TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of Mechanical & Automotive Engineering
UNIVERSITY EXAMINATION FOR:
BSc. Mechanical Engineering
TMC 4222 : MECHANICS OF MACHINES II
END OF SEMESTER EXAMINATION
SERIES: APRIL 2017
TIME: 2 HOURS
DATE: 3 Aug 2017

Instruction to Candidates:

You should have the following for this examination

- *Answer booklet*
- *Non-Programmable scientific calculator*

This paper consists of **FIVE** questions. Attempt any **THREE** questions.
Maximum marks for each part of a question are as shown.
Do not write on the question paper.

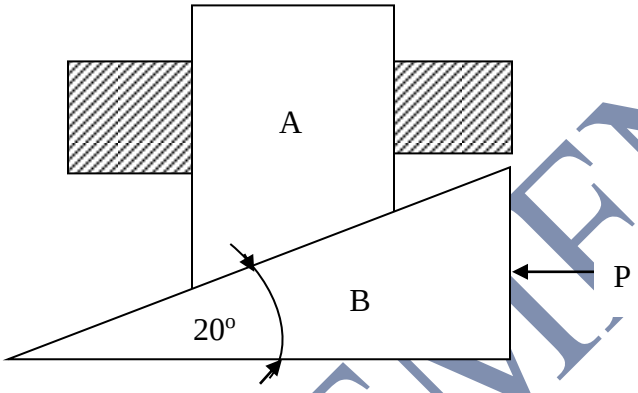
Question ONE

A multi-plate clutch is used to connect two shafts in line. In this, one set of plates can slide axially in a shell attached to one shaft while the other set of plates can slide along the second shaft. Sketch the arrangement showing an operating mechanism for pressing the plates together. If the inner and outer diameters of the contact surfaces are 90 and 140 mm respectively and there are six contacts, find the axial thrust required to transmit 7.5 kW at 750 rev/min. Assume that $\mu = 0.3$ and that the contact pressure times radius is a constant over each surface. Find also the contact pressures at the inner and outer radii. (20 marks)

Question TWO

a) Two wedges A and B of mass 120 kg and 15 kg respectively are in contact as shown in **Fig. Q2a**. If the coefficient of friction on all contact surfaces is 0.2, determine the least value of the force P to push wedge A upwards. What would be its value if there were no friction? (10 marks)

Figure Q2a



b) Find the force required to move a load of 300 N up a rough plane, the force being applied parallel to the plane. The inclination of the plane is such that a force of 60 N inclined at 30° to a similar smooth plane would keep the same load in equilibrium. The coefficient of friction is 0.3.

Question THREE

a) A square-threaded screw of mean diameter 40mm and having 160 threads per m is used to raise a load of 7.5 kN. The nut, which rotates, has a bearing surface whose mean diameter is 56 mm. Find the effort required at the end of a lever 300mm effective length to raise the load when μ=0 08. (10 marks)

b) A single-start thread has a mean diameter of 60 mm and a pitch of 12 mm. The section of the thread is of Acme form having a total angle of 29° between the faces. If μ=0.05, find;

(i) The torque necessary to overcome an axial load of 30 kN

(ii) The efficiency of the thread (10 marks)

Question FOUR

A cam is to give the following motion to a knife-edged follower :
1. Outstroke during 60° of cam rotation **2.** Dwell for the next 30° of cam rotation
3. Return stroke during next 60° of cam rotation, and **4.** Dwell for the remaining 210° of cam rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when **(a)** the axis of the follower passes through the axis of the cam shaft, and **(b)** the axis of the follower is offset by 20 mm from the axis of the cam shaft.(20 marks)

Question FIVE

a) **Fig 5a** shows the particulars of two brake shoes which act on the internal surface of a cylindrical brake drum. The braking forces F_1 and F_2 are applied as shown, and each shoe pivots on its fixed fulcrum O_1 and O_2. The width of the brake lining is 35 mm. The intensity of pressure at any point A is $0.4 \sin \theta$ N/mm^2, where θ is measured as shown from either pivot. The coefficient of friction is 0.4 . Determine the braking torque and the magnitude of the forces F_1 and F_2. (10 marks

b) An open belt drive connects two pulleys 1.2 and 0.5 m diameter, on parallel shafts 3.6 m apart. The belt has a mass of 0.9 kg/m length, and he maximum tension in it is not to exceed 2 kN. The 1.2 m pulley, which is the driver, runs at 200 rev/min. Due to belt slip on one of the pulleys, the velocity of the driven shaft is only 450rev/min. Calculate the torque on each of the two shafts, the power transmitted, and the power lost in friction. μ=0.3. What is the efficiency of the drive? (10 marks)

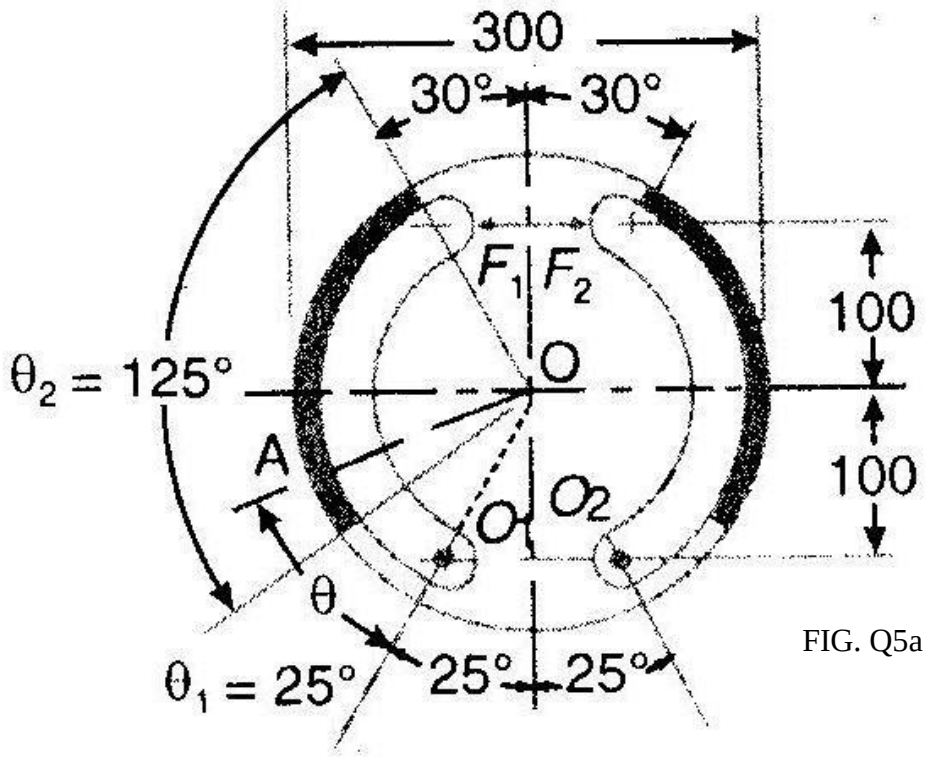


FIG. Q5a

All dimensions in mm.