DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY

UNIVERSITY EXAMINATIONS FOR ACADEMIC YEAR 2021/2022

FIRST YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN ELECTRICAL & ELECTRONIC ENGINEERING, BED TECH IN ELECTRICAL & ELECTRONIC ENGINEERING & BACHELOR OF SCIENCE IN TELECOMMUNICATION AND INFORMATION ENGINEERING

EME 1102: WORKSHOP PRACTICE I

DATE: OCTOBER 2021 TIME: 2HRS

INSTRUCTIONS

1. The paper has **FIVE** questions
2. Attempt **QUESTION 1** and **ANY OTHER TWO** Questions

QUESTION 1 (Compulsory) 30 Marks

a) With the aid of a sketch, describe the working principle of Gang drilling machine. **[4mks]**

a)

i. Define tool life. **[2mks]**

ii. The lives of two tools are governed by Euler equations $\mathbf{VT^{0.25}=8.0}$ and $\mathbf{VT^{0.125}=3}$ respectively in a machining operation where V is the cutting speed in m/s while T is the tool life in seconds. Find out the speed (V_o) at which both tools have the same life and also calculate their corresponding tool lives. **[6mks]**

b)

i. List four types of lathe machines. **[2mks]**

ii. How much machining time will it take to reduce the diameter of a shaft from 20 mm to 10 mm over a length of 100 mm long, in a single pass straight turning operation? Assume the

following: feed, S_o=0.2 mm/rev and cutting velocity, V=1000 mm/min, approach, A=2 mm and overrun, O=2 mm. **[4mks]**

c) A machinist working on a horizontal milling machine wishes to face mill the top of an aluminum block, 200 mm length by 40 mm width using a 40 mm width mill cutter. Using the following values: cutting velocity (**V_C**), 100m/min, feed (**f**), 0.25 mm/tooth, number of teeth on the cutter, 5. determine:

i. Spindle speed (RPM) **[1mks]**

ii. Feed rate (F_R) **[1.5mks]**

iii. Time to machine (T_C) **[1.5mks]**

d)

i. Define welding process. **[2mks]**

ii. Describe four conditions necessary for obtaining a quality weld. **[4mks]**

e) List four types of rivets used for general application. **[2mks]**

QUESTION 2 (20 marks)

a) Briefly describe the general provisions of Occupational Health and Safety Act (OSHA) for the health, safety and welfare of persons employed, and all persons lawfully present at workplaces. **[6mks]**

b) A welder using TIG process to butt weld a stainless-steel sheet of thickness 2 mm sets the current at 30A. The arc length is 2 mm and the voltage in the Argon gas acting as a shield is 24V. Taking the weld travel speed to be 120 mm/min, determine the arc energy. **[2mks]**

c) A 100 mm long, 30 mm diameter mild steel shaft is reduced to 20 mm diameter in a single pass straight turning operation. If the feed, f=0.78125 mm/rev and cutting velocity, V=36 m/min, Approach (A) and overrun (O)=5mm each. Determine:

i. Spindle speed (N) **[1.5mks]**

ii. Feed rate (Fr) **[1.5mks]**

iii. Material removal rate (MRR) **[1.5mks]**

iv. Machining time (T_c) **[1.5mks]**

d) Using well labeled diagrams, describe Up/Conventional and Down/Climb milling processes. **[6mks]**

QUESTION 3 (20 marks)

b) State four major causes of accidents in workplaces. **[4mks]**

c) State four differences between drilling and reaming? **[2mks]**

d) Calculate the specific power and unit power in a turning process given the following data: **[5mks]**

- Workpiece diameter: 50mm
- Cutting velocity: 40 m/min
- Feed:0.24 mm/sec
- Depth of cut: 1.8 mm
- Tangential component of the force: 800N

e) Giving two examples for each type, describe the following welding methods: Resistance welding, Gas welding, Solid State welding and Arc welding. **[9mks]**

QUESTION 4 (20 marks)

a) Briefly describe the difference between self-centering and independent jaws chuck as work piece holding tools on a lathe machine. **[3mks]**

b) Describe two factors that affect cutting tool life. **[4mks]**

c) Determine the time required to drill a through hole of diameter 20 mm to a depth of 100mm in a mild steel solid block by HSS twist drill of 120^0 cone angle. Assume the following values: Cutting Velocity, V_C=40 m/min, drill feed, S_o=0.20 mm/rev and approach, A=5.0 mm. **[6mks]**

d) A metal workpiece is being machined at cutting velocity (V_c)=20 m/min. The machining power is found to be 2 kW. Machining process feed rate (f_r)=0.2 mm/rev, and depth of cut (d)=0.5 mm. Determine:

i. The main cutting force in Newtons (N) **[2mk]**

ii. The specific cutting energy in N/mm^2 **[1.5mk]**

iii. The necessary machining time required if the diameter of the machined bar is diameter (D)=60 mm and its length (L)=300 mm **[3.5mk]**

QUESTION 5 (20 marks)

a) Briefly describe three common filing methods. **[6mks]**

b) The figure (fig 5b) below shows a cylindrical storage vessel that has been fabricated from a 2mm steel plate. Briefly describe the most suitable welding methods for the joints shown. **[3mks]**

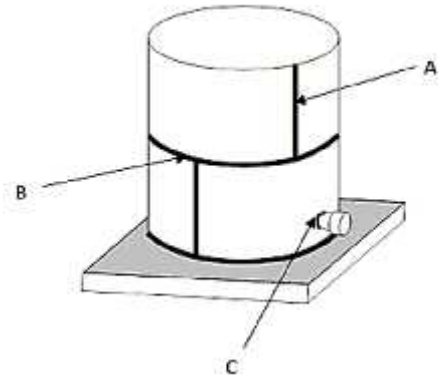

Fig 5b

c) Determine the time (T_m) required to carry out peripheral milling operation on the workpiece below (Fig 5c). Also determine the material removal rate (MRR) for the operation. The workpiece width (W) is 50mm, the cutting velocity, V_C is 60m/min, and the milling cutter teeth number (n_t) is 20 and feed (f)=0.0125mm. **[6mks]**

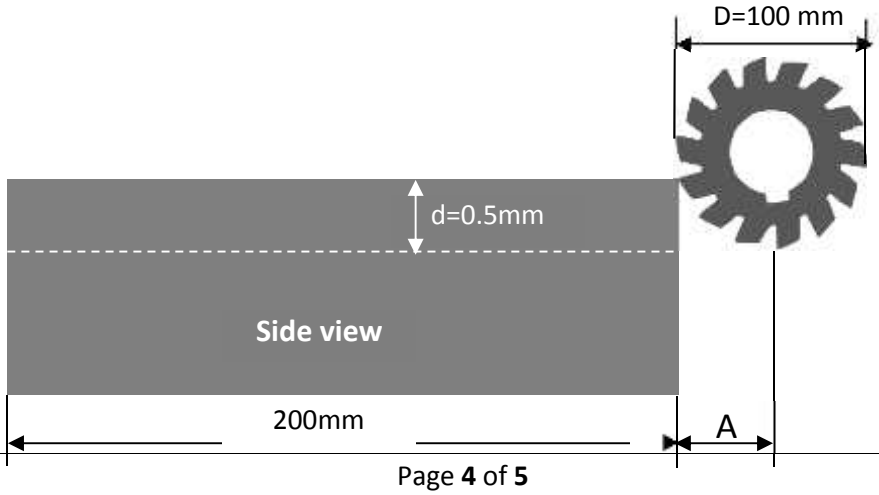

Fig 5c

d) With the aid of well labeled diagrams, describe how step-turning machining process is carried out using a lathe machine. **[5mks]**