



## UNIVERSITY OF RUHUNA

### Faculty of Engineering

End-Semester 3 Examination in Engineering: July 2022

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. Select the correct answer for following questions and write the number relevant to the correct answer in your answer book.
- a) In orthogonal cutting operation, the chip thickness and the uncut chip thickness are equal to 0.35 mm. If the tool rake angle is zero degrees, the shear angle is,
- 30°
  - 45°
  - 18°
  - 60°
- b) A built-up edge is formed while machining
- Ductile material at high speed
  - Brittle material at high speed
  - Ductile material at low speed
  - Brittle material at low speed
- c) Cutting tool is much harder than the workpiece. Yet the tool wears out during the tool-work interaction, because
- Extra hardness is imparted to the workpiece due to coolant used
  - Oxide layers on the workpiece surface impart extra hardness to it
  - Extra hardness is imparted to the workpiece due to severe rate of strain
  - Vibration of induced in the machine tool
- d) In ECM the material removal is due to
- Corrosion
  - Erosion
  - Fusion
  - Ion displacement

- e) An orthogonal cutting operation is being carried out under the following conditions: Cutting speed = 2 m/sec, Depth of cut=0.5 mm, Chip thickness = 0.6 mm. What is the chip velocity?
- 2 m/sec
  - 2.4 m/sec
  - 1 m/sec
  - 1.66 m/sec
- f) In a machining test, a cutting speed of 100 m/min indicated the tool life as 16 min and a cutting speed of 200 m/min indicated the tool life as 4 min. The values of  $n$  and  $C$  are,
- 0.5 and 200
  - 0.25 and 200
  - 0.5 and 400
  - 0.25 and 400
- g) In wire cut EDM process the necessary conditions that have to be met for making a successful cut are that
- Wire and sample are electrically non-conducting
  - Wire and sample are electrically conducting
  - Wire is electrically conducting, and sample is electrically non-conducting
  - Sample is electrically conducting, and wire is electrically non-conducting
- h) Continuous chips are formed during metal cutting operation due to
- ductile work materials
  - large rake angle
  - high cutting speed
  - all of the above

[8.0 Marks]

- Q2. a) The rake angle in an orthogonal cutting operation is  $12^\circ$ . The chip thickness before the cut 0.30 mm, and the resulting chip thickness after the cut 0.70 mm. Calculate
- the shear plane angle and
  - the shear strain for the operation.

[4.0 Marks]

- b) In question Q2 (a) suppose the rake angle were changed to  $0^\circ$ . If the friction angle remains the same, determine
- the shear plane angle,
  - the chip thickness, and
  - the shear strain for the operation.

[4.0 Marks]

- Q3. a) Derive expressions for cutting velocity that will yield a minimum cost per piece and tool life for minimum cost per piece.

[4.0 Marks]

- b) In a machine shop 50 similar work pieces to be milled in a vertical milling machine. In each piece 200 mm length to be milled with a 4cm diameter cutter having 37 teeth. The cutter rotates at a speed of 1000 rpm and the feed rate per tooth is 2mm per tooth per revolution. The following parameters are known.

Machine operator's rate Rs 70 per hour

Machine department's overhead rate Rs 120 per hour

Cost of cutter Rs 6000

Number of possible regrinds 20

Tool changing time 3 min

Idle time 3 min

Tool grinding time 10 min

Machine setting up time 20 min

$VT^{0.2}=350$  (where V is in m/min)

Determine the cutting velocity that will yield a minimum

- i) cost per piece and
- ii) tool life for minimum cost per piece.

[4.0 Marks]

- Q4. a) What is the difference between hazard and risk? Explain by means of two (02) examples.

[2.0 Marks]

- b) List four (04) articles of personal protective equipment that should be worn by workers involve in lath (machining) operation? Explain the function of each article.

[2.0 Marks]

- c) Steamy environment can be hazardous, give five reasons why this is so?

[2.0 Marks]

- d) How often should a machine be cleaned? And how do you carry out this task in your workshop? Explain the things by giving an example machine.

[2.0 Marks]

- Q5. a) What is meant by a "Joining Process"? Classify them.

[2.0 Marks]

- b) State the types of flames used in gas welding, sketch them and state their applications.

[3.0 Marks]

- c) Briefly explain the working principle of the Shielded Metal Arc Welding (SMAW) with neat sketches and mention its applications.

[3.0 Marks]