B. Tech Degree VI Semester Examination, June 2006

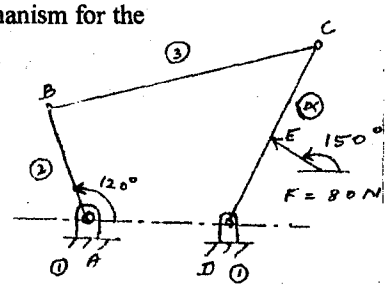
ME 601 DYNAMICS OF MACHINERY

(Prior to 2002)

Time : 3 Hours Maximum Marks : 100

I. (a) What are conditions for a body to be in equilibrium under the action of two forces and three forces? (6)

(b) A four-link mechanism with the following dimensions is acted upon by a force $80\angle 150^0 N$ on link DC, in the figure AD = 50mm, AB=40mm, BC=100mm, DC 75mm DE=35mm. Determine the input torque T on the link AB for the static equilibrium of the mechanism for the given configuration. (14)



OR

II. (a) State and explain D' Alembert's principle. (6)

(b) A horizontal gas engine running at 210rpm has a bore of 220mm and a stroke of 440mm. The connecting rod is 924 mm long and the reciprocating part weigh 20Kg. When the crank is turned through an angle of 30^0 from the inner dead center, the gas pressures on the cover and the crank sides are $500KN/m^2$ and 60KN respectively. Diameter of the piston rod is 40mm.
Determine

(i) Turning moment on the crash shaft
(ii) Thrust on the bearings
(iii) Acceleration of the fly wheel which has a mass of 8Kg and radius of gyration of 600mm while the power of the engine is 22 KW. (14)

III. (a) Find a relation for the coefficient of fluctuation of speed in terms of maximum fluctuation of energy and the kinetic energy of the fly wheel at mean speed. (6)

(b) A punching machine carries out 6 holes per minute. Each hole of 40mm diameter in 35mm thick plate requires 8 r.m of energy/ mm^2 of the sheared area. The punch has a stroke of 95mm. Find the power of the motor required if the mean speed of the fly wheel is 20m/s.

If total fluctuation of speed is not to exceed 3% of the mean speed, determine the mass of the fly wheel. (14)

OR

IV. (a) What do you mean by gyroscopic couple? Derive a relation for its magnitude. (6)

(b) A disc with radius of gyration 60mm and a mass of 4Kg is mounted centrally on a horizontal axle of 80mm length between the bearings. It spins about the axle at 800rpm counter clock wise when viewed from the right hand side bearing. The axle precesses about a vertical axis at 50rpm in the clock wise direction when viewed from above. Determine the resultant reaction at each bearing due to the mass and the gyroscopic effect. (14)

V. (a) Explain the term static balancing and dynamic balancing. (6)

(b) Four masses m_1, m_2, m_3 and m_4 are 200Kg, 300Kg, 240Kg and 260 Kg respectively. The corresponding radii of rotation are 0.2m, 0.15m, 0.25m and 0.3m respectively and the angles between successive masses are 45^0, 75^0 and 135^0. Find the position and magnitude of the balance mass required if its radius of rotation is 0.2m. (14)

OR

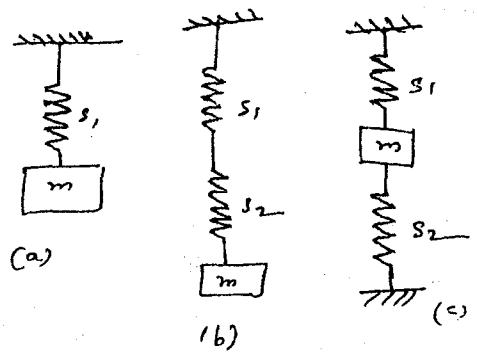
Mass of revolving parts = 30Kg at crank radius
Speed = 150 rpm
Stroke = 350 mm
If 60% of the reciprocating parts and all the revolving parts to be balanced, determine

(i) The balance mass required at a radius of 320 mm.
(ii) The unbalanced force when the crank has turned 45° from the top dead center (14)

VII. (a) What is free damped and forced vibration? Explain. (6)

(b) Determine the equivalent spring stiffness and natural frequency of the following vibrating systems when (refer the figure a,b,c)

(a) The mass is suspended to a spring
(b) The mass is suspended at the bottom of two springs in series
(c) The mass is fixed in between two springs. (14)



OR

VIII. (a) Explain the working of an accelerometer. (6)

(b) In a single-degree damped vibrating system a suspended mass of 8Kg makes 30 oscillations in 18 seconds. The amplitude decreases to 0.25 of the initial value after 5 oscillations. Determine

(i) The stiffness of the spring
(ii) The logarithmic decrement
(iii) The damping factor
(iv) The damping coefficient (14)

IX. (a) Derive an expression for natural frequency of free longitudinal vibration by Rayleigh's method. (6)

(b) A shaft 40mm diameter and 2.5m long has a mass of 15Kg per meter length. It is simply supported at the ends and carries 3 masses 90Kg, 140Kg and 60Kg at 0.8m, 1.5m and 2m respectively from the left support. Taking $E = 200GN/m^2$, find the frequency of the transverse vibrations. (14)

OR

X. (a) Discuss free tortional vibrations of geared system. (6)

(b) A shaft shown in the figure carries two masses. The mass A is 300Kg with radius of gyration of 0.75m and the mass B is 500Kg with radius of gyration 0.9m. Determine the frequency of the torsional vibrations. It is desired to have the mode at the mid-section of the shaft of 120mm diameter by changing the diameter of the section having a 90mm diameter. What will be the new diameter? (14)