

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING

Bachelor of Engineering (Hons) Degree Industrial and Manufacturing Engineering

MANUFACTURING SYSTEMS I

TIE 5103

FIRST SEMESTER SUPPLEMENTARY EXAMINATION

DECEMBER 2014

This examination paper consists of 4 pages

ours

Total Marks: 100

Special Requirements: Nil

Examiner's Name: Eng. M. Makhurane

INSTRUCTIONS AND INFORMATION TO CANDIDATES

- 1. Answer any five (5) questions
- 2. Each question carries 20 marks

MARK ALLOCATION

QUESTION	MARKS
1.	20
2.	20
3.	20
4.	20
5.	20
6	20
7	20
TOTAL	100

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QUESTION 1

a) b)	What are the 3 basic categories of material removal processes? How different are the each other? A hole is being drilled in a block of magnesium alloy with a 15-mm drill bit at a feed mm/rev and with the spindle running at N = 1200 rpm. Calculate i. material-removal rate ii. Torque on the drill	y from [8] of 0.5 [4] [8]	
QU	UESTION 2		
a)	Describe Hot Isostatic Pressing (HIP) discuss what advantages it has over convention pressing methods	nal [8]	
b)	There are various methods of metal powder production for Powder Metallurgy. Use well labeled diagrams to illustrate and explain the following atomization methods		
	i) Gas atomization	[4]	
	ii) Centrifugal Atomization	[4]	
	iii) Water Atomisation	[4]	
QU	UESTION 3		
Ex	plain in detail how the following chips are formed		
	i. Continuous chipii. Continuous with built edgeiii. Discontinuous chipiv. Serrated chip	[5] [5] [5] [5]	
QU	UESTION 4		
a)	Show a clear illustration of the Injection Molding process.	[8]	
b)	A cylindrical work bar with 45 mm diameter and 520 mm length is chucked in an engine lathe and supported at the opposite end using a live center. A 46.0mm portion of the length is to be turned to a diameter of 42.5 mm one pass at a speed of 13500 mm/min. The metal		

to be turned to a diameter of 42.5 mm one pass at a speed of 13500 mm/min. The metal removal rate should be 67.5 mm^3/min . Determine the

i.	required depth of cut,	[4]
ii.	required feed,	[4]
iii.	cutting time.	[4]

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QUESTION 5

a) Discuss the following operations in material removal

i.	Honing	[2]
ii.	Boring	[2]
iii.	Counter boring	[2]
iv.	Broaching	[2]

b) Discuss the reasons why orthogonal cutting is important in the engineering analysis of cutting
[4]

c) Discuss four (4) disadvantages of the Powder Metallurgy process [8]

QUESTION 6

a) In a production turning operation, the foreman has decreed that a single pass must be completed on the cylindrical work-piece in 5.0 min. The piece is 400 mm long and 150 mm in diameter. Using a feed of 0.30 mm/rev and a depth of cut 4.0 mm, what cutting speed must be used to meet this machining time requirement? [8]

b) A two-spindle drill simultaneously drills a 1.25cm hole and a 2cm hole through a work-piece that is 2.5mm thick. Both drills are twist drills with point angles of 118°. Cutting speed for the material is 7500mm/min. The rotational speed of each spindle can be set individually. The feed rate for both holes must be set to the same value because the two spindles lower at the same rate. The feed rate is set so the total metal removal rate does not exceed 3.2cm² /min. Determine

i.	the maximum feed rate (cm/min) that can be used,	[4]
ii.	the individual feeds (cm/rev) that result for each hole,	[4]
iii.	the time required to drill the holes.	[4]

QUESTION 7

- a) A peripheral milling operation is performed on the top surface of a rectangular work-part which is 400 mm long by 60 mm wide. The milling cutter, which is 80 mm in diameter and has five teeth, overhangs the width of the part on both sides. Cutting speed is 70 m/min, chip load is 0.25 mm/tooth, and depth of cut is 5.0 mm. Determine
 - i. the actual machining time to make one pass across the surface [4]
 - ii. the maximum material removal rate during the cut. [4]

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b) Name and discuss the processes in Figure Q7

Figure Q7

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