



# **NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**

## **FACULTY OF INDUSTRIAL TECHNOLOGY**

### **DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING**

#### **Bachelor of Engineering Honours Degree Industrial and Manufacturing Engineering**

#### **COMPUTER AIDED DESIGN/COMPUTER AIDED MANUFACTURING (CAD/CAM) I**

**TIE 5111**

**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**

**Examiner's Name: Nicholas Tayisepi**

#### **INSTRUCTIONS AND INFORMATION TO CANDIDATE**

1. Answer any four (4) questions
2. Each question carries 25 marks
3. Use of calculators is permissible

#### **MARK ALLOCATION**

<b>QUESTION</b>	<b>MARKS</b>
1.	25
2.	25
3.	25
4.	25
5.	25
6.	25
<b>TOTAL</b>	<b>100</b>

### Question 1

- a) What are the main elements of the CAD system of a Computer Aided Designing/Computer Aided Manufacturing System? [5]
- b) Comprehensively discuss the factors considered in the evaluation and selection a CAD system. [20]

### Question 2

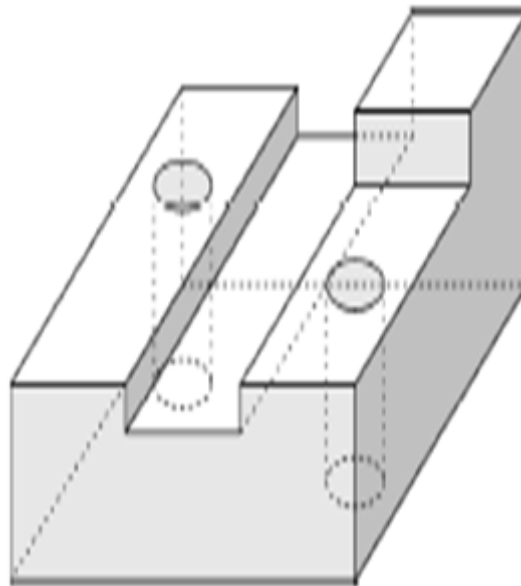
- a) Equation of cubic polynomial on Bezier basis is given as:

$$P = P(u) = P_0(1 - 3u + 3u^2 - u^3) + p_1(3u - 6u^2 + 3u^3) + p_2(3u^2 - 3u^3) + p_3(u^3)$$

Calculate a parametric point on a Bezier cubic curve that fits parameter  $U = 0.4$

and points:  $P_0 = (2,4)$        $P_1 = (4,3)$        $P_2 = (5,2)$        $P_3 = (6,1)$  [8]

- b) State the Euler's –Poincare formula for topological consistency validation of solids. [6]
- c) Determine whether the solid model shown in Figure QU2 is topologically consistent. [13]



**Figure QU2. Stepped-slotted block**

### Question 3

- a) Briefly explain the main stages of design process according to the Ohsuga model of the design process. Illustrate the answer with the aid of relevant diagram(s) showing the input and output for each stage. [10]
- b) Generate the vertex and edges table in wire frame representation of the component shown in Figure QU3

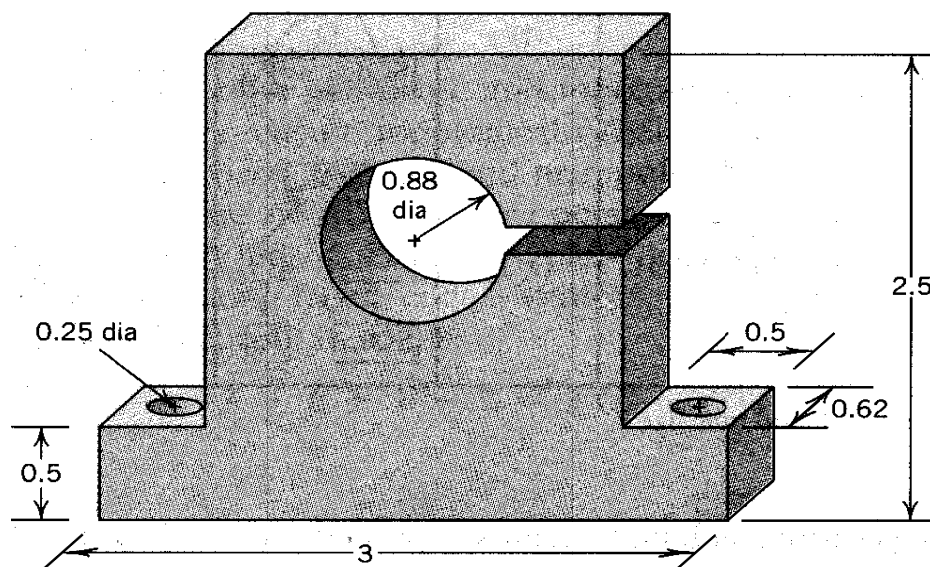
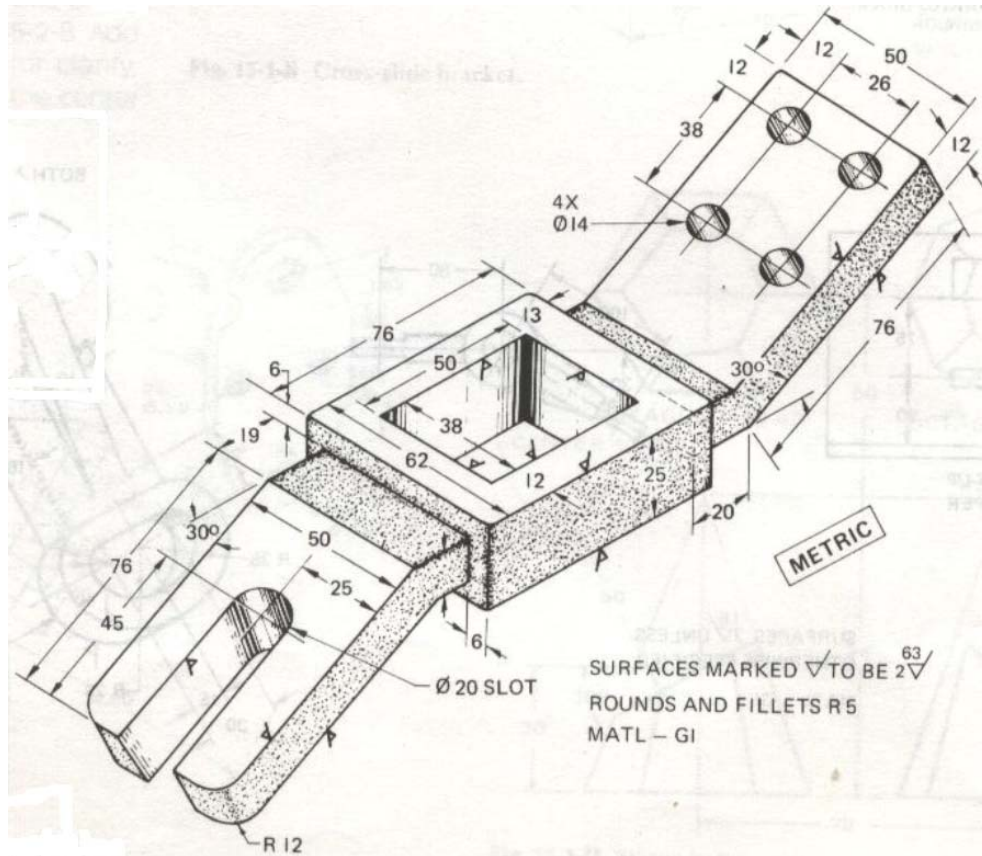


Figure QU3. Holding Bracket

### Question 4

- (a) Distinguish between any two main Solid Modelling methods with respect to the generation of CAD models [6]
- (b) Develop the Constructive Solid Geometry (CSG) tree for the 3-D modelling scheme represented in Figure QU4, below. Use circles to represent the nodes and solid primitives as building blocks step by step. [16]
- (c) What is the height of the binary tree? [3]



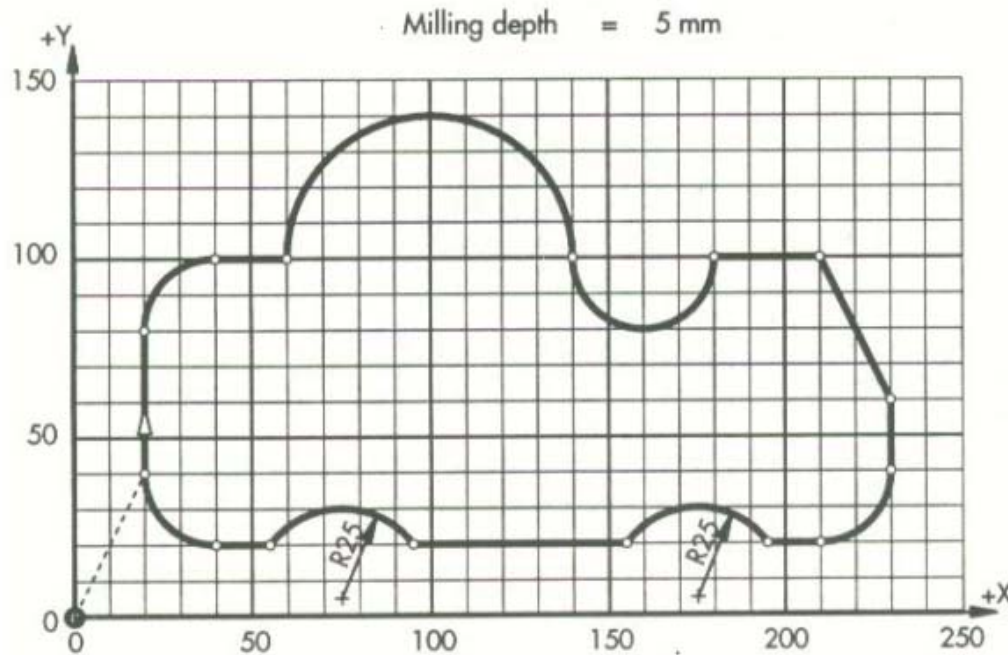
**Figure QU4. Adaptor**

### Question 5

- a) Discuss the deficiencies of Geometric Models in Computer Aided Designing and Computer Aided Manufacturing. [8]
- c) Briefly outline the main feature modeling techniques used in a Computer Aided Designing environment. [5]
- d) Modern engineering applications dictate the necessity of the capacity for data transfer Is inbuilt in most of the systems so that CAD models between dissimilar computer programs be possible. Explain the concept of CAD data exchange in Computer Aided designing giving 4 examples of data exchange standards. [12]

### Question 6

- a) 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 template feature represented in Figure QU6 below. Most of the feature parameters should be depended on one or two main parameters. The programme should be introduced. [10]



**Figure QU6. Template**

- b) Explain the concept of Computer Aided Engineering (CAE) as utilised in the engineering product design environments. [3]
- c) What the benefits of Finite Element Analysis (FEA) are as utilised in a Computer Aided Designing office? [5]
- d) With the aid of well labeled sketches describe any one Rapid Prototyping (RP) technique. [7]

.....End of Examination.....