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10ME54

Fifth Semester B.E. Degree Examination, Dec.2014/Jan.2015
Dynamics of Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. State the conditions for the equilibrium of the following systems: i) Two force member; ii) Three force member; iii) Member with two forces and a torque. **(08 Marks)**

b. Determine the required input torque on the crank of a slider crank mechanism shown in Fig.Q.1(b) for static equilibrium. **(12 Marks)**

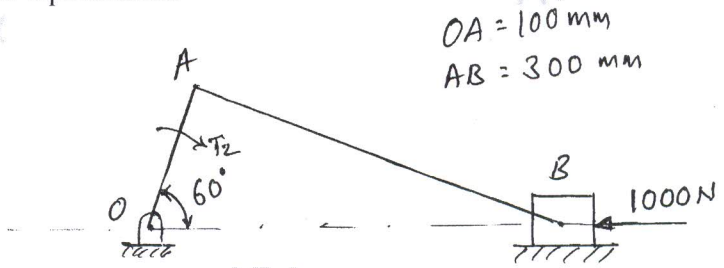

Fig.Q.1(b)

2 In a machine, the intermittent operations demand the torque to be applied as follows. During the first half revolution, the torque increases uniformly from 800 N-m to 3000 N-m. During next one revolution, the torque remains constant. During next one revolution, the torque decreases uniformly from 3000 N-m to 800 N-m. During last 1½ revolution, the torque remains constant.
Thus a cycle is completed in 4 revolutions. The motor to which the machine is coupled exerts a constant torque at a mean speed of 250rpm. A flywheel of mass 1800kg and radius of gyration of 500mm is fitted to the shaft. Determine: i) The power of the motor; ii) the total fluctuation of speed of the machine shaft. **(20 Marks)**

3 a. State two laws of friction. **(05 Marks)**

b. A belt drive is required to transmit power from a motor running at 900rpm. The diameter of the driving pulley of the motor is 300mm. The driven pulley runs at 300 rpm and the distance between centres of two pulleys is 3m. The width and thickness of belt are 80mm and 10mm respectively. The density of belt material is 1000kg/m^3. The maximum allowable stress in belt material is 2.5 MPa. Te coefficient of friction between belt and pulley is 0.3. Assume open belt drive and neglect slip in belt drive. Determine the power transmitted by the belt drive. **(15 Marks)**

4 a. Define static and dynamic balancing. **(05 Marks)**

b. A rotating shaft carries 4 masses A, B, C and D at radii 100, 125, 200 and 150mm respectively. The planes in which the masses revolve are spaced 600mm apart and the masses B, C and D having 10, 5 and 4 kg respectively. Find the required mass A and the relative angular positions of 4 masses to keep the shaft in balance. **(15 Marks)**

PART – B

5 The cranks and connecting rods of a 4 cylinder in-line engine rotating at 1800rpm are 60mm and 240mm each respectively. The cylinders are spaced at 150mm apart and are numbered 1 to 4 in sequence from one end. The cranks appear at intervals of 90° in an end view in the order 1-4-2-3. The reciprocating mass corresponding to each cylinder is 1.5kg. Determine:

a. Unbalanced primary and secondary forces, if any.

b. Unbalanced primary and secondary couples with reference to central plane of the engine.

(20 Marks)

6 a. Define the following terms with respect to governors: i) Sensitiveness; ii) Isochronism; iii) Controlling force; iv) Governor power. **(08 Marks)**

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

7 a. With neat sketches, explain the effect of gyroscopic couple on steering of aeroplane, when it takes a right turn. The engine runs in clockwise when viewed from rear. **(06 Marks)**

b. Each wheel of a motor cycle is of 600mm diameter and has a moment of inertia of 1.2 kg-m^2. The total mass of the motor cycle and rider is 180kg and the combined centre of mass is 580mm above the ground level when the motor cycle is upright. The moment of inertia of the rotating parts of the engine is 0.2 kg-m^2. The engine speed is 5 times the speed of the wheels and is in the same sense. Determine the angle of heel necessary when the motor cycle takes a turn of 35m radius at a speed of 54 kmph. **(14 Marks)**

8 a. For a circular arc cam with flat faced follower, derive expressions for velocity and accelerations of the follower when it is touching the circular flank. **(10 Marks)**

b. A tangent cam with a base circle diameter of 50mm operates a inline roller follower of diameter 20mm. The angle between the tangential faces of cam is 60°, speed of the cam shaft 200rpm and lift of the follower 15mm. Determine:

i) The main dimensions of the cam.

ii) The acceleration of the follower at the beginning of lift. **(10 Marks)**

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