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06ME53

Fifth Semester B.E. Degree Examination, June/July 2011
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. Define equilibrium with respect to two force members and three force members. **(04 Marks)**

b. A four bar mechanism under the action of external force is shown in Fig.Q1(b). Determine the torque T_2 and various forces on links for the equilibrium of the system. **(16 Marks)**

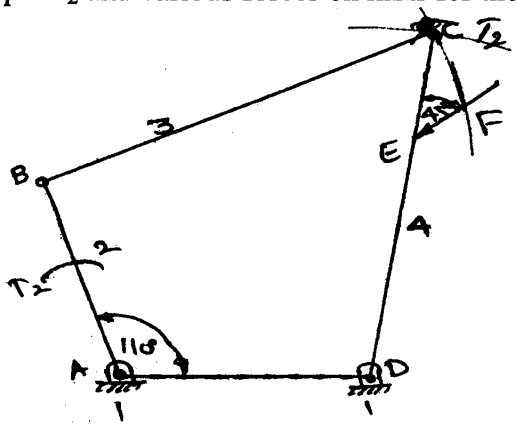

Fig.Q1(b)

F = 2000 N at 45^0 on CD

AB = 200 mm

AD = 215 mm

BC = 370 mm

DC = 350 mm

CE = 100 mm

2 a. Derive an expression for 'size of flywheel'. **(06 Marks)**

b. A punching machine is required to punch 5 holes per minute of 50 mm diameter in 40 mm thick plate. The ultimate shear strength of plate material is 225 MPa. The punch has a stroke of 100 mm. Find the power of motor required if mean speed of flywheel is 18 m/s. If coefficient of fluctuation of energy is 4%, find the mass of the flywheel. **(14 Marks)**

3 a. State the laws of dynamic or kinetic friction. **(03 Marks)**

b. Derive an expression for frictional torque in a single collar bearing assuming uniform pressure. **(05 Marks)**

c. An open belt drive connects two pulleys 1.5 m and 0.5m diameter on parallel shafts 3.5m apart. The belt has a mass of 1 kg/m length and the maximum tension in the belt is not to exceed 2 kN. The 1.5m pulley, which is the driver runs at 250 rpm. Due to belt slip, the velocity of the driven shaft is only 730 rpm. If the coefficient of friction between the belt and the pulley is 0.25 find,
i) The torque on each shaft ii) Power transmitted iii) The power lost in friction and iv) The efficiency of the drive. **(12 Marks)**

4 a. Explain the procedure for balancing several masses rotating in the same plane. **(05 Marks)**

b. Four masses M_1 = 100 kg, M_2 = 175 kg, M_3 = 200 kg and M_4 = 125 kg are fixed to the crank of 200 mm radius and revolve in planes 1, 2, 3 and 4 respectively. The angular position of the planes 2, 3 and 4 with respect to first mass are 75°, 135° and 240° taken in the same sense. Distance of the planes 2, 3 and 4 from first are 600 mm, 1800 mm and 2400 mm. Determine the magnitude and position of the balancing masses at radius 600 mm in planes 'L' and 'M' located in the middle of 1 and 2 and in the middle of 3 and 4 respectively. **(15 Marks)**

PART – B

5 a. Obtain an expression for primary forces for a V engine having two identical cylinders lying in a plane. The included angle between the cylinder centre line is 22. **(06 Marks)**

b. A four crank engine has two outer cranks set at 120° to each other, and their reciprocating masses are each 400 kg. The distance between the planes of rotation of adjacent cranks are 450 mm, 750mm and 600 mm. If the engine is to be in complete primary balance, find the reciprocating mass and the relative angular position for each of the inner cranks. If the length of each crank is 300 mm, length of each connecting rod is 1.2 m and the sped of rotation is 240 rpm, what is the maximum secondary unbalanced force? **(14 Marks)**

6 a. Explain sensitiveness, stability, isochronism and hunting of governor. **(08 Marks)**

b. The radius of rotation of the balls of a Hartnell governor is 100 mm at the minimum speed of 300 rpm. Neglecting gravity effect, determine the speed after the sleeve has lifted by 50 mm. Also determine the initial compression of the spring, governor effort and power. Take length of ball arm of lever = 150 mm, length of sleeve arm = 100 mm, weight of each ball = 40 N and stiffness of spring = 25 N/mm. **(12 Marks)**

7 a. Explain with a sketch gyroscope, axis of spin, precession and axis of precession. **(06 Marks)**

b. A rear engine automobile is traveling along a track of 100 m mean radius. Each of the four wheels has a moment of inertia of 2 kg.m^2 and an effective diameter of 0.6 m. The rotating parts of the engine have a moment of inertia of 1.25 kg m^2. The engine axis is parallel to rear axle and the crank shaft rotates in the same direction as the wheels. The gear ratio of engine to back axle is 3:1. The automobile mass is 1500 kg and the centre of gravity is 0.5m above the road level. The width of track of the vehicle is 1.5m. Determine the limiting speed of the vehicle around the curve for all four wheels to maintain contact with the road surface if it is not banked. **(14 Marks)**

8 a. Derive an expression for velocity and acceleration for circular arc cam with roller follower when the contact is on the flank. **(10 Marks)**

b. The particular of a symmetrical tangent cam operating a roller follower are as follows:
Least radius of cam = 30 mm Roller radius = 20 mm
Angle of ascent = 75° Total lift = 20 mm
Speed of cam shaft = 600 rpm.
Calculate i) the principal dimensions of the cam and ii) the equation of the displacement curve when the follower is in contact with straight flank and circular nose. Assume that there is no dwell between the ascent and return. **(10 Marks)**

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