Fifth Semester B.E. Degree Examination, June 2012
Dynamics of Machines

Time: 3 hrs.   Max. Marks:100

Note: *Answer FIVE full questions, selecting*
at least TWO questions from each part.

PART – A

1   a.   Explain static force analysis of two and three force members.   **(06 Marks)**
    b.   Explain principle of virtual work application to static force analysis.   **(06 Marks)**
    c.   Explain the procedure for static force analysis of four bar mechanism.   **(08 Marks)**

2   a.   Explain turning moment diagrams of 4-stroke IC engine and multi-cylinder engine. **(06 Marks)**
    b.   A three cylinder single acting engine has its cranks set equally at 120° and it runs at 600 rpm. The torque crank angle diagram for each cycle is a triangle for the power stroke with a maximum torque of 90 N-m at 60° from dead centre of corresponding crank. The torque on the return stroke is sensibly zero. Determine : i) Power developed ; ii) Coefficient of fluctuation of speed ; iii) Coefficient of fluctuation of energy and iv) Maximum angular acceleration of the flywheel. Take mass of flywheel is 12 kg and radius of gyration of 80 mm.   **(14 Marks)**

3   a.   Derive an expression of total friction torque for a pivot bearing subjected to uniform pressure.   **(08 Marks)**
    b.   A pulley is driven by a flat belt, the angle of lap being 120°. The belt is 100mm wide, 6mm thick and density of 1000 kg/m^3. If the coefficient of friction is 0.3 and the maximum stress in the belt is not to exceed 2 MPa, find the greatest power which the belt can transmit and the corresponding speed of the belt.   **(12 Marks)**

4   a.   Explain balancing of several masses rotating in the same plane.   **(06 Marks)**
    b.   Four masses A, B = 10 kg, C = 5 kg, D = 4 kg are placed at radius 100, 125, 200 and 150mm respectively. The distance between the planes are 600mm. Find the required mass A and the relative angular positions of the four masses to achieve complete balance.   **(14 Marks)**

PART – B

5   a.   Check the conditions of primary and secondary balancing of 2-cylinder and 3-cylinder in line engine.   **(06 Marks)**
    b.   In an in line six cylinder engine working on two stroke cycle, the cylinder centre lines are spaced at 600 mm. In the end view, the cranks are 60° apart and in the order 1-4-5-2-3-6. The stroke of each piston is 400mm and the connecting rod length is 1m. The rotating and reciprocating mass is 300 kg/cylinder and operating speed is 300 rpm. Examine the engine for the balance of primary and secondary forces and couples.   **(14 Marks)**

6 a. Explain sensitiveness, isochronism, effort and power of a governor. **(08 Marks)**

b. In a spring loaded Hartnell governor, the extreme radii of rotation of the balls are 80mm and 120mm. The ball arm and sleeve arm of the bell crank lever are equal in length. The mass of each ball is 2 kg. If the speeds at the two extreme positions are 400 and 420 rpm. Find : i) the initial compression of the central spring and ii) the spring stiffness. **(12 Marks)**

7 a. Explain the effect of gyroscopic couple on an aeroplane. **(06 Marks)**

b. A four-wheeled vehicle of mass 2500 kg runs round a track of radius 30m at 24 km/hr. The distance between the wheels of rear end is 1.5m, diameter of each wheel is 0.75m. The direction of rotation of wheels and engine are opposite and the speed ratio of engine to wheel is 5. The I_W = 18 kg m^2, I_E = 12 kg m^2 and centre of gravity of the vehicle is 0.9m above the ground. Determine the gyroscopic couples and reaction at outer and inner wheel. **(14 Marks)**

8 A symmetrical circular dam operating a flat-faced follower has the following particulars : Minimum radius of the cam = 30mm; nose radius = 5mm ; total lift = 20mm ; angle of lift = 75° and operating speed = 600 rpm. Find : i) The principal dimensions of the cam and ii) the acceleration of the follower at the beginning of the lift, at the end of contact with the circular flank, at the beginning contact of the nose and at the apex of the nose. **(20 Marks)**

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