NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF 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

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

Question One

(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 of a CAD system. **[20]**

Question Two

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

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

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

and points: P_o = (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. **[4]**

(c) Determine whether the solid model shown in Figure QU2 is topologically consistent. **[13]**

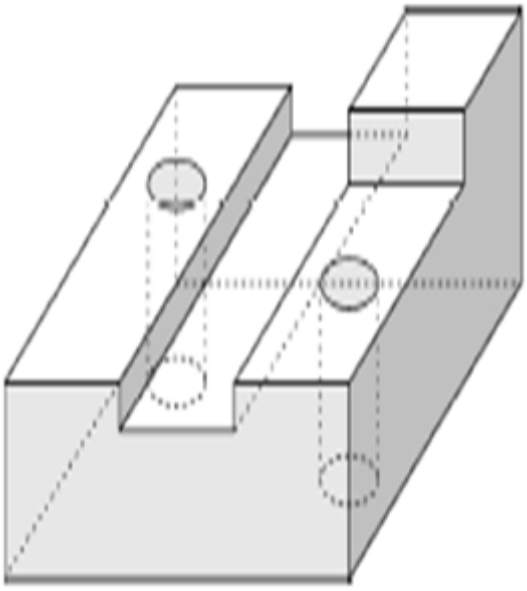

Figure QU2. Stepped-slotted block

Question Three

(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. **[15]**

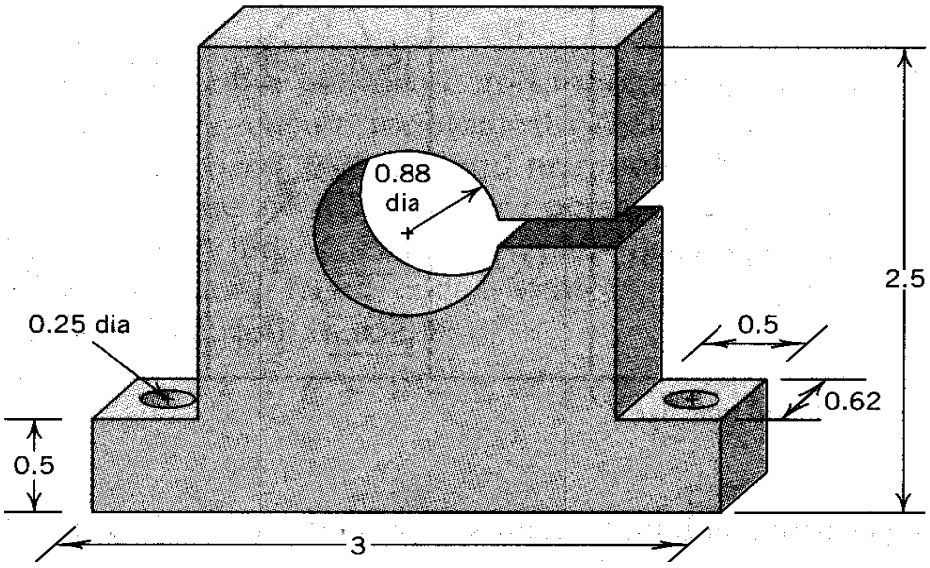

Figure QU3. Holding Bracket

Question Four

(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]**

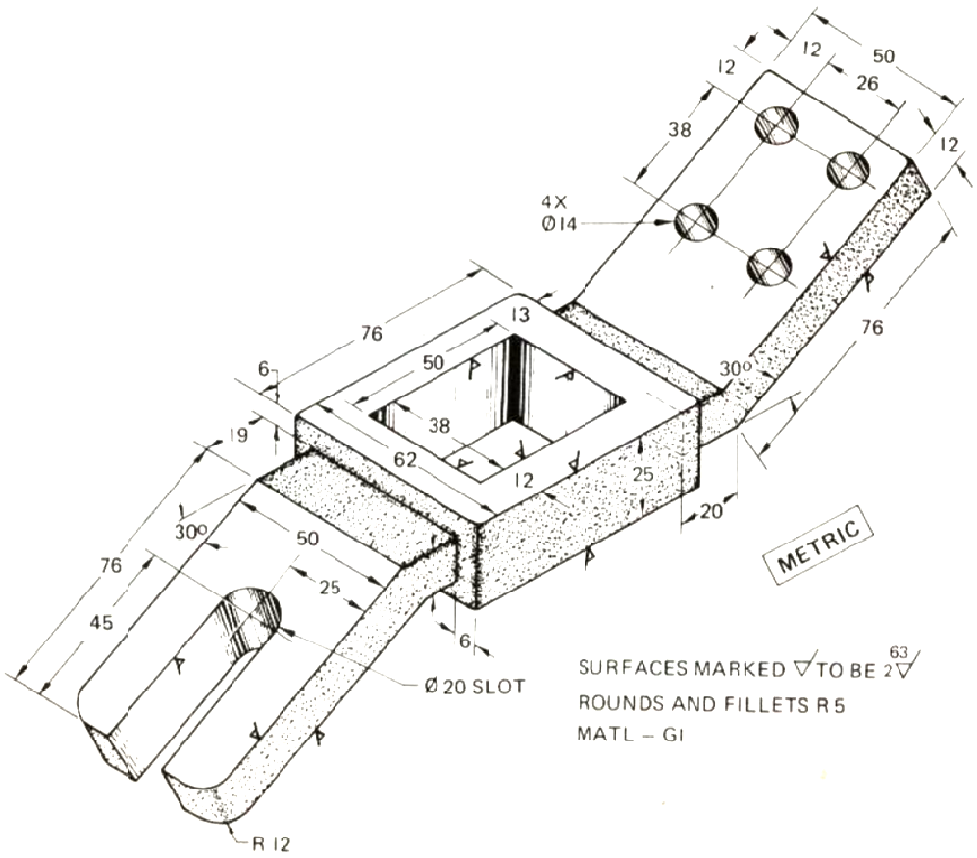

Figure QU4. Adaptor

Question Five

(a) Discuss the deficiencies of Geometric Models in Computer Aided Designing and Computer Aided Manufacturing. **[8]**

(b) Briefly outline the main feature modeling techniques used in a Computer Aided Designing environment. **[5]**

(c) Modern engineering applications dictate the necessity of the capacity for data transfer is inbuilt for most of the systems so that CAD models exchange between dissimilar computer programs is possible. Explain the concept of CAD data exchange in Computer Aided designing giving 4 examples of data exchange standards. **[12]**

Question Six

(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 dependent on one or two main parameters. The programme should be introduced. **[10]**

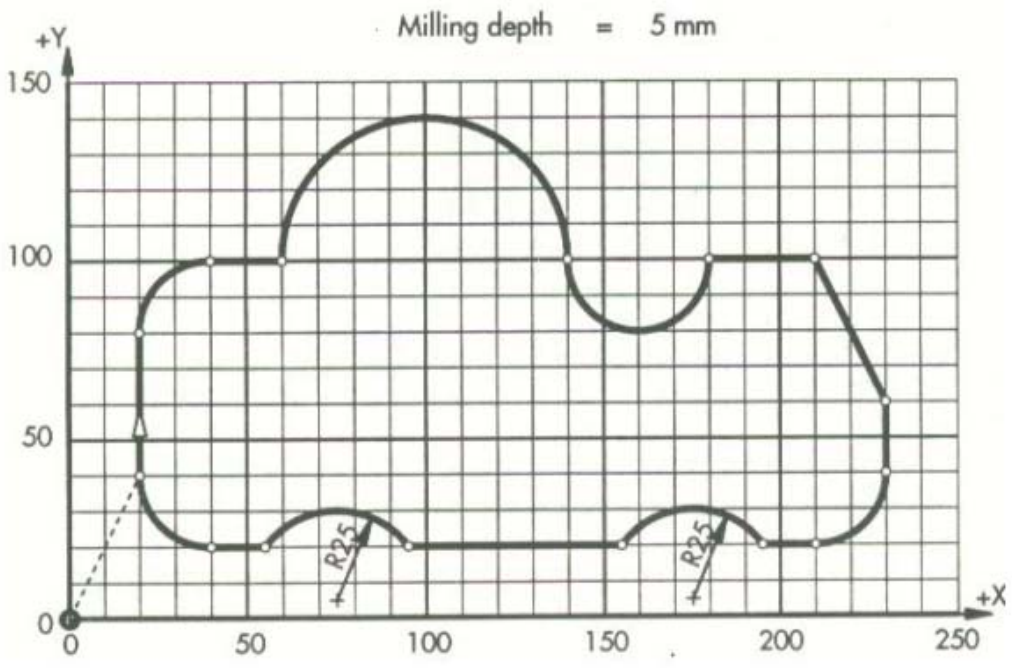

Figure QU6. Template feature

(b) Explain the concept of Computer Aided Engineering (CAE) as utilised in the engineering product design environments. **[5]**

(c) What are the benefits of Finite Element Analysis (FEA) as utilised in a Computer Aided Designing office? **[10]**

……End of Examination……