NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING

MASTER OF ENGINEERING IN MANUFACTURING ENGINEERING AND OPERATIONS MANAGEMENT

MANUFACTURING TECHNOLOGY

TIE 6122

First Semester Main Examination Paper

December 2014

This examination paper consists of 5 printed pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: None

Examiners' Names: Dr Zwelibanzi B. Dlodlo and Mr Nicholas Tayisepi

INSTRUCTIONS AND INFORMATION TO CANDIDATE

1. Answer four (4) questions altogether. Choose two (2) questions from each Section A and B
2. Each question carries 25 marks
3. Use of calculators is permissible

MARK ALLOCATION

QUESTION	MARKS
1.	**25**
2.	**25**
3.	**25**
4.	**25**
5.	**25**
6.	**25**
TOTAL MARKS ATTAINABLE BY CANDIDATE	**100**

SECTION A

Answer two (2) questions from this Section

Question 1

(a) In a production turning operation, the foreman has decided that a single pass must be completed on a cylindrical workpiece in 5.0 min. The piece is 400 mm long and 150 mm in diameter. Using a feed = 0.30 mm/rev and a depth of cut = 4.0 mm, what cutting speed must be used to meet this machining time requirement? [5]

(b) Explain the main lathe machining process cut types with the aid of illustrative sketches. [10]

(c) Briefly outline the work holding methods used on a lathe machine. [5]

(d) Selection of cutting tool materials is very important in metal machining processes. Briefly explain the properties which cutting tools should possess. [5]

Question 2

(a) In a turning operation on stainless steel with hardness = 200 HB, the cutting speed = 200 m/min, feed = 0.25 mm/rev, and depth of cut = 7.5 mm. How much power will the lathe draw in performing this operation if its mechanical efficiency = 90% and the specific energy = 2.8 J/mm^3? [4]

(b) Briefly discuss why different cutting speeds should be used when machining different metals? [6]

(c) Which are the factors that affect cutting speeds during the milling machining process? [4]

(d) If a 50 mm diameter, 6 tooth milling cutter is turning at 100 revolutions per minute (RPM), what is the calculated cutting speed of the cutter (SFPM)? [5]

(e) Proffer brief explanations how the cutting speed (v_c) against specific cutting pressure (P_s) plot would assume the shape of the graphical expression as shown in Figure Q2. [6]

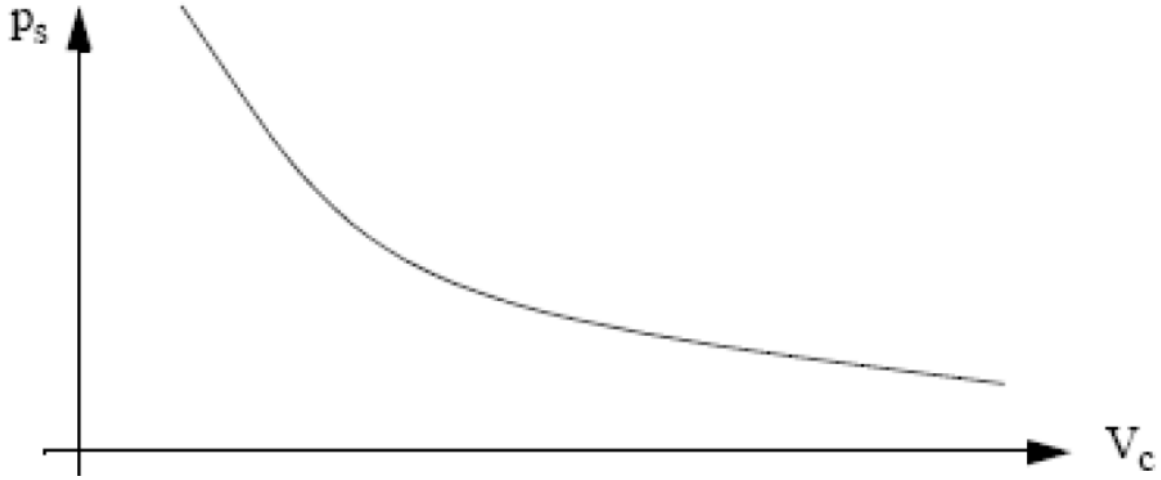

Figure Q2. Cutting speed against specific cutting pressure

Question 3

(a) Distinguish between Rapid Prototyping (RP) and Rapid Manufacturing (RM). [6]

(b) With the aid of neatly annotated diagrams describe in each case one technique of RP:

(i) Liquid based prototyping, [6]

(ii) Powder based prototyping, [6]

(iii) Solid based prototyping. [7]

SECTION B

Answer two (2) questions from this Section

Question 4

(a) Describe how in the Electro Discharge Machining (EDM) process electrical energy is transformed into thermal energy between the tool and workpiece. Illustrate your answer with diagrams which show the important stages during the EDM cycle. [8]

(b) Show the relationship between metal removal rate in EDM and

(i) material melting point, [3]

(ii) material hardness. [3]

(c) An EDM machine incorporates a servomechanism to advance and retract the tool. Illustrate

(i) how the conditions at the tool/workpiece gap vary and [5]

(ii) a suitable control circuit which utilizes these conditions. [6]

Question 5

(a) Rotational and blow moulding are used to produce hollow plastic articles. But the principles of each process are different. Describe each process highlighting these differences. [10]

(b) With the aid of diagrams describe the following processing methods for polymers:

(i) Compression mouldin, [5]

(ii) Transfer moulding. [5]

(c) Giving examples, explain for which conditions the processing methods in (b) are most suitable. [5}

Question 6

(a) Compare the applicability and performance of Laser Beam Machining (LBM) and Electron Beam Machining (EBM) in cutting sheets and plates of various materials.[8]

(b) Which of the three modes of EBM are used? [3]

(c) Name six properties of the laser that affect processing quality and efficiency in laser material processing. [6]

(d) Compare the applicability and performance of Oxygen Cutting (OC) and Plasma Arc Cutting (PAC) in cutting various metals. [8]

END OF EXAMINATION