TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATIONS 2013/2014
FOR THE DEGREE OF BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EMG 2208: MECHANICS OF MACHINES I

SUPPLEMENTARY/SPECIAL EXAMINATIONS
SERIES: FEBRUARY 2013
TIME: 2 HOURS

INSTRUCTIONS:

- You should have the following for this examination:
  - Answer booklet
  - Scientific calculator
  - Drawing instrument
- This paper consists of **FIVE** questions
- Answer any T**HREE**
- All questions carry equal marks

This paper consists of Three printed pages.

QUESTION 1

In the mechanism shown in Fig. Q. 1 the driving crank OA rotates clockwise with a speed of 250m rev/min. The lengths of various links are OA = 100mm, AB = 300mm, BC = 150mm, CD = 250mm, DE = 200mm and CE = 167 mm. Angle CoA = 30^0. Determine the velocity and acceleration of F for the configuration shown. **(20 marks)**

QUESTION 2

The table of planning machine is transverse by means of a simple square threaded screw 12mm pitch and 50mm outside diameter. The thrust on the screw is taken by a collar bearing of 76mm mean diameter. If the pressure of cut is 400N the total mass of the table and part being machined is 230kg and the speed of cutting is 0.15m/s. Find the power employed. Take the various coefficients of friction as follows: table in guides 0 =.10, screw = 0.15, and collar bearing = 0.20. **(20 marks)**

QUESTION 3

a) For a V-grooved belt system show that the effective ratio of belt tension is given by

$$\frac{T_1 - TC}{T_2 - TC} = e^{uo\cos ets}$$

Where: -

T_1 = Tension on the tight side

T_2 = Tension on the slack side

T_C = Centrifugal tension

θ = The angle of lap

β = Semi angle of groove

μ = Coefficient of friction **(6 marks)**

b) A 4-to-1 speed reduction drive between two parallel shafts at 2m centres is provided by means of five parallel V-belts running on suitable pulleys mounted on the shafts. The effective diameter of the driving pulley is 350mm and the driving shaft rotates at 740 rev/min. the included angle of each pulley groove is 40^0, each V-belt has a mass of 0.45Kg/m and the coefficient of friction between the belt and groove is 0.28. the tension on each belt is not to exceed 800N. Determine

i) Power transmitted by the drive

ii) The initial belt tension. **(14 marks)**

QUESTION 4

A body of mass M on a plane inclined at 20^0 for the horizontal and for which the coefficient of friction is U, is acted upon by a force applied upwards and parallel to the plane. When this force has a value of 60N, the body slides steadily downwards, when the value is 175N, the body moves steadily upwards.

a) Deduce from these results the values of M and U.

b) A difference body of mass 50kg and with a surface for which, on the same plane, the friction coefficient is 0.15, is to be moved by a force P directed at an angle of 15^0 to the plane, i.e 350 to the horizontal. Calculate:

i) The value of P which will cause steady upward movement.

ii) The value to which P must be reduced before downward movement becomes possible.

(10 marks)

QUESTION 5

Figure Q5 shows two wheels S_1 and S_2 which are integral with the driving shaft. The wheel P_1 revolves on a pin attached to the arm A, which is integral with the driven shaft and P_1 meshes with the annulus wheel I_2 and meshes with S_2 and the fixed annular wheel I. The number of teeth are $S_1 = 31$, $S_2 = 26$, $I_1 = 83$, $I_2 = 88$. If the input to the driving shaft is 22Kw at 3000 revolutions per minute find:

a) The output speed and

b) The torque to fix the gear box **(20 marks)**