



# UNIVERSITY OF RUHUNA

## Faculty of Engineering

End-Semester 4 Examination in Engineering: November 2017

Module Number: ME4303

Module Name: Manufacturing Engineering

[Three Hours]

[Answer all questions, each question carries 12 marks]

State the assumptions where necessary and do the calculations stating the units. All the notations have usual meanings.

- Q1. a) Define the single-point and multi-point cutting tools with appropriate examples. [2.0 Marks]
- b) Clearly state three grades of High Speed Steel (HSS) tools and their recommended applications. [2.5 Marks]
- c) Briefly explain the formation of Built Up Edge (BUE) chips during machining with aid of clear sketches. [2.5 Marks]
- d) Explain the "Broaching" operation with aid of clear sketches. [2.5 Marks]
- e) Describe two mechanisms that cause wear at the tool-chip and tool-work interfaces in machining. [2.5 Marks]
- Q2. a) Clearly state the difference between threading and tapping. [2.0 Marks]
- b) None of the four force components  $F$ ,  $N$ ,  $N_s$  and  $S$  can be directly measured in a machining operation. However the force components  $F_v$  and  $F_t$  acting against the tool can be measured by using a force measuring device called dynamometer.
- I. Define the forces denotes by  $F$ ,  $N$ ,  $N_s$ ,  $S$ ,  $F_v$  and  $F_t$ . [2.0 Marks]
- II. With aid of a force diagram show the geometric relationship between forces and derive equations for the forces of  $F$ ,  $N$ ,  $N_s$  and  $S$ . [2.0 Marks]
- III. With aid of suitable sketches show that the shear angle on shear plane is equal:

$$\phi = \frac{\pi}{4} - \frac{(\beta - \alpha)}{2}$$

[2.0 Marks]

- c) The cutting force and thrust force in an orthogonal cutting operation are 1470 N and 1589 N respectively. The rake angle is  $5^\circ$  and width of the cut is 5 mm. The chip thickness before the cut is 0.6 mm and the chip thickness ratio is 0.38.

Determine,

- I. The shear angle of the work-tool interface.

[1.5 Marks]

- II. The coefficient of friction in the operation.

[2.5 Marks]

- Q3. a) List four principal criteria that can be used to select a cutting fluid for a machining operation.

[2.0 Marks]

- b) Briefly describe advantages and disadvantages of Electro Discharge Machining (EDM).

[2.0 Marks]

- c) Explain the working principle of Plasma Arc Machining (PAM) with aid of suitable sketches.

[3.0 Marks]

- d) In a turning operation, the work part is 125 mm in diameter and 300 mm long. A feed of 0.225 mm/rev is used in the operation. If cutting speed = 3.0 m/s, the tool must be changed every 5 work parts; but if cutting speed = 2.0 m/s, the tool can be used to produce 25 pieces between tool changes. Determine the Taylor tool life equation for this job.

[5.0 Marks]

- Q4. a) Explain with suitable examples, why the pattern is different from casting?

[1.5 Marks]

- b) Describe with neat sketches, the design steps in casting process.

[2.0 Marks]

- c) I. Explain in detail, what do you understand by classification of welding processes?

- II. What are the limitations and advantages of each process?

[2.5 Marks]

- d) How is an arc obtained in arc welding?

[1.5 Marks]

- e) I. What is meant by "Powder metallurgy"?

- II. Discuss the applications of powder metallurgy.

[1.5 Marks]

- f) Describe briefly the various powder production methods.

[1.5 Marks]

- g) Explain the different properties of the metal powder suitable for powder metallurgy process.

[1.5 Marks]

Q5. Explain any three of the following manufacturing processes with aid of neat sketches. Your each explanation should consist of working principle, advantages and limitations.

- a) Notching
- b) Brazing
- c) Shape Rolling
- d) Laser Welding
- e) Electron Beam Welding

[12.0 Marks]