



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN MECHANICAL ENG.

EMG 2208 : MECHANICS OF MACHINES I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: AUGUST 2017

TIME: 2 HOURS

DATE: 18 Sep 2017

Instructions to Candidates

You should have the following for this examination

- Answer Booklet, examination pass and student ID
- Scientific Calculator
- Drawing Instruments

This paper consists of **FIVE** questions. Attempt any **THREE** questions.

Do not write on the question paper.

Question ONE

- a) (i) List any **THREE** practical of areas of application of a chain drive and briefly explain its **THREE** limiting specifications.
(ii) Illustrate a typical chain drive
(8 marks)
- b) Derive, using the usual notation, an expression for horizontal force and torque that would be experienced in a screw thread subjected to an axial force.
(6 marks)
- c) A spring is compressed by means of screw thread which is co-axial with it and bears directly on its end. The screw has a 60° V-thread, of mean diameter 48 mm and pitch 8mm. The spring has a stiffness of 35 kN/m and has been compressed initially through 80mm.

If the coefficient of friction at the screw thread is 0.1, calculate the work done on the screw in compressing the spring through a further 60mm.

(6 marks)

Question TWO

Figure 1 shows a compound epicyclic gear in which the input shaft X is connected to the sun wheel S_1 . The pinions P_1 are free to rotate on pins carried on the arm L_1 , which is connected by shaft to the sun wheel S_2 . The pinions P_2 are free to rotate on pins carried on the on the arm L_2 , which is connected to the output shaft Y. The numbers of teeth on the wheels are as follows: A_1 ;80, S_1 ;24, A_2 ;90 and S_2 ;28. If the input power is 60kW at 2000 rev/min. clockwise and the annulus A_1 is fixed, determine:

- The output speed,
- The fixing torque on the annulus A_1 by neglecting friction.

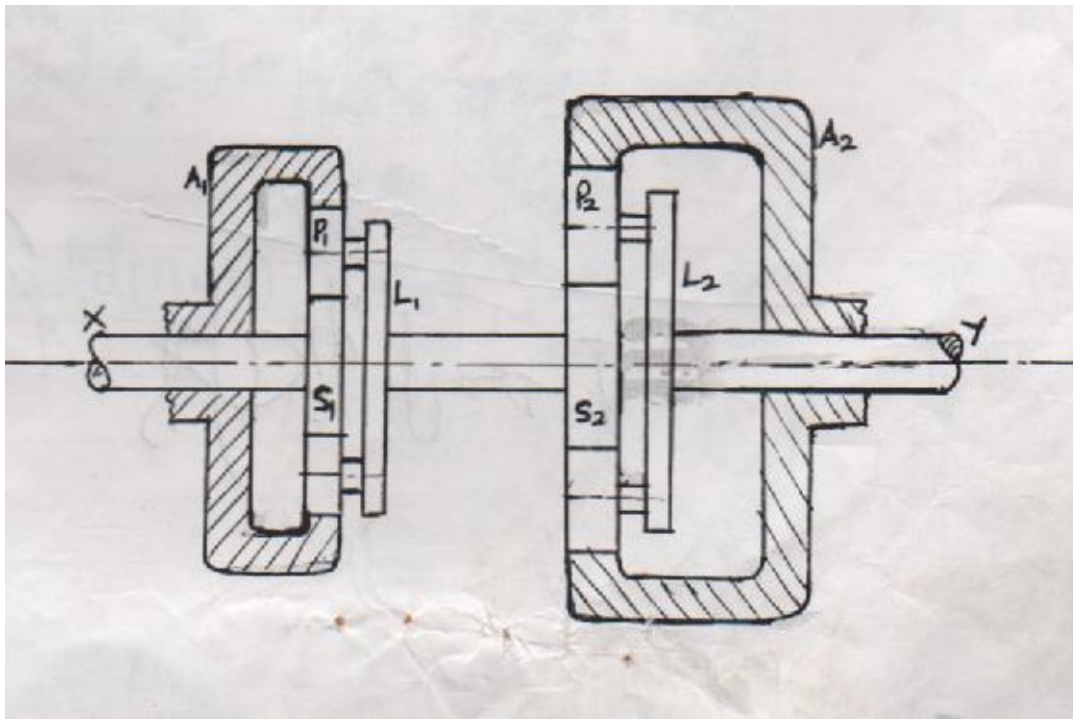


Figure 1

(20 marks)

Question THREE

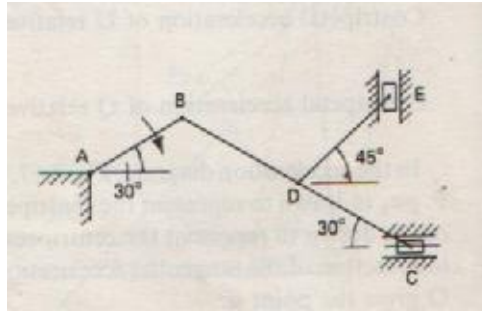
- Deduce an expression for power transmitted in a belt drive fitted with a V-grooved pulley.
- Power is transmitted from an electric motor to a machine tool by an open belt drive. The effective diameter of the pulley on the motor shaft is 150 mm, while that on the machine tool is 200 mm with a centre distance of 600 mm. If the motor speed is 1440 rev/min. and the maximum permissible belt tension is 900N, then the maximum power transmissible is 6kW. It is necessary that the power transmissible be increased to 6.75kW, using the same pulley, centre distance and motor speed. The belt is treated with a special preparation that increases its coefficient of friction by 10% of its existing value and in addition a jockey pulley may be fitted. Determine:

- (i) coefficient of friction existing
- (ii) the new angle of lap.

(20 marks)

Question FOUR

In the mechanism shown in figure 2, the crank AB is 75 mm long and rotates uniformly clockwise at 8 rad/s. Given that $BD=DC=DE$ and $BC = 300$ mm, draw the velocity and acceleration diagrams. State the velocity and acceleration of the pistons at C and E.



(20 marks)

Question FIVE

The first and third shafts of a double reduction spur gearbox are in line and a total reduction of approximately 10:1 is required. The module of the high speed pair is to be 5, that of the low speed pair is to be 8, and no wheel is to have than 20 teeth.

- (a) Calculate suitable values of the centre distance between the first and the second shafts and the numbers of teeth on the wheels so as to satisfy the above conditions.
- (b) Determine the actual gear ratio.

(20 marks)