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10ME54

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Dynamics of Machines

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of drawn of graph sheets is permitted.***
3. ***Missing data assume accordingly.***

PART – A

1 a. Explain the equilibrium of two force member and three force member. **(04 Marks)**

b. What is Free body diagrams? **(02 Marks)**

c. For the mechanism shown in Fig. Q1 (c), find the magnitude and direction of input torque T_2 for the static equilibrium. Take AB = 70 mm, BC = 150 mm, BD = 100 mm and CD = 70 mm, $\angle ABC = 90^\circ$. Also determine the forces at pinpoints A, B and C.

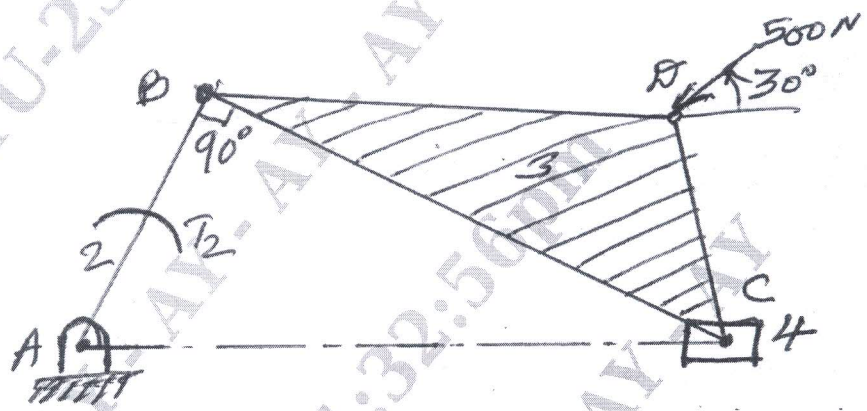

Fig. Q1 (c) **(14 Marks)**

2 a. What is the function of a flywheel? How does it differ from that of a governor? **(06 Marks)**

b. A punching press is required to punch 40 mm diameter holes in a plate of 30 mm thickness at the rate of 4 holes per minute. It required 6 Nm of energy per mm^2 of sheared area. The punch has a stroke of 100 mm. The rpm of the flywheel varies from 320 to 280. If the radius of gyration of flywheel is 1 m, find (i) the power of the motor and (ii) mass of the fly wheel. **(14 Marks)**

3 a. Derive an equation to calculate the centrifugal tension in a flat belt drive. **(06 Marks)**

b. Power is transmitted by an open belt drive from a pulley 0.3 m diameter running at 600 rpm to a pulley 0.5 m diameter, angle of lap on smaller pulley = 160°. The belt is on the point of slipping when 2 kW is being transmitted, coefficient of friction is 0.25. It is desired to increase the power to be transmitted. State which of the following methods suggested would be more effective.

(i) Increase in initial tension in the belt by 10%.
(ii) Increase in coefficient of friction by 10% with the application of suitable dressing to the belt.
(iii) Also calculate the percentage increase in power in each case. **(14 Marks)**

4 A shaft carries four masses A, B, C and D which are placed in parallel planes perpendicular to the longitudinal axis. The unbalanced masses at planes B and C are 3.6 Kg and 2.5 Kg respectively and both are assumed to be concentrated at a radius of 25 mm while the masses in planes A and D are both at radius of 40 mm. The angle between the planes B and C is 100° and that between B and A is 190°, both angles being measured in counter clockwise direction from the plane B. The planes containing A and B are 250 mm apart and these containing B and C are 500 mm. If the shaft is to be completely balanced determine

(i) Masses at the planes A and D.
(ii) The distance between the planes C and D.
(iii) The angular position of the mass D. **(20 Marks)**

PART – B

5 The pistons of a 4 cylinder vertical inline engine reach their uppermost position at 90° interval in order of their axial position. Pitch of cylinder = 0.35 m, Crank radius = 0.12 m, Length of CR = 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 unbalanced primary and secondary forces and couples. Take central plane of engine as reference plane. **(20 Marks)**

6 a. Write short note on controlling force curve with respect to governors. **(06 Marks)**
b. A porter governor has all four arms 300 mm long, the upper arms are pivoted on the axis of rotation and lower arms are attached to the sleeve at a distance 35 mm from axis. The mass of each ball is 7 kg and the load on the sleeve is 540 N. Determine the equilibrium speed for the two extreme radii of 200 mm and 260 mm of rotation at governor balls. **(14 Marks)**

7 a. Derive an expression for the gyroscopic couple. **(06 Marks)**
b. A disc weighing 50 N and of diameter 300 mm is mounted on one end of a arm of length 600 mm, the other end of arm is fixed to rotate in a universal bearing. The disc spins at 300 rpm 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 procession takes place. **(14 Marks)**

8 In a four stroke petrol engine, the crank angle is 4° after TDC. When the suction valve opens and 50° after BDC. When the suction valve closes. The lift is 10 mm, the nose radius is 2.5 mm and the least radius of the cam 20 mm. The shaft rotates at 600 rpm. The cam is of the cirucular type with a circular nose and flanks while the follower is flat faced. Determine the maximum velocity, maximum acceleration and retardation of the valve. What is the minimum force exerted by the springs to overcome the inertia of moving parts weighing 250 gm. **(20 Marks)**

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