**TECHNICAL UNIVERSITY OF MOMBASA**

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**Faculty of Engineering and Technology**
**Department of Mechanical & Automotive Engineering**
**UNIVERSITY SPECIAL/SUPPLEMENTARY EXAMINATION FOR:**
**BSc. Mechanical Engineering**
**EMG 2504 : COMPUTER AIDED DRAWING AND MANUFACTURING**
**SPECIAL/SUPPLEMENTARY EXAMINATION**
**SERIES: AUGUST2017**
**TIME: 2 HOURS**
**DATE:** Pick Date**Aug2017**

Instruction **to Candidates:**

You should have the following for this examination

- *Answer booklet*
- *Non-Programmable scientific calculator*

This paper consists of **FIVE** questions.
Question **ONE** is **COMPULSORY**
Attempt any other **TWO** questions.
Maximum marks for each part of a question are as shown.
Do not write on the question paper.
Mobile phones are not allowed in the examination room.

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**Question ONE (COMPULSORY: 30 Marks)**

a. Define the terms CAD, CAM and describe the relationship between CAD and CAM giving rise to CAD/CAM. (6 marks)
b. Discuss the following terms in relation with computer systems.
    i. Application Software
    ii. Operating system (4 marks)
c. With the aid of sketches describe the working principle of an LCD Screen display. (4 marks)
d. A point $P$ (1, 0, 0) is translated by a vector $[3\ 4\ 5]^T$ . Then it is rotated $30^o$ about the z-axis, followed by a rotation of $45^o$ about the x-axis. What are the new coordinates of the point? (6 marks)

e. Describe briefly the purpose of tool compensation and state the TWO types of compensation used on machining centers. (6 marks)

f. Explain the meaning of the following inline keywords:

   i. N5 G92 X-1.000 Y1.000 Z1.000

   ii. N125 G03 X1.000 Y-1.250 R.250 (4 marks)

**Question TWO (20 Marks)**

a) List FOUR (4) Finite Element Analysis (FEA) applications (4 Marks)

b) With the aid of sketches, list and explain the THREE (3) different types of finite elements (6 Marks)

c) Briefly explain (with sketches) the steps carried out in solving a physical problem using FEA software. (6 Marks)

d) List FOUR (4) advantages of carrying out FEA analysis at the design stage (4 Marks)

**Question THREE (20 Marks)**

a) Giving an example in each case, state THREE (3) categories of CAD software systems (6 Marks)

b) Illustrate with sketches the following common assembly constraints:

   i) Mate (2 Marks)

   ii) Insert (2 Marks)

c) List the FOUR (4) common editing errors in robot programming. (6 Marks)

d) A Computer Numerical Controlled (CNC) program consists of function and addresses. Fill in the appropriate identification letter for address against the function, as shown below:

| Function | Address |
|---|---|
| Spindle function | _____ |
| Coordinate word | _____ |
| Parameters for circular interpolation | _____ |
| Preparatory function | _____ |

(4 Marks)

**Question FOUR (20 Marks)**

a) What do you understand by the terminology "Computer Numerical Control (CNC)"? (3 Marks)

b) State and briefly describe the following control systems used in a computer numerical machine:

   i) Open Loop System

   ii) Close Loop System

Which of these systems do most of the modern CNC machines use? (6 Marks)

c) State and briefly describe the six (6) major elements of a CNC system. (12 Marks)

**Question FIVE (20 Marks)**

**a.** State and briefly describe the procedures (steps) to be followed in Computer Numerical Control (CNC) programming and machining. (10 marks)

**b.** Figure 5 shows a part that is to be machined from a 100 × 80 × 40mm billet. A three axis CNC is to be used for the process. Write a part program that can be used to effectively machine the part. The cutting parameters are given below: (10 marks)

**Table 1:** Cutting parameters

| | **Milling** | **Drilling** |
|---|---|---|
| Cutter | Ø20mm flat end mill | Ø16mm drill bit |
| Spindle speed (rpm) | 3000 | 500 |
| Feed (mm/min) | 500 | 240 |

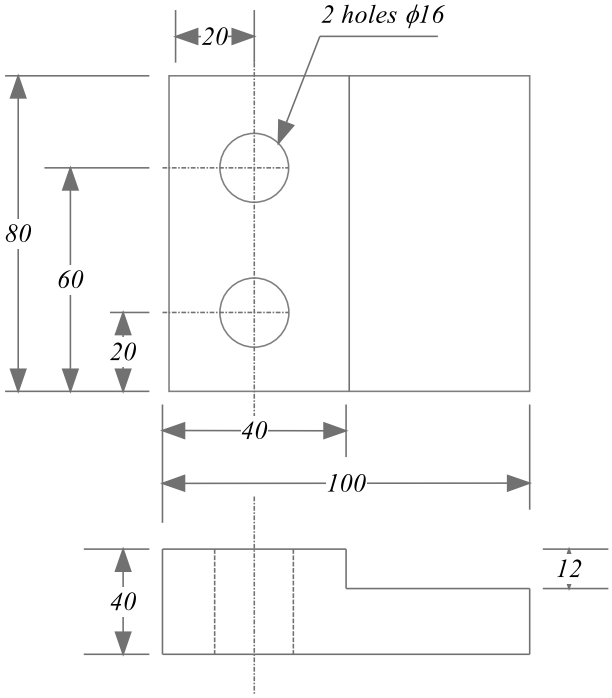


Figure 5