## TECHNICAL UNIVERSITY OF MOMBASA

## FACULTY OF ENGINEERING AND TECHNOLOGY

## DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

## UNIVERSITY EXAMINATION FOR (SCHOOL BASED):

## BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

## EMG 2311: DESIGN OF TRANSMISSION SYSTEMS

## END OF SEMESTER EXAMINATION

## SERIES: AUGUST 2017

## TIME: 2 HOURS

## DATE: Pick Date July 2017

**Instructions to Candidates**
You should have the following for this examination
    -*Answer Booklet, examination pass and student ID Pocket Calculator*
This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.
**Do not write on the question paper.**

---

**Question ONE**

a) With the help of diagrams explain the differences between a spiral and square jaw clutch.      **(6 marks)**

b) Sketch and give the formulae used for the design of a compression helical spring of rectangular section.
**(10marks)**

c) Sketch out and give the various classification of bearings                                                              **(8 marks)**

d)  A steel shaft is to transmit 20kW at 400 rpm. The ultimate shear stress for the steel may be taken as 320MPa and a factor of safety as 6. Determine the diameter of the shaft if it were:

  i.    The shaft was solid

  ii.    The shaft was hollow with the ratio of diameters being 0.6                                    **(6 marks)**

**Question TWO**

a) Derive the formula for shaft design for a shaft experiencing combined twisting and bending moments

**(10 marks)**

b) List 6 designs that are used in power transmission systems **(6marks)**

c) Discuss the rated life of a bearing and the life modification factors used to adjust bearing life.

**(4marks)**

**Question THREE**

**a)** List various important factors used in the selection of a belt drive. **(6 marks)**

**b)** Discuss the design of a single disk clutch considering uniform pressure and uniform wear **(14 marks)**

**Question FOUR (20 marks)**

**a)** Discuss similarities and differences of the cylindrical roller and tapered bearing **(4 marks)**

**b)** Explain the process of bearing type selection when already knowing the bore size and life. **(5 marks)**

c) Discuss material selection as a method used for corrosion prevention. **(5marks)**
d) A compression coil spring made of an alloy steel is having the following specifications: mean diameter D=50mm, wire diameter d= 5mm, number of active coils =20 &G =80 GPa. If the spring is subjected to an axial load of 500N; Calculate the maximum shear stress to which the spring material is subjected and the deflection per active coil. **(6 marks)**

**Question FIVE**

A spring closed thrustor operated double shoe brake is to be designed for a maximum torque capacity of 3000Nm. The brake drum diameter is not to exceed 1 meter and the shoes are to be lined with Ferrodo having a coefficient of friction of 0.3. The other dimensions are as shown below:



All dimensions in mm.
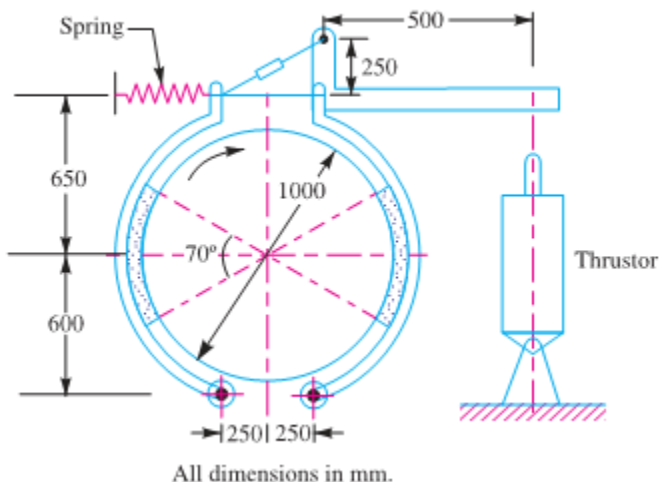
i) Find the spring force necessary to set the brake .

ii) If the permissible stress of the spring material is 500MPa, determine the dimensions of the coil assuming the spring index to be 6. The maximum spring force is to be 1.3 times the spring force requires during braking. There are eight active coils. Specify the length of the spring enclosed in the position of the brake. Modulus of rigidity is 80kN/mm$^2$.

iii) Find the width of the brake shoes if the bearing pressure on the lining material is not to exceed 0.5MPa.

iv) Calculate the force required to be exerted by the thrustor to release the brake.

**(20 marks)**