THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
DIPLOMA IN TECHNOLOGY – LEVEL 03
FINAL EXAMINATION 2008/2009
MEX 3230 – MECHANICS OF MACHINES
DATE :17TH MARCH 2008
TIME :0930 HRS - 1230 HRS
DURATION :03 HOURS

ANSWER ANY FIVE (05) QUESTIONS. ALL QUESTIONS CARRY EQUAL MARKS.

QUESTION 01:

(a) A flat belt drive found to have belt slip when power is being transmitted. Briefly indicate the methods proposed to overcome this problem.

(b)

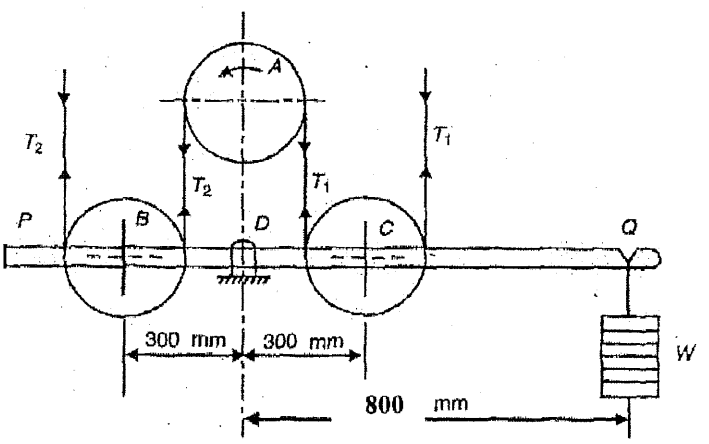


Fig.01

The essential features of a belt transmission dynamometer are shown in Fig.01. ***A*** is the driving pulley which runs at 500 r.p.m. ***B*** and ***C*** are jockey pulley mounted on a horizontal beam ***PQ*** pivoted at point ***D*** about which the complete beam is balanced when at rest. ***E*** is the driven pulley (not shown in the figure). Pulleys ***A, B*** and ***C*** at 300 mm apart from each other and the portions of the belt between the pulleys are vertical.
Determine the

(i) weight ***W*** to maintain the beam horizontally when 5.0 kW power is being transmitted
(ii) value of weight ***W*** when the belt just begins to slip on the pulley ***A.***
Assume that the coefficient of friction is 0.2 and the maximum tension in the belt is 1.5kN.

QUESTION 02:

A three cylinder single acting engine has its crank journals set equally at 120^0 and runs at 600 rpm. The turning moment diagram for each cylinder is a triangle and maximum torque is 100 Nm at 60^0 from top dead centre of the corresponding crank. The torque on the return stroke is zero. Determine,

(a) power developed
(b) coefficient of fluctuation of speed if the flywheel has mass of 8 kg and radius of gyration is 100mm
(c) coefficient of fluctuation of energy
(d) the maximum angular acceleration of the flywheel

QUESTION 03:

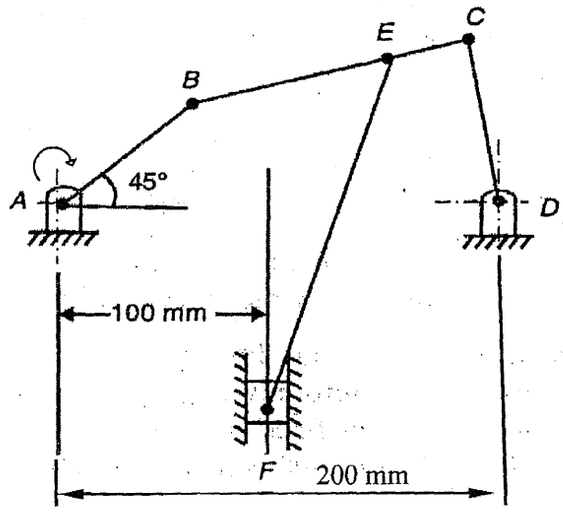


Fig.03

In the mechanism shown in Fig.03, the crank **AB** rotates uniformly in clockwise direction at 240 rpm and the slider '**F**' moves vertically. The dimensions of various links are:
AB = 60 mm, BC = 160 mm, CD = 100 mm and EF = 200 mm. The distances
AD = 200 mm, and CE = 40mm. Determine for the position shown, the linear acceleration of slider **F**. Also determine the angular velocity and the acceleration of the link **EF**.

QUESTION 04:

(a) Explain the method of balancing of different masses revolving in the same plane.

(b) **A, B, C** and **D** are four masses carried by a rotating shaft at radii 100,125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of **B, C** and **D** are 10 kg and 4 kg respectively.
Find the required mass **A** and the relative angular settings of the four masses, so that the shaft shall be in complete balance.

QUESTION 05:

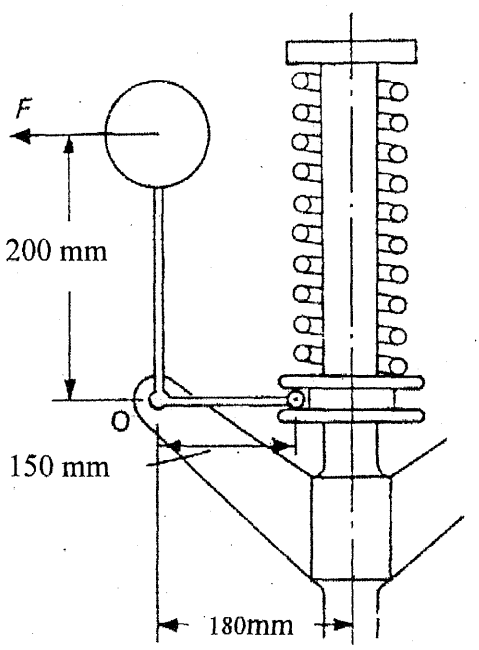


Fig.05

In a Hatnell governor (shown in Fig.05), the length of the ball arm is 200 mm, that of the sleeve arm is 150 mm and the mass of each ball is 2.5 kg. The distance of the pivot of each bell-crank lever from the axis of rotation is 180 mm, and the speed, when the ball arm is vertical is 250 rev/min. The speed is to increase 0.5 % for a lift of 12 mm of the sleeve.

(a) Neglecting the dead load on the sleeve, find the necessary stiffness of the spring and the required initial compression.

(b) What spring stiffness and initial compression would be required if the speed is to remain the same of the change position of the sleeve (i.e the governor is to be isochronous)?

QUESTION 06:

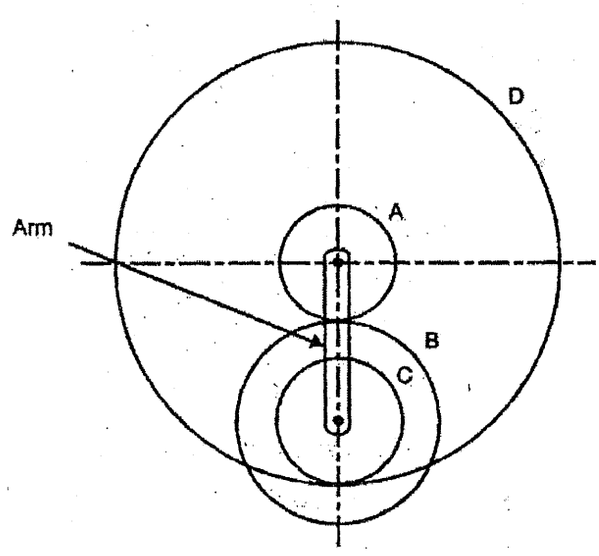


Fig.06

Fig.06 shows an epicyclic gear train in which gear ***A*** drives the internal gear ***D*** through compound gears ***B*** and ***C***. The number of teeth in gear ***A*** is 20 and center distance between the centers of gears ***A*** and ***B*** is 300 mm. If the module of all gears is 10mm and gear ***C*** has 30 teeth, find the speed of gear ***D***. The arm rotates at 600 rpm in counterclockwise direction and gear ***A*** is fixed.

QUESTION 07:

A turnbuckle consists of a box nut connecting two rods, one screwed right handed and other left handed, each having a pitch of 4 mm and mean diameter of 23 mm. The thread is of V form with included angle of 55^0 and coefficient of friction may be taken as 0.18. Assuming that rods do not turn, calculate

(a) torque required on the nut to produce a pull of 50 kN
(b) efficiency of the screw

QUESTION 08:

(a) Show that the free vibration of a single degree of freedom damped system is periodic if $c < 2\sqrt{km}$

(b)

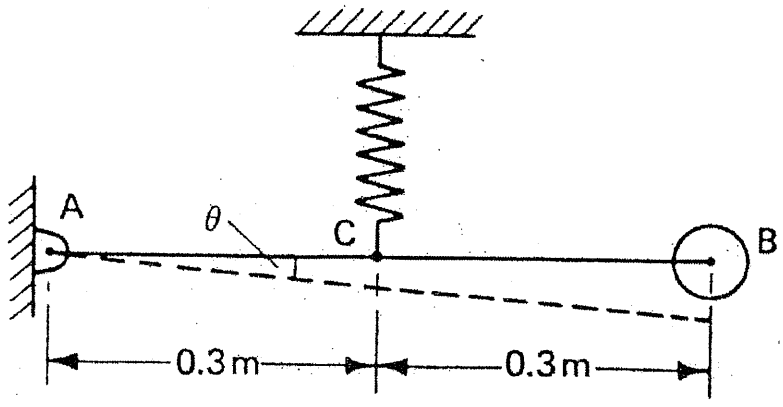


Fig.08

The uniform thin rod, **AB** shown in Fig.08 has a mass of 1 kg and carries a concentrated mass of 2.5 kg at **B**. The rod is hinged at **A** and is maintained in the horizontal position by a spring of stiffness 1.8 kN/m at **C**. Find the frequency of oscillation, neglecting the effects of the mass of the spring.

ALL RIGHT RESERVED