THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL

DIPLOMA IN TECHNICAL EDUCATION EXAMINATION

789 METAL WORKING AND MECHANICAL PRACTICE

(SUPPLEMENTARY)

Time: 3 Hours. **Year: 2001**

Instructions

1. This paper consists of **eight (8)** questions.
2. Answer any **five (5)** questions.
3. Each question carries **twenty (20)** marks.
4. Non-programmable calculators may be used.
5. Communication devices, programmable calculators and any unauthorized materials are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s).

1. (a) (i) Define the lathe operation called 'boring'.

   (ii) Explain the function of the Apron mechanism on a centre lathe.

   (iii) Identify four essential functions of the carriage assembly on a centre lathe.

   (b) Differentiate between the 'lead screw' and the 'feed rod' on a lathe machine.

   (c) Outline the steps required to safely perform a knurling operation on a lathe.

2. (a) State four specific requirements for securely mounting a workpiece in a four-jaw independent chuck.

   (b) Explain the term 'centre drilling' and its importance before the main drilling operation on a lathe.

   (c) Outline the procedure for aligning the tailstock of a centre lathe to correct for a taper error.

3. (a) (i) Define the terms 'feed' and 'depth of cut' with reference to lathe operations.

   (ii) Describe the phenomenon of tool chatter and state two ways to minimize its occurrence.

   (iii) Differentiate between roughing cuts and finishing cuts.

   (c) State three purposes of performing a facing operation on a lathe.

4. (a) Give the functions of the following lathe accessories:

   (i) The steady rest

   (ii) The follower rest

   (iii) The chasing dial

   (iv) The machine spindle

(b) Briefly describe how to determine the correct clearance angle for a cutting tool based on the material being machined.

(c) Outline four safety precautions specific to working around a rotating lathe chuck.

5. (a) (i) Define the operation of 'reaming'.

(ii) Explain the difference between a parallel shank reamer and a taper shank reamer.

(iii) Outline the four main steps for the correct procedure of sharpening a twist drill.

(b) Give three reasons why excessive drill speed can be detrimental to the drill bit and the workpiece.

(c) What is the function of the pilot on a counterbore tool?

6. (a) Explain the concept of 'runout' in a rotating machine spindle.

(b) (i) Define the terms 'limit' and 'tolerance' in engineering design.

(ii) Explain the importance of keyways and state two common types of keys used in power transmission.

(c) State three different types of fit (clearance, transition, and interference) that can exist between two mating parts.

7. (a) Outline three basic types of chip produced when cutting metals.

(b) Explain the primary function of a cutting fluid (coolant) in machining.

(c) State four criteria for selecting the correct cutting fluid for a turning operation.

8. (a) A 30 mm diameter bar is being turned at 400 r.p.m. with a feed of 0.15 mm/rev. Calculate the metal removal rate (MRR) in mm^3/min, assuming a depth of cut of 2 mm.

(b) Calculate the feed per tooth in mm/tooth if a 12 tooth milling cutter is running at 100 r.p.m. and the table feed rate is set to 180 mm/min.

(c) Calculate the rotational speed (N) in r.p.m. required to machine a 50 mm diameter bar with a cutting speed of 150 m/min. (Take π=3.14).