8] *[Total No. of Printed Pages : 4*

Roll No

ME-505 (GS)

B.E. V Semester

Examination, December 2017

Grading System (GS)

Dynamics of Machines

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.
ii) All questions carry equal marks.
iii) Assume suitable data or dimensions, if necessary.

1. a) What is meant by piston effort and crank effort? Derive a relation for the turning moment at the crankshaft in terms of piston effort and the angle turned by the crank.

   b) The turning moment diagram for a petrol engine is drawn to a vertical scale of 1mm = 500Nm and a horizontal scale of 1mm = 3°. The turning moment diagram repeats itself after every half revolution of the crank shaft. The areas above and below the mean torque line are 260, –580, 80, –380, 870 and –250mm^2. The rotating parts have a mass of 55kg and radius of gyration of 2.1m. If the engine speed is 1600 rpm, determine the coefficient of fluctuation of speed.

2. a) Describe the function of a Proell governor with the help of neat sketch. Establishes a relation among various forces acting on the bent link.

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   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 5kg and the sleeve mass is 50kg. The force of friction on the sleeve of the mechanism is 40N. Determine the range of speed of the governor for extreme radii of radius of 125mm and 150mm.

3. a) What is meant by static and dynamic unbalance in machinery? Deduce expression for the variation in tractive forces, swaying couple and hammer blow for an uncoupled two cylinder locomotive engine.

   b) Each crank and the connecting rod of a four-crank in line engine are 200mm and 800mm respectively. The outer cranks are set at 120° to each other and each has a reciprocating mass of 200kg. The spacing between adjacent planes of cranks is 400mm, 600mm and 500mm. If the engine is in complete primary balance, determine the reciprocating masses of the inner cranks and their relative angular positions. Also find the secondary unbalanced force if the engine speed is 210 rpm.

4. a) What is friction? Is it necessary evil or blessing? Explain uniform pressure and uniform wear theories for a clutch.

   b) In a thrust bearing, the external and internal diameters of the contacting surfaces are 320mm and 200mm respectively. The total axial load is 80kN and the intensity of pressure is 350kN/m^2. The shaft rotates at 400 rpm. Taking the coefficient of friction as 0.06, calculate the power lost in overcoming the friction. Also, find the number of collars required for the bearing.

5. a) What is the effect of centrifugal tension on power transmission? Derive the relation for the ratio of the belt tensions in a flat-belt drive.

   b) An open belt drive is required to transmit 10kW of power from a motor running at 600 rpm. Diameter of the driving pulley is 250mm. The speed of the driven pulley is 220rpm. The belt is 12mm thick and has a mass density of 0.001 g/mm^3. Safe stress in the belt is not to exceed 2.5N/mm^2. The two shafts are 1.25m apart. The coefficient of friction is 0.25. Determine the width of the belt.

6. a) What is main function of a flywheel? Write the procedure for determining the turning moment diagram.

   b) A vehicle moves on a road that has a slope of 15° the wheel base is 1.6m and the centre of mass is at 0.72m from the rear wheels and 0.8m above the inclined plane. The speed of the vehicle is 45km/h. The brakes are applied to all the four wheels and the coefficient of friction is 0.4. Determine the distance moved by the vehicle before coming to rest and the time taken to do so if it moves:
      i) Up the plane, and
      ii) Down the plane

7. Four masses A, B, C and D are completely balanced. masses C and D makes the angle of 90° and 210° respectively with that of mass B in a counter clockwise direction. The rotating masses have following properties:
   $M_b = 25kg$; $M_c = 40kg$; $M_d = 35kg$; $R_a = 0.15m$; $R_b = 0.20m$; $R_c = 0.10m$; $R_d = 0.18m$. Plans B and C are 0.3m apart. Determine:
   I - Mass A and its angular position with that of mass B.
   II - Position of all the planes relative to the plane of mass A.

8. Write short notes on followings: (any four)
   a) Hunting of governor
   b) Lanchester technique
   c) Friction circle
   d) Hammer blow and tractive effort
   e) Jump and cross over shock
   f) Antifriction bearings

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