NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT OF TECHNICAL AND ENGINEERING EDUCATION AND TRAINING

ENGINEERING DESIGN

PTE 2245

Main Examination Paper

May 2019

This examination paper consists of 3 pages

Time Allowed:	**3 hours**
Total Marks:	**100**
Special Requirements:	**Nil**
Examiner's Name:	**Eng B. Sarema**

INSTRUCTIONS AND INFORMATION TO CANDIDATE

1. Answer any four (4) questions
2. Each question carries 25 marks
3. There are six (6) questions
4. Use of calculators is permissible

QUESTION 1

Outline how you would use the phases of engineering design to solve a "stated problem" of your choice [25]

QUESTION 2

A steel shaft transmits 20 kW at 200 r.p.m. It carries a central load of 900 N and is simply supported between the bearings which are 2.5 m apart. Determine the size of the shaft if the allowable shear stress is 42 MPa and the maximum tensile or compressive stress is limited to 56 MPa. [25]

QUESTION 3

Derive and explain the condition for self-locking for a square threaded power screw

[25]

QUESTION 4

A crossed belt is to transmit 15 kW at 1000 RPM of the smaller pulley. The smaller pulley has a diameter of 250 mm; the velocity ratio is 2; and centre distance is 1.25 m. A flat belt 6 mm thick with an expected coefficient of friction 0.3 is to be used. If the maximum allowable stress in the belt is 1.7 MPa and the belt width is 95 mm, how many belts should be used to achieve the required power. The density of leather may be taken as 970 kg/m^3.

[25]

QUESTION 5

The gear train of a machine tool is shown in Figure Q5. The motor shaft is connected to gear A and rotates at 975 RPM. The gear wheels B, C, D and E are fixed to parallel shafts rotating together. The final gear F is fixed on the output shaft. Determine the output speed of the setup given the numbers of teeth on each gear are as given in Table Q5. [25]

Table Q5: Number of teeth on each gear

Gear	*A*	*B*	*C*	*D*	*E*	*F*
No. of teeth	*20*	*50*	*25*	*75*	*26*	*65*

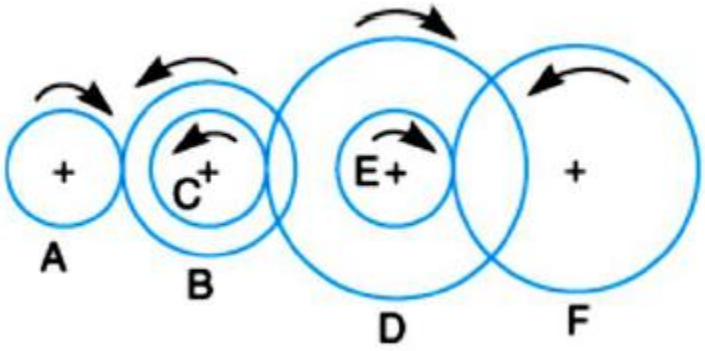

Figure Q5: Gear Train

QUESTION 6

(a) Explain the differences and similarities between braking and clutching systems [8]

(b) With the aid of sketches distinguish between a Radial braking system and an Axial braking system [8]

(c) Discuss the factors to be considered when selecting material for brake lining [9]