TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of Mechanical & Automotive Engineering
UNIVERSITY EXAMINATION FOR:
Diploma in Mechanical Engineering (Y3S1)
EMR 2306 : Applied Mechanics III (Paper 2)
SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: SEPTEMBER 2018
TIME: 2 HOURS
DATE: Sep 2018

Instruction to Candidates:
You should have the following for this examination
- *Examination Pass & Student ID Card*
- *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) An epicyclical gear box (**Fig. Q1**) has a fixed sun gear *B* with 150 teeth. Gear *C* has 30 teeth and is compounded with *D* which has 30 teeth. The gear box efficiency is 55%. Calculate;
  i.   The number of teeth in *E*
  ii.   The gear box ratio
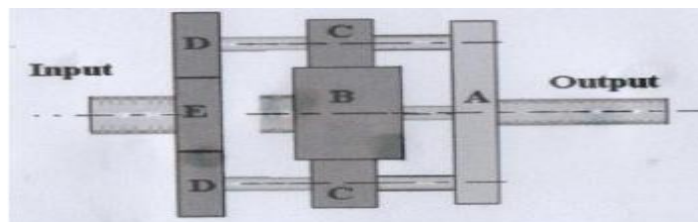 iii. The output speed and direction

   Fig. Q1

b) A single plate clutch has internal and external radii of 125 mm and 200 mm respectively. The spring load is 600 N and the coefficient of friction is 0.3.

Assuming constant pressure, determine the time required to accelerate a counter shaft of rotating mass 500 kg and radius of gyration 200 mm to full speed of 250 rpm.

(20 marks)

Question TWO

A pump is driven by an electric motor through an open type flat belt drive. Determine the belt specifications for the following data:

Motor pulley diameter (d_S) = 300 mm, Pump pulley diameter (d_L) = 600 mm

Coefficient of friction (μ_S) for motor pulley = 0.25

Coefficient of friction (μ_L) for pump pulley = 0.20

Center distance between the pulleys = 1000 mm; Rotational speed of the motor = 1440 rpm; Power transmission = 20 kW; density of belt material (ρ) = 1000 kg/m^3 allowable stress for the belt material (σ) = 2 MPa; thickness of the belt = 5mm.

(20 marks)

Question THREE

a) A cone clutch has n included angle of 120°. The outer and inner diameters are 80 mm and 20 mm respectively. Calculate the force required to press the two halves together if it is to transmit 200 W at 600 rev/min. The coefficient of friction is 0.3. Use both uniform wear theory and uniform pressure theory.

b) A gear box has an input speed of 1500 rev/min clockwise and an output speed of 300rev/min anticlockwise. The input shaft power is 20 kW and the efficiency is 70%. Calculate: the gear ratio, the input toque, the output torque and the holding torque.

(20 marks)

Question FOUR

A plate clutch having a single driving plate with contact surfaces on each side is required to transmit 110 kW at 1250 rev/min. The outer diameter of the contact surfaces is to be 300 mm. The coefficient of friction is 0.4.

a) Assuming a uniform pressure of 0.17 N/mm²; determine the inner diameter of the friction surfaces.

b) Assuming the same dimensions and the same total axial thrust, determine the maximum torque that can be transmitted and the maximum intensity of pressure when uniform wear conditions have been reached.

(20 Marks)

Question FIVE

Two parallel shafts, about 600 mm apart are to be connected by spur gears. One shaft is to run at 360 rev/min and the other at 120 rev/min. Design the gears, if the circular pitch is to be 25 mm.

(20 marks)