B. Tech Degree VI Semester (Supplementary) Examination, September 2008

ME 601 DYNAMICS OF MACHINERY

(2002 Scheme)

Time : 3 Hours Maximum Marks : 100

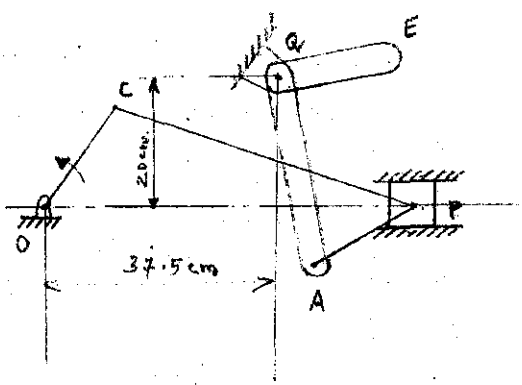
I. (a) Illustrate Coriolis Component acceleration observed in mechanisms. (5)

(b) The figure shows configuration of a mechanism find,

(i) Angular velocity and acceleration of the link AQ

(ii) The acceleration of the piston

The crank oc rotates uniformly at 120 r.p.m the anticlockwise direction and the lever AQE rocks about the fixed centre Q



OC	=	12.5 cm	
CP	=	50 cm	
AQ	=	25 cm	
QE	=	12.5cm	(15)

II. (a) In a double acting vertical steam engine running at 360 r.p.m, cylinder diameter is 25cm, stroke is 30 cm, diameter of piston rod is 3.75 cm and length of connecting rod is 60 cm. When the crank has moved 120 degrees from top dead centre, the pressure of the steam at cover end is 35×10^4 N/m^2 and at the crank end is 3×10^4 N/m^2. If the mass of the reciprocating parts is 45 Kg, find

(i) Piston effort

(ii) Turning moment on the crank shaft for the given crank position. (15)

(b) Explain the concept of Equivalent dynamical system. (5)

III. (a) Derive an expression for energy stored in a solid flywheel disc. (5)

(b) The turning moment diagram of an engine rotating at 200 r.p.m is given by the relation, $T = (15 + 8 \sin 2\theta - 2 \cos 2\theta)$ KN-m where θ is the crank angle. External resistance is constant. A fly wheel weighting 20 KN is fitted on the engine shaft so that total fluctuation of speed does not exceed 1%. Determine the least value of moment of Inertia of the flywheel and its radius of gyration. (15)

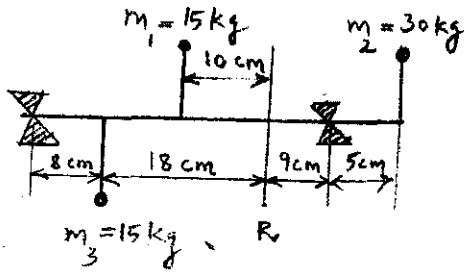
OR

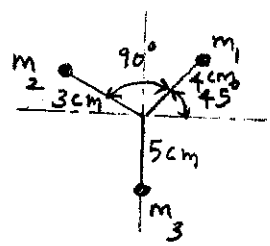
IV. (a) What is Gyroscopic Couple? Obtain an expression for the same. (10)

(b) A ship's turbine rotor is 20 tonnes with radius of gyration 50 cm. The rotor rotates of 2000 r.p.m in a clockwise direction when viewed from the rear end of the ship. The ship pitches with a total pitch angle 15^0. The motion can be considered simple harmonic with equal deviations on both sides of the axis of the spin with a time period 15 seconds. Calculate the maximum gyroscopic couple on the bolts of the turbine and the direction of yaw as the bow rises. (10)

(Turn Over)

V. Three masses located in planes, 1,2 and 3 are to be balanced by correcting masses the planes 3 and R. While balancing this rotor on a machine, if the maximum error in determining the magnitude of correcting masses is +5%; determine the bearing reactions left on the supports as a percentage of original reactions. (20)



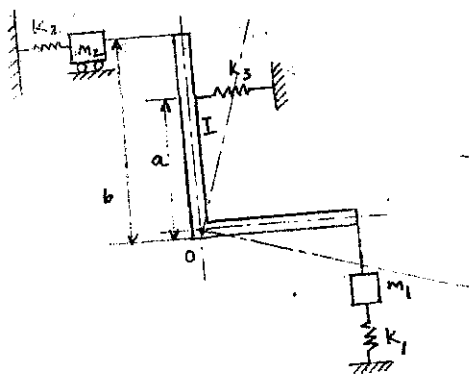


OR

VI. A twin cylinder V. Engine has the cylinders set at an angle of 45^0. The connecting rods are 30cm long and the crank radius is 70 mm. The total rotating mass is equivalent to 3 Kg at the crank radius and the reciprocating parts mass is 2 Kg per line. A balance mass is fitted opposite to the crank equivalent to 2.5 Kg at a radius 10 cm. The engine speed is 2000 r.p.m. Compute maximum and minimum values of primary forces and secondary forces. (20)

VII. (a) Explain Rayleigh's Maximum Energy principle. (5)

(b) An indictor mechanism with its arm pivoted at point O, having a mass moment of inertia I. Determine the natural frequency of the system for angular oscillations of the system about the pivot O. (15)



OR

VIII. (a) What is Vibration Isolation? Derive an expression for Transmissibility Ratio. (10)

(b) A Rotating machine 650 Kg, operating at 1500 rpm, has an unbalance 0.12 Kgm. If the damping in the isolators is given by 0.08, determine

(i) The stiffness of the isolators so that the transmissibility at the operating speed is less than 0.15

(ii) Magnitude of the force transmitted. (10)

IX. Derive an expression for the fundamental frequency of a simply supported beam of length L and cross sectional flexural rigidity EI carrying a distributed mass m Kg/m. Assume a mode shape of type $y = y_0 \sin\frac{\pi x}{L}$. (20)

OR

X. A light elastic shaft AB of uniform cross section, supported freely in bearings, carries a disc at each end, it is found that the natural frequency of torsional vibration is 40Hz. A third disc is mounted at a point C on the shaft such that $AC = \frac{3}{4}AB$. If all the disc have same mass moment of inertia, determine the torsional natural frequency. (20)

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