Fourth Semester B.E. Degree Examination, June/July 2016
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.   Discuss the equilibrium of the following systems:
         i) Two Force members   ii) three force members.   **(04 Marks)**
     b.   A four mechanism under the action of external force is shown in Fig Q1(b). Determine the
        Torque T_2 and various forces on link for the equilibrium of the system.   **(16 Marks)**
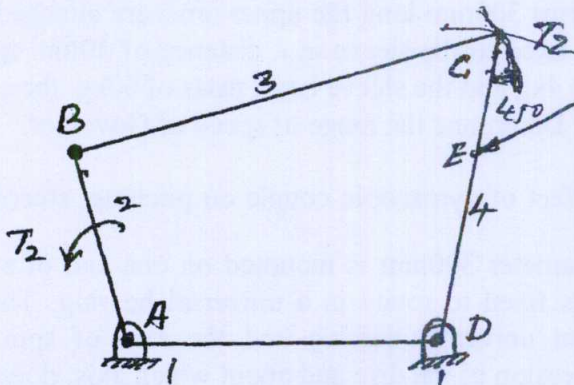

F = 2000N at 45°CD
AB = 200mm
AD = 215mm
BC = 370mm
DC = 350mm
CE = 100mm

Fig. Q1(b)

2   a.   Explain D'Alemberts principle and state why it is used.   **(06 Marks)**
     b.   The turning moment requirement of a machine is representing by the equation
        $T = [1000+500\sin 2\theta - 300 \cos2\theta]Nm$, where '$\theta$' in the angle turned by the crank shaft of
        the machine. It the supply torque is constant determine ;
        i)   The moment of inertia of flywheel of the total fluctuation of speed in not to exceed one
            % of the mean speed of 300rpm.
        ii)   Angular acceleration of the flywheel when the crankshaft has turned through 45° from
            the beginning to the cycle.
        iii)   Power required to drive the machine.   **(14 Marks)**

3   a.   Define static and dynamic friction and give example.   **(06 Marks)**
     b.   A belt drive is required to transmit 10kW from a motor running 600rpm. The belt is 12mm
        thick and has a mass density 0.001 9r/mm³. Safe stress in the belt is not to exceed 2.5N/mm²·
        Diameter of the driving pulley is 250mm where as the speed of the driven pulley is 220rpm.
        Two shafts are 1.25m apart the co-efficient of friction is 0.25. Determine the width of the
        belt.   **(14 Marks)**

4   a.   Write a note on static and dynamic balancing.   **(06 Marks)**
     b.   Four masses m_1, m_2, m_3 and m_4 are 200kg, 300kg, 240kg and 260kg respectively, the
        corresponding radii of rotation are 0.2m, 0.15m, 0.25 m and 0.3 m respectively. The angles
        between successive masses are 45°, 75° and 135°. Find the position and magnitude of the
        balance mass required, if its radius of rotation is 0.2m.
                                                       (14 Marks)

PART – B

5 a. Derive an expression for resultant unbalanced force in a partially balanced single cylinder engine. **(05 Marks)**

b. Explain the method of direct and reverse cranks for balancing of primary forces. **(05 Marks)**

c. A six cylinder two stroke single acting engine with cylinder centre lines are spaced at 650mm. In the end view the cranks are 60° apart and in order 1 – 4 – 5 – 2 – 3 – 6 the stroke of each position of 400mm and the crank to C.R ratio is 1:5 the mass of reciprocating part is 250kg per cylinder and that of rotating part is 100kg par crank the engine rotates at 240rpm. Investigate the engine for out of balance primary and secondary forces and couples. **(10 Marks)**

6 a. Define Governor and explain the function of a different types of Governors. **(10 Marks)**

b. A Porter governor has all four arms 300mm long the upper arms are attached on the axis of rotation and the lower arms are fixed to the sleeve at a distance of 30mm from the axis of rotation. The mass of each ball is 4kg and the sleeve has a mass of 60kg. the extreme radii of rotation are 160mm and 200mm. Determine the range of speed of Governor. **(10 Marks)**

7 a. With neat sketch, explain the effect of gyroscopic couple on pitching, steering and rolling. **(10 Marks)**

b. A disc weighing 50N and of diameter 300mm is mounted on one end of a arm of length 600mm. the other end of arm is fixed to rotate in a universal bearing. The disc spins at 300rpm clockwise looking from universal bearing and the axis of spin is horizontal. Determine angular speed of precession of the disc and about which axis, does the precession take place? **(10 Marks)**

8 A cam has straight working surface which are tangential to the base circle of the cam, the follower is a roller follower with line of stroke passing through the axis of the cam. The particulars are the following base circle diameter = 100mm, roller diameter = 50mm, the angle between the tangential faces of the cam = 90°, the face are joined by a nose circle of radius = 10mm. The speed of rotation of cam = 180rpm : Determine the acceleration of the roller centre.

   i) When the roller just leaves contact of the flank on its ascent?

   ii) When the roller is at its outer ends of its lift? **(20 Marks)**

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