B.Tech Degree VI Semester Examination, April 2010

ME 602 DYNAMICS OF MACHINERY

(2006 Scheme)

Time: 3 Hours Maximum Marks: 100

PART – A

(Answer ***ALL*** questions)

(8 x 5 = 40)

I. (a) Write a brief note on force analysis of Bevel and Helical gears.

(b) Define and explain the terms 'Friction circle' and 'Friction axis' of a link.

(c) Explain the condition for Isochronism in governors. Find the required condition for isochronism in case of Hartnel governor.

(d) Explain the gyroscopic effect of 'steering, pitching and rolling' on Naval ships.

(e) Explain 'variation in tractive force 'and 'swaying couple' for an uncoupled two cylinder locomotive engine.

(f) Briefly explain direct and reverse crank method used in balancing.

(g) Explain 'self locking' and 'self energised' brakes.

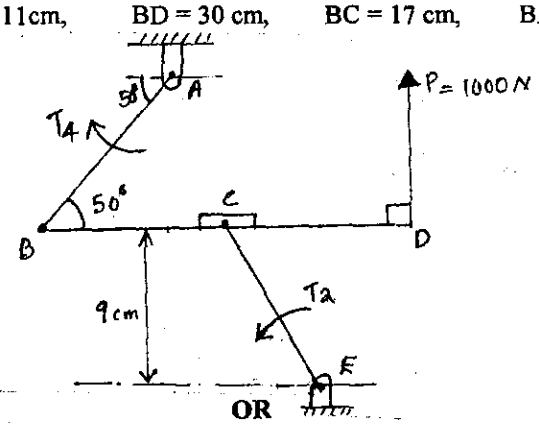
(h) Obtain the condition for maximum power transmission by a belt drive considering the effect of centrifugal tension.

PART – B

(4 x 15 = 60)

II. Determine the value of T_2 shown in figure. The value of T_4 = 5600 N-cm and P = 1000 N. The various dimensions of the links are given below:

CE = 11cm, BD = 30 cm, BC = 17 cm, BA = 14 cm.



(15)

OR

III. A single cylinder vertical engine has a bore of 300mm and a stroke of 400mm. The connecting rod is 1m long. The mass of the reciprocating parts is 140 kg. On the expansion stroke, with the crank at 30^0 from the top dead center, the gas pressure is 0.7 MPa. If the engine runs at 250 rpm, determine:

(i) Net force acting on the piston

(ii) Resultant load on the gudgeon pin

(iii) Thrust on the cylinder walls

(iv) The speed above which, other things remaining same, the gudgeon pin load would be reversed in direction. (15)

IV. The turning moment diagram, for a multi cylinder engine has been drawn to a scale of 1mm to 500 N-m torque and 1mm to 6^0 of crank displacement. The intercepted area between output torque curve and mean resistance line taken in order from one end in square mm are –30, +410, -280, +320, -330, +250, -360, +280, -260 sq.mm, when the engine is running at 800 rpm. The engine has a stroke of 300mm and fluctuation of speed is not to exceed 2% of mean speed. Determine a suitable diameter and cross section of the flywheel rim for a limiting value of the safe centrifugal stress of $7N/mm^2$. The density of the material is given as 7200 Kg/m^3 and the width of the rim is 5 times the thickness. (15)

OR

(Turn Over)

V. A four wheeled trolley car has a total mass of 3000 Kg. Each axle with its two wheels and gears has a total moment of inertia of 32 Kgm^2. Each wheel is of 450mm radius. The center of distance between two wheels on an axle is 1.4m. Each axle is driven by a motor with a speed ratio of 1:3. Each motor along with its gear has a moment of inertia of 16 Kgm^2 and rotates in the opposite direction to that of the axle. The center of mass of the car is 1m above the rails. Calculate the limiting speed of the car when it has to travel around a curve of 250m radius without the wheels leaving the rails. (15)

VI. A shaft carries four rotating masses A, B, C and D in this order along its axis. The mass A may be assumed to be concentrated at a radius of 12cm, B at 15cm, C at 14cm and D at 18cm. The masses A, C and D are 15 Kg, 10Kg. and 8 Kg. respectively. The planes of A and B are 15 cm apart and of B and C are 18cm apart. The angle between the radii of A and C is 90^0. If the shaft is in complete dynamic balance, determine:

(i) The angles between the radii of A, B and D
(ii) The distance between the planes of revolution of C and D
(iii) The magnitude of mass B. (15)

OR

VII. The cranks of a two cylinder uncoupled outside cylinder locomotive are at right angles and are 300mm long. The distance between the center lines of the cylinder is 1.8m. The wheel center lines are 1.4m apart. The rotating mass per cylinder is 350 Kg and the mass of the reciprocating parts per cylinder is 285 Kg. The whole of the rotating and two third of the reciprocating masses are to be balanced in the plane of the driving wheels at a radius of 800mm, then find:

(i) The magnitude and angular positions of balance masses.
(ii) The maximum speed of the locomotive in Km/hr without lifting the wheels from the rails if the dead load on each driving wheel is 28000 N and diameter of the driving wheel is 1.8m
(iii) Swaying couple at the maximum speed (15)

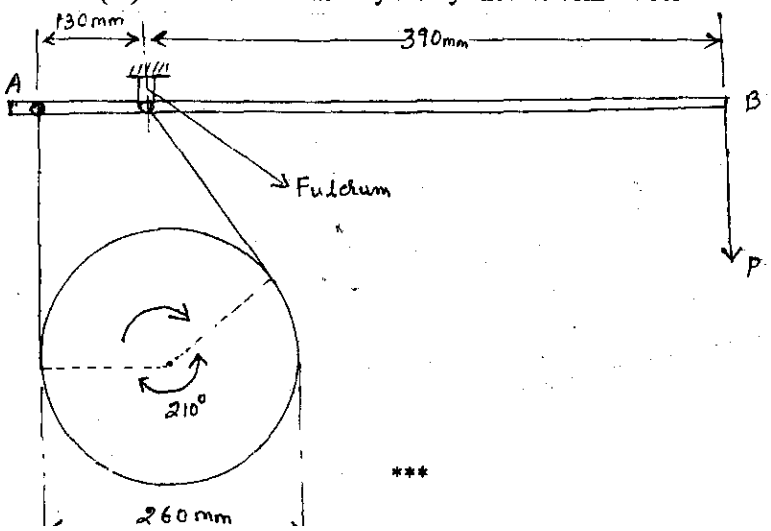
VIII. (a) Power is transmitted using a V-belt drive. The included angle of V-grooves is 30^0. The belt is 2cm deep and maximum width is 2cm. If the mass of the belt is 3.5gm. per cm length and maximum allowable stress is 140 N/cm^2. Determine the maximum power transmitted, when the angle of lap is 140^0 and $\mu = 0.15$. (9)

(b) The capacity of a single plate clutch having both sides effective, decreases by 16% during the initial wear period. Determine the minimum value of the ratio of internal radius to the external radius (r_2 / r_1) for the axial load. (6)

OR

IX. Figure shows a simple band brake which is applied to a shaft carrying a fly wheel (ie. Rotating drum) of mass 300 Kg and of radius of gyration 350mm. The flywheel rotates at 200 rpm. The brake drum diameter is 260mm and coefficient of friction is 0.20. The angle of lap of the band on the drum is 210^0. If the braking torque is 39 N-m, find:

(i) The force applied at the lever end
(ii) The number of turns of the flywheel before it comes to rest
(iii) The time taken by the flywheel to come to rest



(15)

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