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10ME54

Fifth Semester B.E. Degree Examination, April 2018

Dynamics of Machines

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. For the mechanism shown in the Fig.Q1(a), determine the torque T_2 for equilibrium. The force applied to the piston is 1000 N when the crank is at 60° from IDC. The length of AB = 100 mm, BC = 300 mm.

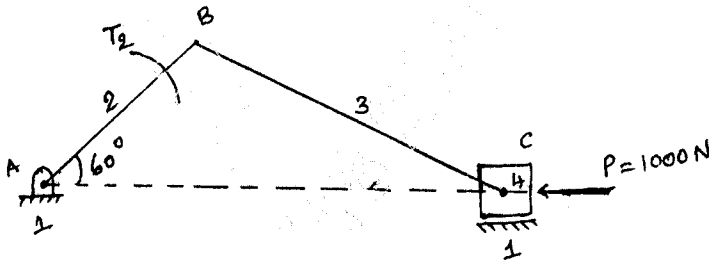

Fig.Q1(a) **(12 Marks)**

b. State the conditions for a link to be in equilibrium
   i) when three nonparallel forces act
   ii) when two forces and a torque acts. **(04 Marks)**

c. Write a brief note on 'Friction Circle'. **(04 Marks)**

2 a. Define coefficient of fluctuation of speed and coefficient of fluctuation of energy. **(04 Marks)**

b. A single cylinder single acting 4 stroke gas engine develops 18.4 kW at 300 rpm with workdone by the gases during the expansion stroke is 3 times the workdone on the gases during compression stroke. The workdone during suction and exhaust being negligible and the total fluctuation is 2% of mean. The TMD during expansion is assumed to be triangular in shape. Find the moment of inertia of the flywheel. **(16 Marks)**

3 a. State the types of friction and the laws of dry friction. **(08 Marks)**

b. Power is required to transmit from a 300 mm diameter pulley running at 500 rpm through an open belt drive to a pulley of 500 mm diameter. The centre distance between the pulleys is 1.5 mt and the coefficient of friction in the belt drive is 0.3. If the safe pull in the belt is not to exceed 600 N, determine the power transmitted by the belt drive. Also find the length of the open belt required. **(12 Marks)**

4 A shaft running in bearings carries masses 20 kg, 30 kg, 40 kg in planes A, B and C with C.G from the axis of the shaft 30 mm, 20 mm and 15 mm respectively. The distance of planes B and C from 'A' are 1000 mm and 2000 mm to the right of 'A'. The relative angular positions of the centre of gravity of the unbalanced masses are such that they are in static balance. To obtain complete dynamic balance suitable masses are introduced in planes 'D' and 'E' with C.G 100 mm from the axis. D is 500 mm to the left of A and E is 500 mm to the right of 'C'. Determine the position and magnitude of the balancing masses. **(20 Marks)**

PART – B

5 A six cylinder two stroke in-line diesel engine with cylinder centre lines are spaced at 650 mm. In the end view the cranks are 60° apart and in order 1-4-5-2-3-6. The stroke of each piston is 400 mm and the crank to C.R ratio is 1:5. The mass of reciprocating part is 250 kg per cylinder. The engine rotates at 240 rpm. Investigate the engine for out of balance primary and secondary force and couples. Consider the plane which is located exactly mid junction of cylinder 3 and cylinder 4 as reference plane. **(20 Marks)**

6 a. Explain the term and derive expression for effort of a porter governor. **(08 Marks)**

b. The arms of porter governor are each 250 mm long and pivoted on the governor axis. The mass of each ball is 5 kg and the mass of central sleeve is 30 kg. The radius of rotation of balls is 150 mm when the sleeve begins to rise and reaches a value of 200 mm for maximum speeds. Determine speed range of governor. If the friction at the sleeve is equivalent to 20 N of load at the sleeve, determine how the speed range is modified. **(12 Marks)**

7 a. Explain the effect of the gyroscopic couple on pitching, rolling, steering of a ship with neat sketches. **(06 Marks)**

b. An aeroplane flying at 240 km/hr turns towards left and completes a quarter circle of 60 m radius. The mass of the rotary engine and propeller of the plane amounts to 450 kg, with a radius of gyration of 320 mm. The engine speed is 2000 rpm clockwise when viewed from the rear. Determine the gyroscopic couple on the aircraft and state its effect. In what way the effect is changed when the aeroplane turns towards right? **(14 Marks)**

8 a. Derive an expression for displacement, velocity and acceleration when the flat face follower has contact on the circular flank of circular arc cam. **(08 Marks)**

b. For a symmetrical tangent cam operating a roller follower, the least radius of cam is 30 mm and roller radius is 15 mm. The angle of ascent is 60°, the total lift is 15 mm and the speed of the cam shaft is 300 rpm. Calculate principal dimensions of cam, acceleration of the follower at the beginning of lift and at the apex of the circular nose. Assume that there is no dwell between ascent and descent. **(12 Marks)**

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