

# NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

## FACULTY OF INDUSTRIAL TECHNOLOGY

### DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING

#### FEBRUARY 2010 EXAMINATIONS

Degree of Bachelor of Engineering Honours: Part 5

### MANUFACTURING PROCESSES: TIE 5103

Time allowed: 3 hours

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#### *INSTRUCTIONS TO CANDIDATES*

*Answer ANY FIVE questions. Each question carries 20 marks.*

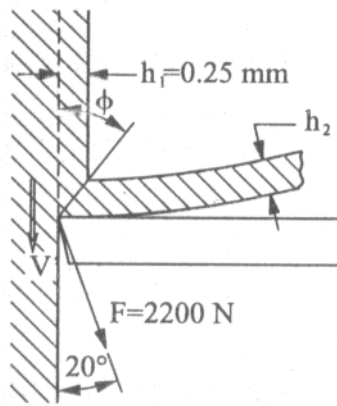
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**Q1** The cutting operation shown in Fig Q1 has the following characteristics:

$b = 5$  mm,  $\phi = 28^\circ$ , rake angle  $\alpha = 0^\circ$  and cutting speed  $v = 3$  m/s.

Determine

- (a) The deformed chip thickness. [5]
- (b) The shearing velocity  $v_s$  and the chip velocity  $v_c$ .  
Sketch the hodograph. [5]
- (c) The shearing force  $F_s$  and the shearing power  $P_s$ . [5]
- (d) The friction force  $F_f$  and power  $P_f$ . [5]



**Fig Q1**

- Q2**
- (a) One of the principal cutting parameters in a machining operation is the cutting tool. Name any other 5. [5]
  - (b) What are the basic requirements for cutting tool materials? [6]
  - (c) What is a “built-up edge”, and under what conditions does it occur? [5]
  - (d) How does “built-up edge” affect the cutting operation and the tool wear rate? [4]
- Q3.**
- (a) Describe, with the aid of sketches, rotational moulding of plastics. [6]
  - (b) With the aid of diagrams, describe
    - i) the extrusion dies and [3]
    - ii) the processes for wire coating and for sheet forming. [3]
  - (c) What special process is used for making thin sheet (film). [4]
  - (d) Name and describe the process that is used for making plastic bottles. [4]
- Q4.**
- (a) Name the three forms of tool wear? [3]
  - (b) Describe, briefly, how each of the forms of tool wear develops [6]
  - (c) Diffusion is one of the five most common mechanisms that contribute to tool wear. Name the other four mechanisms. [4]
  - (d) Describe the process of diffusion as a mechanism in tool wear. [7]
- Q5.**
- (a) Which two properties of polymers in general are most decisive in choosing the methods for processing them into usable shapes? [6]
  - (b) What is the main conceptual difference in processing thermoplastics versus thermosets? [4]
  - (c) How does this difference affect the process of extrusion and injection moulding? [5]
  - (d) What is the difference in the design of the injection moulding screw for each case? [5]

- Q6.** (a) Describe the steps involved in producing components from metal powders using the die compaction technique. [12]  
(b) List four, machine parts (of any machine) that in your opinion would be best manufactured using powder technology techniques. With the aid of diagrams, where appropriate, give technical and economic reasons for your answer. [8]
- Q7.** (a) Give six principal parameters of powder metallurgy. Explain how these parameters affect the structure and mechanical properties of the part. [12]  
(b) Give, with brief explanations, issues to keep in mind when designing parts to be manufactured using powder metallurgy techniques. [8]

**END OF EXAMINATION**