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06ME53

Fifth Semester B.E. Degree Examination, June/July 2015
Dynamics of Machines

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What are the conditions of static equilibrium of a three force member (non parallel forces) and a member with two forces and a torque? **(06 Marks)**

b. A slider crank chain is as shown in Fig.Q.1(b). The value of the force applied on the slider is 3000N. Determine forces on various links and also calculate the driving torque T_2. Link lengths are AB = 100mm; BC = 300mm. **(14 Marks)**

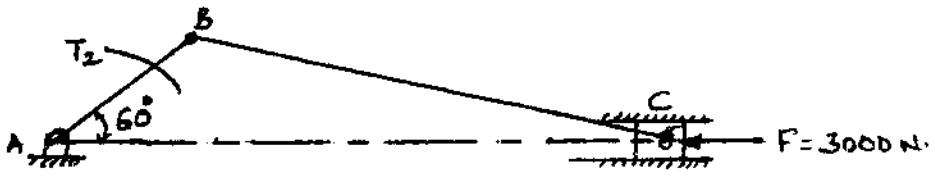

Fig.Q.1(b)

2 a. State and explain D'Almbert's principle. **(02 Marks)**

b. Define coefficient of fluxuation of speed and coefficient of energy. **(06 Marks)**

c. The radius of gyration of a flywheel is 1 meter and the fluctuation of speed is not to exceed 1% of mean speed of flywheel. If the mass of the flywheel is 3340kg and the steam engine develops 150kW at 135 rpm, then find:
   i) Maximum fluctuation of energy and
   ii) Coefficient of fluctuation of energy. **(12 Marks)**

3 a. Derive an equation for frictional torque lost in friction for a flat pivot bearing with uniform wear conditions. **(08 Marks)**

b. A belt of density 1gm/cm^3 has a maximum permissible stress of 250N/cm^2. Determine the maximum power transmitted by a belt of 20cm × 1.2cm if the rate of the tight side to slack side tension is 2. **(12 Marks)**

4 a. Explain how a single rotating mass is balanced by balancing masses in different planes. **(05 Marks)**

b. A shaft is supported in bearings 1.8m apart and projects 0.45m beyond bearings at each end. The shaft carries three pulleys one at each end and one at the middle of its length. The mass of end pulleys is 48kg and 20kg and their centre of gravity are 15mm and 12.5mm respectively from the shaft axis. The centre pulley has a mass of 56kg and its centre of gravity is 15mm from the shaft axis. If the pulleys are arranged so as to give static balance, determine: i) Relative angular positions of the pulleys and ii) Dynamic forces produced on bearings when the shaft rotates at 300 rpm. **(15 Marks)**

PART – B

5 a. Explain direct and reverse crank method of balancing for primary and secondary forces in a reciprocating engine mechanism. **(04 Marks)**

b. A five cylinder in-line engine running at 750 rpm has successive cranks 144° apart, the distance between cylinder centre lines being 375mm. The piston stroke is 225mm and ratio of connecting rod to crank is 4. Examine the engine for balance of primary and secondary forces and couples. Find the maximum values of these and the position of central crank at which these maximum values occur. The reciprocating mass for each cylinder is 15kg. **(16 Marks)**

6 a. Plot controlling force curve for stable, unstable and isochronous conditions for Hartnell type governor and define the condition of isochronism. **(05 Marks)**

b. The lengths of the upper and lower arms of a portor governor are 200mm and 250mm respectively. Both the arms are pivoted on the axis of rotation. The central load is 150N, the weight of each ball is 20N, and friction of the sleeve together with the resistance of the operating gear is equivalent to a force of 30N at the sleeve. If the limiting inclinations of the upper arms to the vertical are 30° and 40°, determine the range of speed of the governor. **(15 Marks)**

7 a. Define the following: i) Principle of gyroscope; ii) Pitching; iii) Rolling. **(06 Marks)**

b. An automobile is travelling along a curved track of 200m mean radius. Each of four wheels has a mass of 80kg with a radius of gyration of 0.4m. The rotating parts of the engine have a mass moment of inertia of 10 kg-m^2. The crankshaft rotates in same direction as road wheels. The gear ratio of engine to the back wheels is 5:1. The vehicle has a mass of 3000kg and its C.G. is 0.5m above the road level. The width of track of vehicle is 1.5m. Calculate limiting speed of the vehicle around the curve for all wheels to maintain contact with the road surface. **(14 Marks)**

8 a. Derive an equation for displacement, velocity and acceleration for a tangent cam when the roller is in contact with the flank. **(10 Marks)**

b. The following data is related to a symmetrical circular arc cam operating a flat-faced follower: Least radius of cam = 27.5mm; total lift = 12.5mm; angle of lift = 55°; nose radius = 3m; speed of cam = 600 rpm. Find: i) Distance between cam centre and nose centre; ii) Radius of circular flank; iii) Angle of contact on circular flank. **(10 Marks)**

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