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10MR42

Fourth Semester B.E. Degree Examination, June / July 2014
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 the concept of equilibrium of a member with two forces and a torque. **(04 Marks)**

b. In a 4 bar mechanism shown in Fig. Q1 (b) torques T_3 and T_4 have magnitudes of 3000 Nm and 2000 Nm respectively. Given AD = 800 mm, AB = 300 mm, BC = 700 mm and CD = 400 mm. Find the required input torque of the mechanism for static equilibrium. **(16 Marks)**

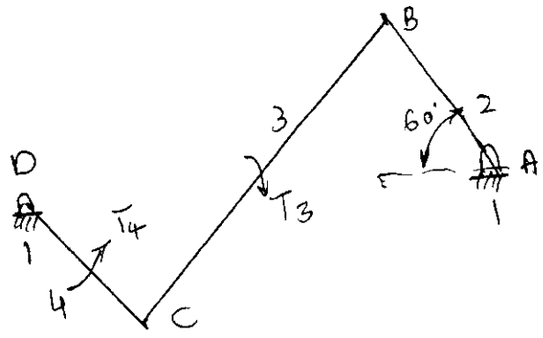

Fig. Q1 (b)

2 a. Derive an expression for the hoop stress developed in a flywheel. **(08 Marks)**

b. A gas engine working on Otto cycle develops 22.08 kW at 300 rpm. The coefficient of fluctuation of energy 1.85. The flywheel mass is 1000 kg and its radius of gyration is 0.9 m. What is the cyclic speed variation from the mean? **(12 Marks)**

3 a. Derive an expression for centrifugal tension in a belt drive. **(06 Marks)**

b. A leather belt is required to transmit 15 kW from a pulley of 1.2 m effective diameter running at 300 rpm. The anlge of contact is spread over $5/12^{th}$ of the circumference and co-efficient of friction between belt and pulley rim is 0.3. If he safe working stress for the belt material is 1.5 MPa and mass of leather is 1000 kg/m^3 and the thickness of belt is 100 mm, determine the width of the belt taking centrifugal tension into account. **(14 Marks)**

4 a. Explain static and dynamic balancing. **(04 Marks)**

b. A, B, C and D are 4 masses carried by a rotating shaft at radius 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the masses B, C and D are 10, 5, 4 kg respectively. Find the required mass A and the relative angular position of the 4 masses to keep the shaft in balance. **(16 Marks)**

PART – B

5 a. What are in –line engines and state how they are balanced. **(06 Marks)**

b. The pistons of a 4-cylinder vertical inline engine reach their upper-most position at 90° interval in the order of their axial position pitch of cylinder = 0.35 m, crank radius = 0.12 m, length of connecting rod = 0.42 m. The engine runs at 600 rpm. If the reciprocating parts of each engine has a mass of 2.5 kg, find the inbalanced primary secondary forces and couples. Take central plane of engine as reference plane. **(14 Marks)**

6 a. Distinguish between a flywheel and a governor. **(05 Marks)**

b. The arms of a porter governor are each 30 cm long and are pivoted on the governor axis. Mass of each ball is 2 kg. At the mean speed of 150 rpm, the arm makes 30° with the vertical. Determine the central load and the sensitivity of the governor if the sleeve movement is ± 2.5 cm. **(15 Marks)**

7 a. Derive an expression for gyroscopic couple with usual notations. **(05 Marks)**

b. The rotor of a turbine of a ship has a mass of 2500 kg and rotates at a speed of 3200 rpm counter clockwise. When of gyration of 0.4 m. Determine the gyroscopic couple and its effect when.

i) The ship steers to the left in a curve of 80 m at a speed of 27900 m/hr

ii) The ship pitches 50 above and 50 below the normal position and the bow is descending with its maximum velocity. The pitching motion is simple harmonic with a periodic time of 40 second

iii) The ship rolls and at the instant the angular velocity is 0.04 rad/s clockwise when viewed from stem. **(15 Marks)**

8 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 m and the speed of the cam shaft is 300 rpm. Calculate :

i) Principal dimensions of cam (i.e. distance between cam centre and hose centre nose radius and angle of contact of cam with straight flank)

ii) Acceleration of the follower at the beginning of the lift, where the roller just touch the nose (i.e. flank merges into the nose) and at the apex of the circular hose assume that there is no dwell between ascent and descent. **(20 Marks)**

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