TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATIONS FOR DEGREE IN

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

(YII, SII)

EMG 2208: MECHANICS OF MACHINES I

END OF SEMESTER EXAMINATIONS

SERIES: APRIL 2015

TIME: 2 HOURS

INSTRUCTIONS:

- You should have; Answer booklet; Drawing instruments and scientific calculator
- This paper consists of **FIVE** questions.
- Answer any **THREE** questions.

This paper consists of Two printed pages

QUESTION 1

a) State any **FOUR** laws of dry friction. **(4 marks)**

b) A body is pushed up a surface inclined at ~ to the horizontal. The inclination of the slope is such that the body would just slide down without acceleration if not supported. Determine the efficiency of the lift if the push is parallel to the incline. **(5 marks)**

c) A screw jack has a square thread of 64mm mean diameter and 12mm pitch. The load on the jack revolves with the screw. The coefficient of friction of the screw thread is 0.05

i) Determine the tangetailforce required at 300mm radius to lift a mass of 550Kg.

ii) State whether the jack is self-locking.

iii) If it is determine the torque which must be applied to keep the load from descending.

(11 marks)

QUESTION 2

a) A ship is dragged through a lock by means of a capstan and rope. The capstan which has a diameter of 500mm, turn at 30 rev/mins. The rope makes 3 complete turns around the capstan, « being 0.25, and at the free end of the rope a pull of 100N is applied. Determine:

i) The pull on the ship.

ii) The power required to drive the capstan **(8 marks)**

b) A belt drive consists of a V-belt working on a grooved pulley, with an angle of lap of 160^0. The cross-sectional area of the belt is $650mm^2$, the groove angle is 30^0 and « = 0.1. The density of the belt material is $1Mg/m^3$ and its maximum safe stress is $8MN/m^2$ of cross-section. Calculate the power that can be transmitted at a belt speed of 25m/s. **(12 marks)**

QUESTION 3

In the linkwork shown in Figure. Q. 3, P and Q are fixed axes. APE rotates about P and along it moves a sliding block attached the end of BQD which rotates about Q. A and B are connected by links AC and BC. AC =70mm, PE =140mm, QD = 110mm, BC = 120mm and QB = PA = 60mm.

If the velocity of E is 80mm/s and angle EPQ $=60^0$ determine the velocity of C.

(20 marks)

QUESTION 4

a) In the epicyclic speed reducing gear shown in Figure Q. 4 (a) , the input shaft A runs at 12000 rev/min and the annular wheel B is fixed. The numbers of teeth in the wheels are A, 15; C, 41; C_1, 25; B, 81.

Determine the speed of the output shaft Z.

(6 marks)

b) A compound epicyclic gear is shown in Fig. Q 4 (b). The sun wheels S_1 and S_2 are integral with the input shaft X and the annular wheel A_1 is fixed. The planet wheel P_1 rotates about a pin carried by the annulus A_2 and the planet wheel P_2 rotates about a pin attached to the arm keyed to the shaft Y. The numbers of teeth are S_1, 30; P_1, 20; P_2, 18; S_2, 32.

Determine the speed of shaft Y when shaft X rotates at 100 rev/min. **(14 marks)**

QUESTION 5

For the mechanism shown in Figure Q. 5. Link AB has an angular velocity of 10 rad/s. determine the acceleration of point C. **(20 marks)**