NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING

MASTER OF ENGINEERING IN MANUFACTURING ENGINEERING/ SYSTEMS

AND OPERATIONS MANAGEMENT

COMPUTER AIDED DESIGN/COMPUTER AIDED MANUFACTURING (CAD/CAM)   TIE 6121

Second Semester Main Examination Paper

September/October 2024

This examination paper consists of 6 printed pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: None

Examiner's Name: Dr Eriyeti Murena (Pr Eng) and Dr Nicholas Tayisepi (Pr Eng)

INSTRUCTIONS AND INFORMATION TO CANDIDATE

1. Answer four (4) questions. Choose a maximum of two (2) questions from each section

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

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SECTION A

QUESTION ONE

(a) Discuss the concept of CAD/CAM Data Exchange and explain the primary constraints of data-sharing between two or more systems. **[6]**

(b) Explain Local Area Network (LAN) and site typical examples of these in the manufacturing or services facilities environments of your choice. **[3]**

(c) Define WAN and give specific instances where it may be found. **[4]**

(b) Sketch and briefly discuss basic types of the following standard LAN arrangements: Star, Bus, Ring, and Tree. **[12]**

QUESTION TWO

(a) Discuss the concept of solid modelling with the aid of sketches where appropriate. **[11]**

(b) Develop the Binary Tree for the Feature shown in Figure QU2. **[12]**
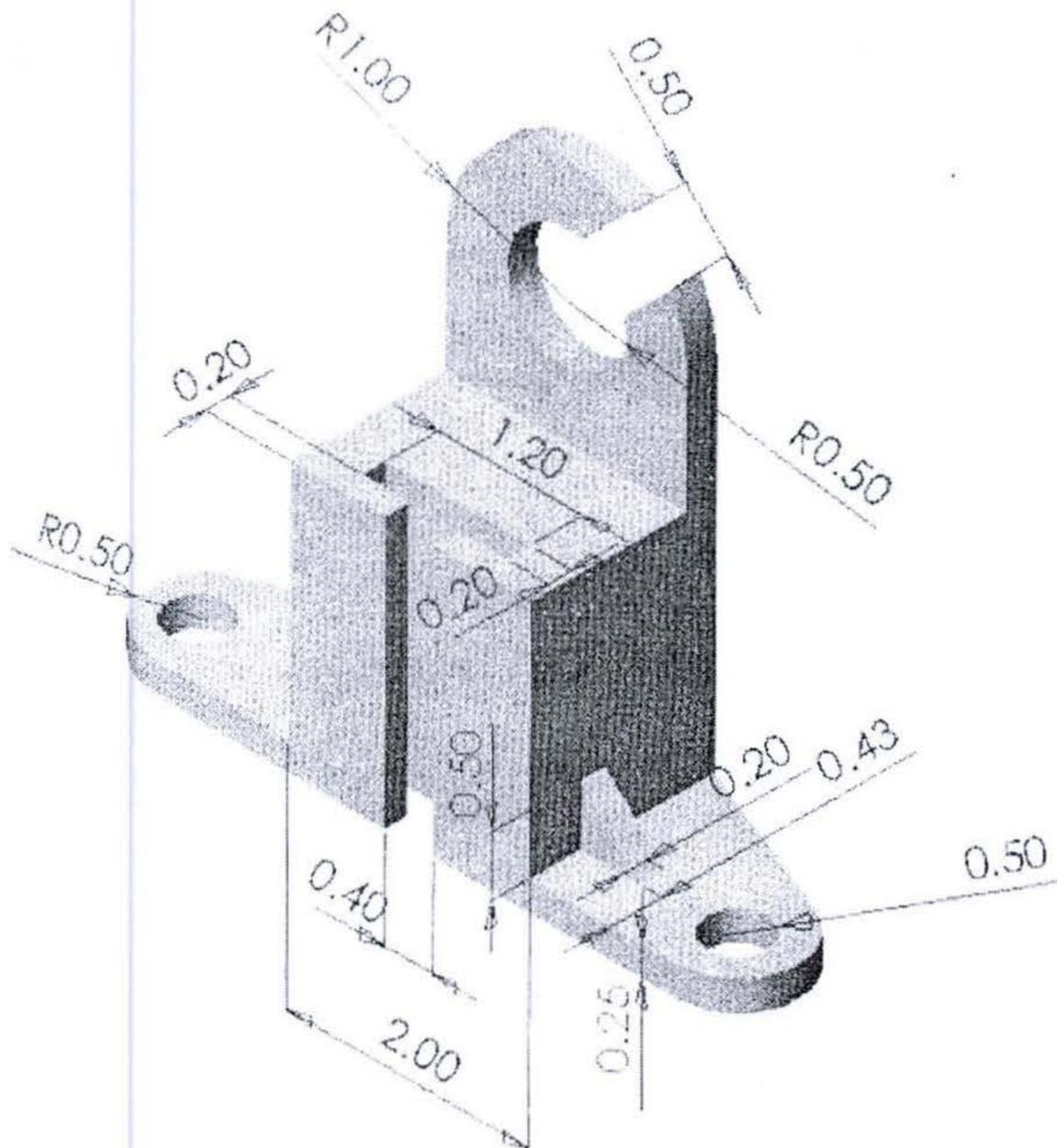
(c) What is the height of the tree? **[2]**

Figure QU2 Binary Tree Block

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QUESTION THREE

A. (i) What is the importance of NURBS in CAD? **[2]**

(ii) Briefly explain four main stages of design process. Illustrate your answer with the Pahl-Beitz or Ohsuga model of the design process. **[10]**

B. AutoLisp programming may be used for automating the draughting of features which may be repetitive in nature yet the sizes may be varied frequently from batch-to-batch. Write an AutoLisp programme for quickly drawing the Adjustable Fork feature represented in Figure QU3. The control feature is the fork arms opening gap. The programme should work in such a way that the operator enters the size of the fork arms opening gap first, followed by picking the coordinates of the start point of the drawing and the rest of the feature drawing should be automatically generated once the start point is established. **[13]**
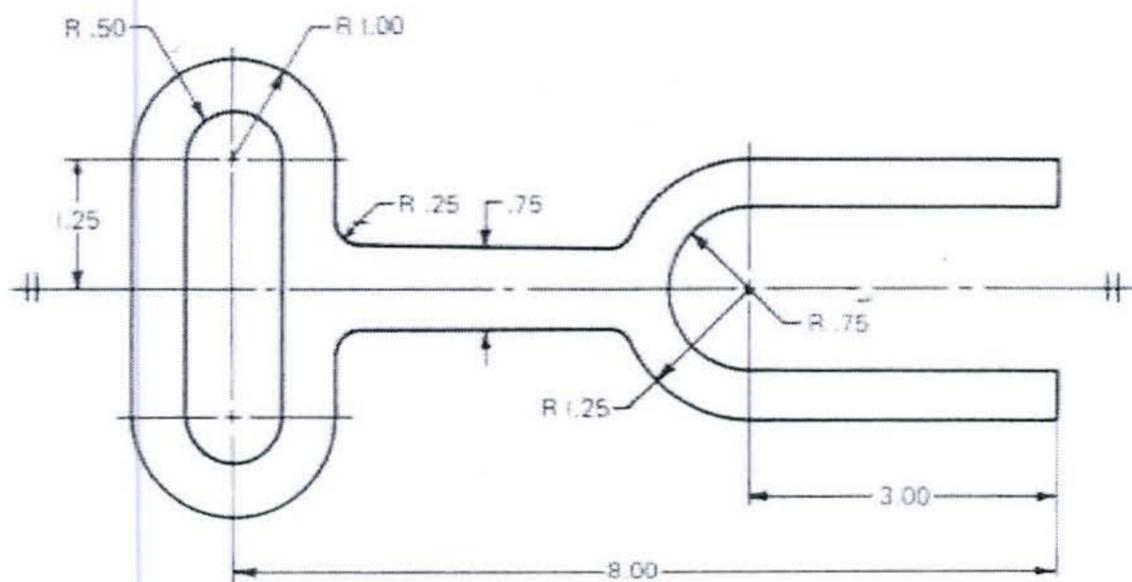

Figure QU3 Fork

SECTION B

QUESTION FOUR

(a) Describe with the aid of diagrams, the difference between Absolute and Incremental dimensions. **[5]**

(b) The component in Figure QU4 is to be made from an aluminium billet 80 mm in diameter. The component is to be faced off and turned to the profile shown. Maximum cut depth should be 2 mm on radius. The turning tools used have a coated carbide insert cutting edge. Tool 1 is to be used for roughing and Tool 2 is to be used for finishing. Both tools have a nose radius of 0.8 mm. Leave a finishing allowance of 0.05 mm when roughing. Do NOT part off.
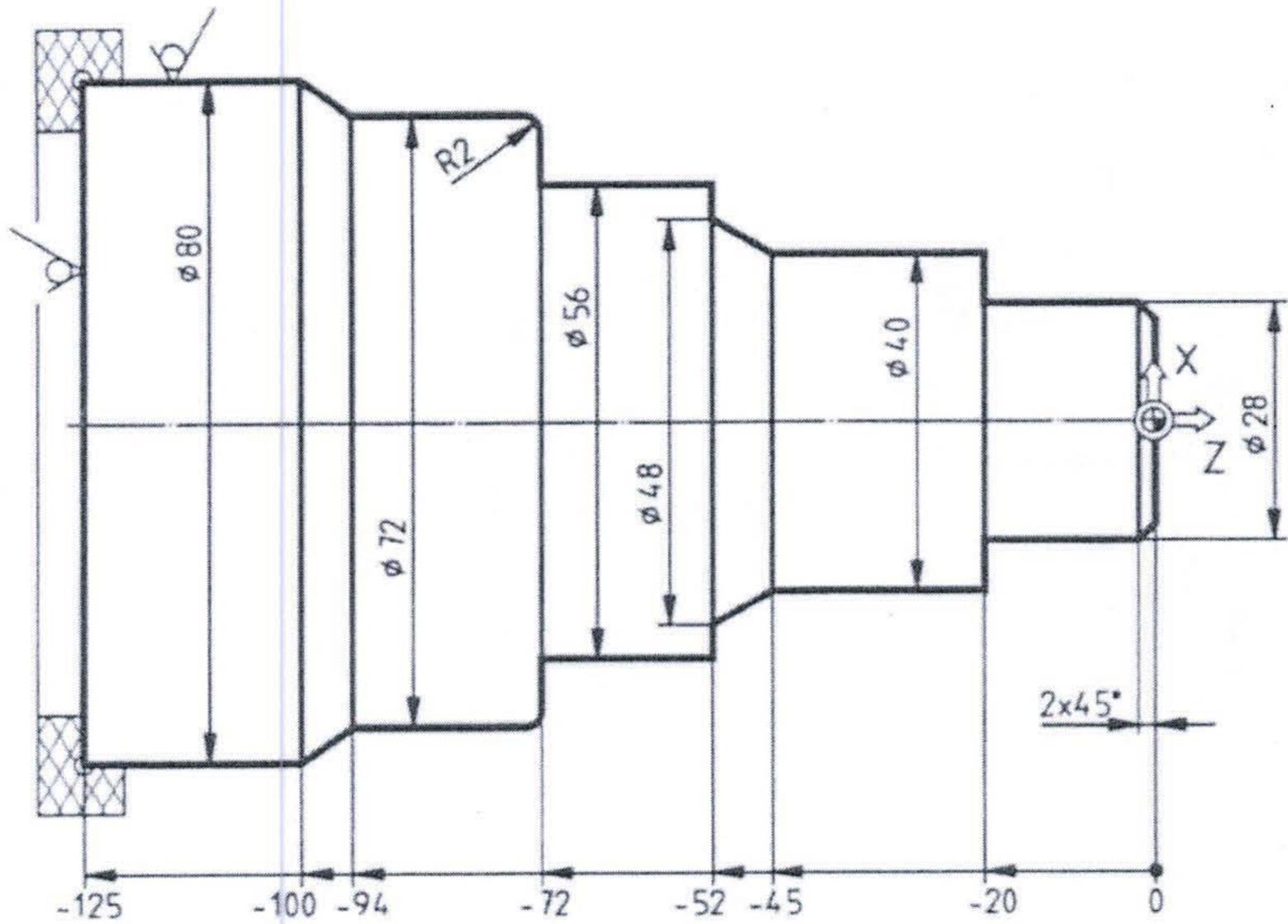
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Figure QU4

Write a part program for making the part on a FANUK controller driven lathe machine

   i. Using Absolute dimensions. **[10]**

   ii. Using incremental dimensions. **[10]**

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QUESTION FIVE

a) With the aid of diagrams explain the main difference between 3 3-axis milling machines and 5-axis milling machines. **[8]**

b) Write a concise part program to machine the component shown in Figure Q5 on a CNC Milling Machine. Given that the milling tool T4 which is of diameter 8 mm operates with a feed rate F = 80 mm/min and the spindle speed S=1392 rev/min while the drilling tool T5 which is of diameter 8 mm operates with a feed rate F = 120 mm/min and spindle speed S = 1193 rev/min. Given also that the maximum depth of cut for the milling tool T4 is 3 mm. **[17]**
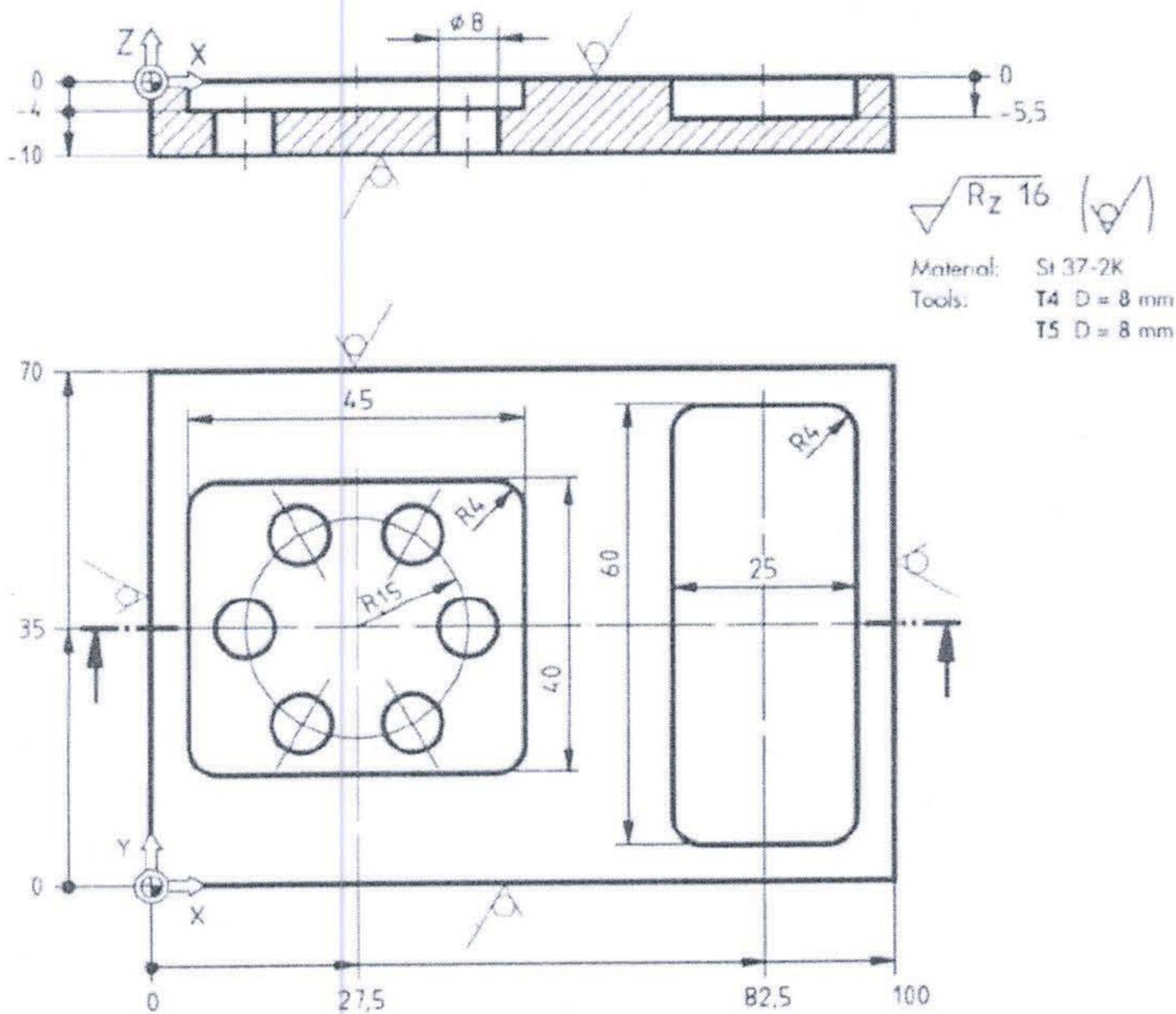

Figure QU5

QUESTION SIX

Explain the five components in the STEP standard. **[5]**

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a) An APT program comprises language statements that fall into the four classes. Discuss the four basic types of statements in the APT language. **[6]**

b) A full APT program is needed to machine the profile for a part given in Fig QU6. The cutter is to machine the outside surface in the counter-clockwise direction. Develop a complete APT Program for machining the part with the given machine condition: The dimensions of the stock material are 200 x 150 x 10mm. Given a milling tool T2 with diameter D = 10 mm, feed rate F = 80 mm/min, and spindle speed S = 477 rev/min. Any other information not given can be assumed and stated in the solution. **[14]**
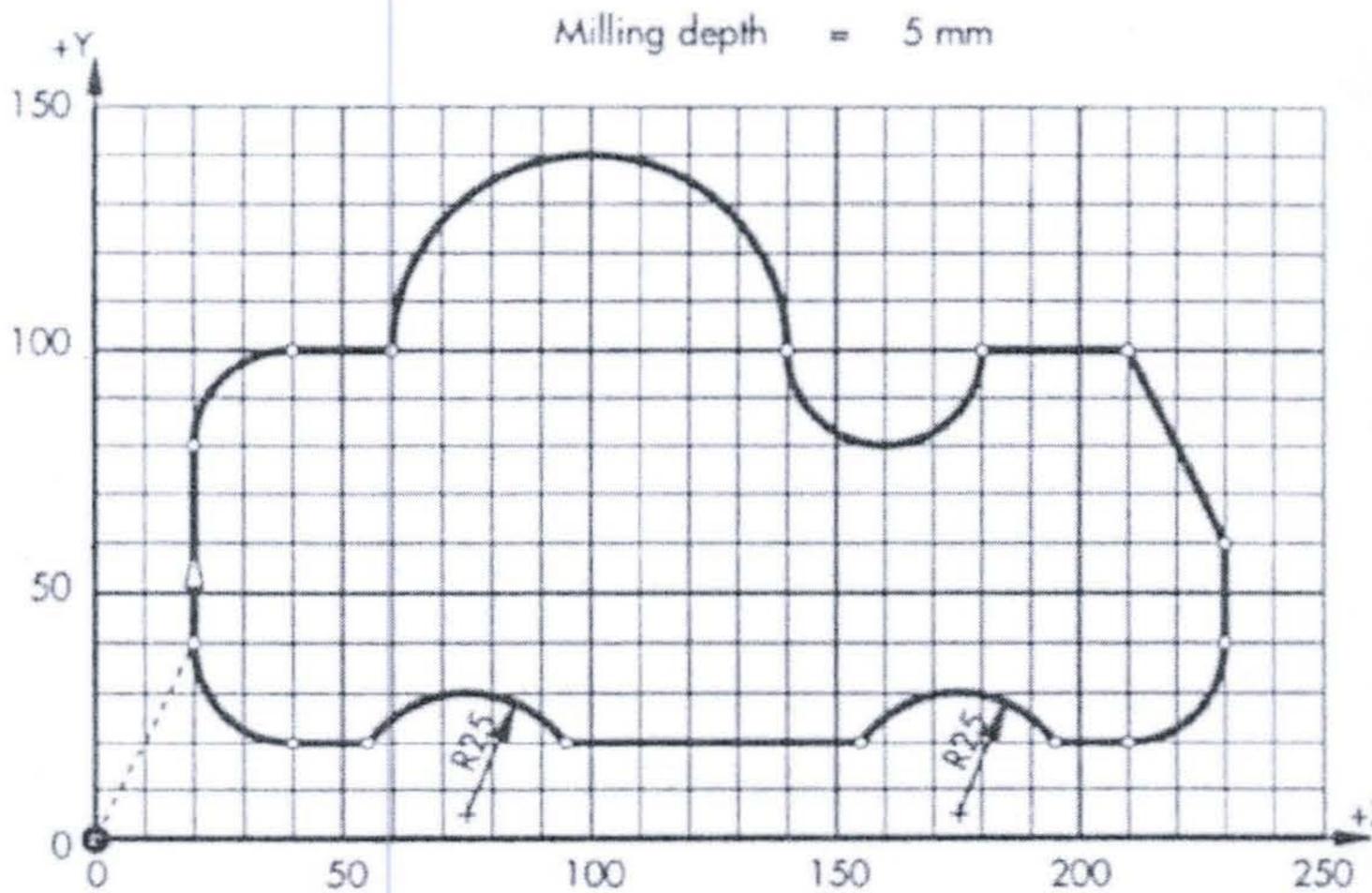

Figure QU6

_____**End of Examination**_____