UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 3 Examination in Engineering: February 2023

Module Number: ME3203 **Module Name: Manufacturing Processes and Practices**

[Three Hours]

[Answer **all questions**, each question carries **eight** marks]

(State the assumptions where necessary and do the calculations stating the units)

Q1. Low carbon steel having a tensile strength of 300 MPa and a shear strength of 220 MPa is cut in a turning operation with a cutting speed of 3.0 m/s. Uncut chip thickness is 0.20 mm and the chip width 3.0 mm. The rake angle of the tool is 5° in the direction of chip flow. The resulting cutting ratio is 0.45. The coefficient of friction between the tool and chip is 0.9.

a) Determine the shear plane angle.

[2.0 Marks]

b) Calculate the shear force.

[2.0 Marks]

c) Determine the shear strain.

[1.5 Marks]

d) Determine the cutting force.

[2.5 Marks]

Q2. a) Name and briefly describe the four types of chips that occur in metal cutting.

[2.0 Marks]

b) Explain the modes of tool failures.

[2.5 Marks]

c) Derive an expression for the "total cost per piece" during turning operation.

[2.0 Marks]

d) Using the above derived expression, derive an expression for tool life for minimum cost per piece.

[1.5 Marks]

Q3. a) "Ductility is an essential requirement of a material for a particular metal forming process". Do you agree or disagree with this statement? Explain your idea.

[3.0 Marks]

b) Briefly explain the difference between "Prototype" and "Product"

[1.5 Marks]

c) Compare and contrast the industrial manufacturing processes with respect to "mass conservation" and "mass change" with the aid of suitable examples

[2.0 Marks]

d) Draw a schematic diagram to represent the general industrial manufacturing process

[1.5 Marks]

Q4. a) Write a short description using the following terms which are keywords in a particular moulding process

I. Mould
II. Core
III. Cavity
IV. Sprue
V. Runners
VI. Gates

[3.0 Marks]

b) Identify the three zones of a welding flame in gas welding and briefly explain their importance on combustion

[1.5 Marks]

c) Describe the utilization of reducing, neutral and oxidizing flames on gas welding according to the behaviour of different metals with examples

[2.0 Marks]

d) Briefly explain the difference between "Brazing" and "Soldering" processes

[1.5 Marks]

Q5. a) "Most of the unconventional machining processes are operated according to the concept of electrochemical cells". Briefly explain this statement

[1.5 Marks]

b) Electrochemical cells are categorized into two types as "Galvanic cells" and "Electrolytic cells". Distinguish between these two types

[2.5 Marks]

c) Write a short description about "Electro Chemical Machining (ECM)" including the process concept, the layout and the benefits among other similar processes

[2.0 Marks]

d) In a glove manufacturing firm, laboratory staff has to insert ceramic formers (moulds) into an oven at 100°C after dipping in a rubber latex compound which consists of ammonia as a major constituent. Imagine you are the laboratory manager of the firm and list out the required personal protective equipment with reasons.

[2.0 Marks]