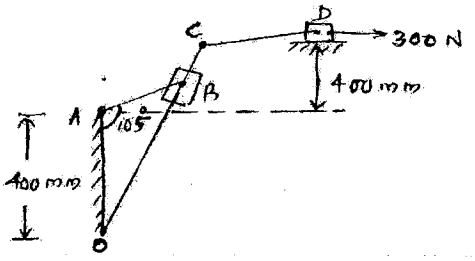
BT MRE – V – 12.13-1009

B. Tech Degree V Semester Examination in Marine Engineering December 2013

MRE 501 DYNAMICS OF MACHINERY

Time : 3 Hours Maximum Marks : 100

I. For the static equilibrium of the quick return mechanism shown in figure, determine the input torque T_2 to be applied on the link AB for a force of 300N on the slider D. The dimensions of the various links are OA=400mm, AB= 200mm, OC=800mm, CD=300mm. (20)



OR

II. The crank and the connecting rod of a vertical single cylinder gas engine running at 1800rpm are 60mm and 240mm respectively. The diameter of the piston is 80mm and the mass of the reciprocating parts is 1.2kg. At a point during the power stroke when the piston has moved 20mm from the top dead centre, the pressure on the piston is 800 KN/m^2. Determine the (20)

(i) net force on the piston
(ii) thrust in the connecting rod
(iii) thrust on the sides of the cylinder walls
(iv) the engine speed at which the above values are zero.

III. (a) Derive a relation for the coefficient of fluctuation of speed in terms of maximum fluctuation of energy and kinetic energy of the flywheel. (5)

(b) A constant torque motor of 2.5kw drives a rivetting machine. The mass of the moving parts including the flywheel is 125kg at 700mm radius of gyration. One rivetting operation absorbs 1kJ of energy and takes one second. Speed of the flywheel is 240rpm before rivetting. Determine. (15)

(i) number of rivets closed per hour.
(ii) reduction in speed after rivetting operation

OR

IV. Each wheel of a four wheeled rear engine automobile has a moment of inertia of 2.4kgm^2 and an effective diameter of 660mm. The rotating parts of the engine have a moment of inertia of 1.2kgm^2. The gear ratio of engine to the back wheel is 3:1. The engine axis is parallel to the rear axle and crankshaft rotates in the same direction as the road wheels. The mass of the vehicle is 2200kg and the centre of mass is 550mm above the road level. The track width of the vehicle is 1.5m. Determine the limiting speed of the vehicles around a curve with 80m radius so that all the four wheels maintain contact with the road. (20)

(P.T.O.)

V. (a) Distinguish between static balancing and dynamic balancing (5)

(b) The details of a rotary system are given below. (15)

Mass	Radius (mm)	Angle	Distance between the planes of the rotor (mm)
m_1=9kg	100	0	-
m_2=7kg	120	60	160
m_3=8kg	140	135	320
m_4=6kg	120	270	560

Of the shaft is balanced by two counter masses located at 100mm radii and revolving in planes midway between masses 1&2 and 3&4, determine the magnitude of the masses and their angular position.

OR

VI. (a) Briefly explain the working principle of a static balancing machine. (5)

(b) 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 400kg. The centre distance between intermediate cranks is 600mm and that between extreme cranks is 1800mm. Lengths is connecting rods and the cranks are 900mm and 200mm respectively. Calculate the masses fixed to the extreme cranks and their relative angular positions. Also find the secondary forces and couples about the centre line of the system if the engine speed in 500rpm. (15)

VII. (a) Derive the expression for the response of a viscous damped of single degree of freedom vibrating system subjected to harmonic exciting force F_0 sin wt. (8)

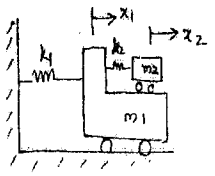
(b) In a single degree damped vibrating system, the suspended mass of 4kg makes 24 oscillations in 20 seconds. The amplitude decreases to 0.3 of the initial value after 4 oscillations. Find the stiffness of the spring, logarithmic decrement, the damping factor, and the damping coefficient. (12)

OR

VIII (a) Explain the working principle of seismometer and accelerometer. (8)

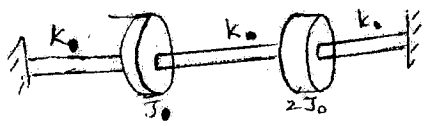
(b) A rotor of mass 12kg is mounted in the middle of 25mm diameter shaft supported between two bearings placed at 900mm from each other. The rotor is having 0.02mm eccentricity if the system rotates at 3000rpm, determine the amplitude of steady state vibrations. Take $E=2x10^5$ N/mm^2. (12)

IX Determine the natural frequencies of the system shown. Given m_1=200kg, m_2=50kg, K_1 = 100 KN/m, K_2 = 20KN/m (20)



OR

X. Find the natural frequencies and mode shapes of the system shown. (20)



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