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10ME54

Fifth Semester B.E. Degree Examination, June/July 2013

Dynamics of Machines

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. i) Explain the equilibrium of two force members and three force members. **(04 Marks)**
ii) Give significance of static force analysis of mechanisms. **(02 Marks)**

b. For the static equilibrium of the mechanism shown in Fig.Q1(b), find the required input torque T_2. The dimensions are AB = 150 mm, BC = AD = 500 mm, DC = 300 mm, CE = 100 mm and EF = 450 mm. **(14 Marks)**

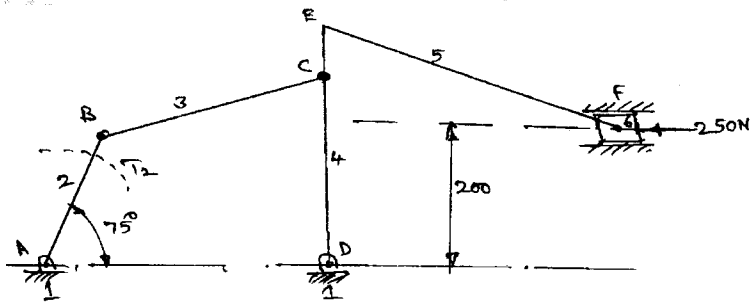

Fig.Q1(b)

2 a. What is the function of a flywheel? How does it differ from that of a governor? **(05 Marks)**

b. A single cylinder, four stroke I.C. engine develops 30 KW of power at 300 rpm. The turning moment diagram for the expansion and compression strokes may be taken as isosceles triangles on bases 0 to π and 3π to 4π radius respectively and the work done during compression is 25% of that of during expansion. Work done during suction and exhaust is neglected. Find the massmoment of inertia of flywheel to keep the speed fluctuations 1.5% on either side of the mean speed. Sketch the T.M. diagram and mark the points of max. and min speed on the diagram. **(15 Marks)**

3 a. Explain: i) Slip, ii) Creep, iii) Initial tension and iv) Centrifugal tension in belt drive. **(06 Marks)**

b. An open belt drive is required to transmit 10 KW from a motor running at 600 rpm. The belt is 12 mm thick and has a mass density of 0.001 gm/mm^3. Safe stress in the belt is not to exceed 2.5 N/mm^2. Effective diameter of the driving pulley is 250 mm whereas the speed of the driven pulley is 220 rpm. The two shafts are 1.25 m apart. If the coefficient of friction is 0.25, determine the width of the belt. **(14 Marks)**

4 A shaft carries four masses A, B, C and D, 200, 300, 240 and 360 kg respectively, revolving at radii 90, 70, 100 and 120 mm respectively. The distance from the plane A, other planes are at 270 mm, 420 mm and 720 mm respectively. Angle between the crank A and B is 45°, B and C is 75°, C and D is 130°. Balancing masses are replaced 120 mm and 100 mm from D and A respectively. The distance between them being 500 mm. Find the balancing masses and their angular positions if they are placed at a radius of 100 mm. **(20 Marks)**

PART – B

5 a. Explain the terms primary balancing and secondary balancing as used in balancing of reciprocating masses. **(05 Marks)**

b. The piston of a 4-cylinder vertical inline engine reach their uppermost position at 90° interval in order of their axial position. Pitch of the 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 the central plane of the engine as reference plane. **(15 Marks)**

6 a. Define: i) Sensitiveness ii) Stability
iii) Isochronism iv) Effort of a governor. **(04 Marks)**

b. The arms of a porter governor are 300 mm long. The upper arms are pivoted on the axis of rotation and the lower arms are attached to the sleeve at a distance of 35 mm from the axis rotation. The mass of the Sleeve is 54 kg and the mass of each ball is 7 kg. Determine the equilibrium speed when the radius of rotation of the ball is 225 mm. What will be the range of speed for this position if the frictional resistance to the motion of the sleeve is equivalent to a force of 30 N at the sleeve. **(16 Marks)**

7 a. Derive an expression for the gyroscopic couple $C = I\omega\omega_p$ from the first principle. **(05 Marks)**

b. Explain the gyroscopic effect of steering, pitching and rolling of a naval ship in a sea. **(09 Marks)**

c. Analyze the stability of a two wheel vehicle taking a turn and derive the necessary equation. **(06 Marks)**

8 For a symmetrical tangent cam operating a roller follower, the least radius of the cam is 30 mm and the 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:

i) Principal dimensions of the cam (i.e., the distance between the cam centre and the nose centre, nose radius and the angle of contact of cam with straight front)

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

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