USN [| | | | | | | | | |]

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Dynamics of Machines

Max. Marks:100

Time: 3 hrs.

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

PART – A

1 Given below is a Fig Q1(a) which shows crank mechanism in which the resultant gas pressure 8×10^4 Nm^{-2} acts on the piston of cross sectional area 0.1m^2. The system is kept in equilibrium as a result of the couple applied to the crank 2 through the shaft at O_2. Determine forces acting on all the links (including the pins) and the couple on 2. **(20 Marks)**
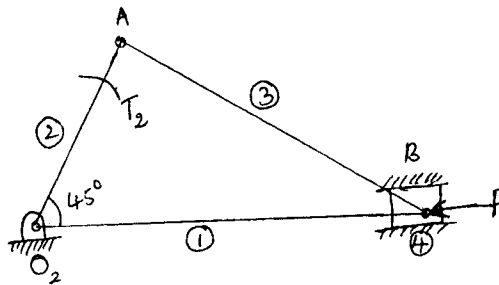

Fig Q1

2 a. Explain D'Alemberts principle and state why it is used. **(05 Marks)**

b. The turning moment diagram for a multi cylinder engine has been drawn to a scale 1mm = 600 N – m vertically and 1mm = 3° horizontally. The intercepted areas between the output torque and the mean resistance line, taken in order from one end are as follows : + 52, –124, + 92, –140, + 85, –72 and + 107 mm^2, when the engine is running at a speed of 600 rpm. If the total fluctuation of the speed does not exceed ± 1.5% of the mean, find the necessary mass of the flywheel of radius 0.5m. **(15 Marks)**

3 a. Derive an equation of ratio of belt tensions in a flat belt drive. **(05 Marks)**

b. Derive an equation for centrifugal tension in belts. **(05 Marks)**

c. A leather belt is required to transmit 7.5kW from a pulley 1.2m in diameter running at 250rpm. The angle embraced is 165° and co-efficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5MPa, density of leather is 1×10^6 gm/m^3 and thickness of belt is 10mm, determine the width of belt taking centrifugal tension into account. **(10 Marks)**

4 Four mass A, B, C and D are to be completely balanced. The planes containing mass 'B' and 'C' are 300mm apart. The angle between the planes containing 'B' and 'C' is 90°, and making angles of 210°, and 120° respectively with 'D' in the same sense. Find the magnitude and angular position of mass 'A' having radius of 180mm and position of planes 'A' and 'D'. Consider mass of 'B' = 30kg, mass of 'C' = 50kg, mass of 'D' = 40kg. The radius of B = 240mm, C = 120mm, and D = 150mm. **(20 Marks)**

PART – B

5 The firing order in 6 cylinder, four stroke inline engine is 1 – 4 – 2 – 6 – 3 – 5. The piston stroke is 100mm, length of each connecting rod is 200mm. The pitch distances between cylinder centre lines are 100mm, 100mm, 150mm, 100mm and 100mm respectively. The reciprocating mass per cylinder is 1kg and the engine runs at 300 rpm. Determine the output of primary and secondary forces and couples on this engine, taking a plane midway between the cylinder 3 and 4, as reference plane. **(20 Marks)**

6 a. Explain the terms sensitiveness, Isochronisms and effort and power of a Governor. **(04 Marks)**

b. The length of upper arm and lower arms of a porter Governor are 200mm and 250mm respectively. Both the arms are pivoted to the axis of rotation. The central load is 15kg, the weight of each ball is 2 kg and the friction of sleeve together with resistance of the operating gear is equivalent to a force of 25N of the sleeve. If the limiting inclinations of the upper arm to the vertical are 30° and 40°, determine the range of speed of the Governor. **(16 Marks)**

7 a. Derive an equation for Gyroscopic couple. **(05 Marks)**

b. A ship propelled by a turbine rotor which has a mass of 5 tonnes and a speed of 2100rpm. The rotor has a radius of 0.5m and rotates in a clockwise direction when viewed from stern. Find the gyroscopic effects in the following conditions.

   i) Ship sails at a speed of 30KmpH and steering to left in a curve of radius 60m

   ii) The ship pitches 6° above and 6° below the horizontal position. The bow is descending with maximum velocity, the motion due to pitching is simple harmonic and the periodic time is 20 seconds.

   iii) The ship rolls and at certain instant has an angular velocity of 0.03 rad/sec clockwise when viewed from stern. **(15 Marks)**

8 A cam has straight working faces which are tangential to a base circle of diameter 90mm. the follower is a roller of diameter 40mm and the centre of roller moves along a straight line passing through the centre line of cam shaft. The angle between the tangential faces of the cam is 90° and the faces are joined by a nose circle of 10mm radius. The speed of rotation of the cam is 120 revolutions per min. Find the acceleration of the roller centre

   (i) when during the lift, the roller is just about to leave the straight flank and

   (ii) when the roller is at outer end of its lift. **(20 Marks)**

* * * * *