B. Tech Degree VI Semester (Supplementary) Examination, October 2009

ME 602 DYNAMICS OF MACHINERY

(2006 Scheme)

Time : 3 Hours Maximum Marks : 100

PART A

(Answer all questions)

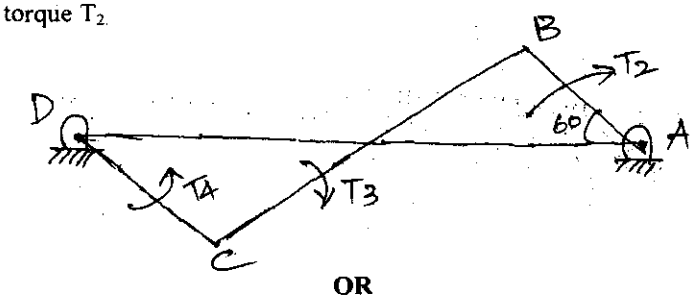
(8 x 5 =40)

I. a. State and explain D' Alembert's principle.
b. Define and explain superposition theorem as applicable to a system of forces acting on a mechanism.
c. Explain in what way the gyroscopic couple affects the motion of an aircraft while taking a turn.
d. Explain the terms sensitiveness, hunting and stability relating to Governors.
e. Explain the method of direct and reverse cranks to determine the unbalanced forces in radial engines.
f. What is meant by static and dynamic unbalance in machinery? How can the balancing be done?
g. Discuss the effect of slip of belt on the pulleys on the velocity ratio of a belt drive.
h. What is meant by a self locking and a self energized brake.

PART B

(4 x 15 =60)

II. In a four link mechanism shown in figure torques T_3 and T_4 have magnitudes of 30N-m and 20 N-m respectively. The link lengths are AD=800 mm, AB=300mm, BC=700 mm and CD=400mm. For the static equilibrium of the mechanism, determine the required input torque T_2.



OR

III. A horizontal gas engine running at 210 rpm has a bore of 220mm and a stroke of 440 mm. The connecting rod is 924 mm long and the reciprocating parts weigh 20 Kg. When the crank has turned through an angle of 30^0 from the inner dead centre, the gas pressures on the cover and crank sides are 500 KN/m^2 and 60 KN/m^2 respectively. Diameter of the piston rod is 40mm. Determine
(i) Turning moment on the crank shaft
(ii) Thrust on the bearings
(iii) Acceleration of the fly wheel which has a mass of 8 Kg. and radius of gyration of 600 mm while the power of the engine is 22 KW.

(Turn over)

IV. In a machine, the intermittent operations demand the torque to be applied as follows:

(i) During the first half revolution, the torque increases uniformly from 800 N-m to 3000 N-m.
(ii) During next one revolution, the torque remains constant.
(iii) During next one revolution the torque decreases uniformly from 3000 N-m to 800 N-m.
(iv) During last 1 1/2 revolution, the torque remains constant.

Thus, a cycle is completed in 4 revolutions. The motor to which the machine is coupled exerts a constant torque at a mean speed of 250 rpm. A flywheel of mass 1800 Kg. and radius of gyration of 500 mm is fitted to the shaft. Determine (i) Power of the motor (ii) the total fluctuation of speed of the machine shaft.

OR

V. In a porter governor, each arm is 200 mm. long and is pivoted at the axis of rotation. The mass of each ball is 5 Kg. and the load on the sleeve is 30 Kg. The extreme radius of rotation are 80 mm and 140 mm. Plot the graph of the controlling force Vs radius of rotation and set off a speed scale along the ordinate corresponding to a radius of 160 mm.

VI. The cylinders of a twin V-engine are set at 60^0 angle with both pistons connected to a single crank through their respective connecting rods. Each connecting rod is 600 mm long and the crank radius is 120 mm. The total rotating mass is equivalent to 2 Kg. at the crank radius and the reciprocating mass is 1.2 Kg. per piston. A balance mass is also fitted opposite to the crank equivalent to 2.2 Kg. at a radius of 150 mm. Determine the maximum and minimum values of the primary and secondary forces due to inertia of the reciprocating and the rotating masses if the engine speed is 800 rpm.

OR

VII. The intermediate cranks of a four cylinder symmetrical engine, which is in complete primary balance, are at 90^0 to each other and each has a reciprocating mass of 400 Kg. The centre distance between intermediate cranks is 600 mm and between extreme cranks 1800mm. Lengths of the connecting rods and the cranks are 900 mm and 200 mm respectively. Calculate the masses fixed to the extreme cranks with their relative angular positions. Also find the magnitude of the secondary forces and couples about the centre line of system if the engine speed is 150 rpm.

VIII. A rope drive transmits 40 KW at 120 rpm by using 15 ropes. Angle of lap on the smaller pulley which is 300 mm in diameter is 165^0. Coefficient of friction is 0.25 and the angle of groove is 40^0. The rope weights $(50 \times 10^{-6}) G^2$ Kg. per meter length of rope and the working tension is limited to $0.14 G^2$N, where G is the girth (circumference) of rope in mm. Determine the initial tension and the diameter of each rope.

OR

IX. In a belt transmission dynamometer, the driving pulley rotates at 300 rpm. The distance between the centre of the driving pulley and the dead mass is 800 mm. The diameter of each of the driving as well as the intermediate pulleys is equal to 360 mm. Find the value of the dead mass required to maintain the lever in a horizontal position, when the power transmitted is 3 KW. Also find its value when the belt just begins to slip on the driving pulley, μ being 0.25 and the maximum tension in the belt 1200 N.

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