



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of Mechanical & Automotive Engineering
UNIVERSITY EXAMINATION FOR:
BSc. Mechanical Engineering
EMG 2504 : COMPUTER AIDED DRAWING AND MANUFACTURING
END OF SEMESTER EXAMINATION
SERIES: DECEMBER2016
TIME: 2 HOURS
DATE: Pick DateDec2016

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.

Question ONE (COMPULSORY: 30 Marks)

- Giving an example in each case, state **THREE (3)** categories of CAD software systems (6 Marks)
- Illustrate with sketches the following common assembly constraints:
 - Mate (2 Marks)
 - Insert (2 Marks)
 - Align (2 Marks)
- List the **FOUR (4)** common editing errors in robot programming. (6 Marks)
- 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:

<u>Function</u>	<u>Address</u>	
Spindle function	_____	
Coordinate word	_____	
Parameters for circular interpolation	_____	
Preparatory function	_____	(4 Marks)

- e) State and briefly describe FOUR (4) functions of computer aided geometry design. (4 Marks)
- f) Some information is embedded in a CAD system. State TWO (2) of the graphical information and TWO (2) of the textual information that embedded in a CAD system. (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) A shaft is made to the dimension $40 \text{ mm} \pm 0.05$. State the nominal dimension, the upper limit, the lower limit and the tolerance. (2 Marks)
- b) Illustrate with sketches each of the following:
- i) Clearance fit (2 Marks)
 - ii) Interference fit (2 Marks)
 - iii) Transition fit (2 Marks)
- c) For each of the following combinations, calculate the extremes of fit. Hence, state whether each fit is a clearance, interference or transition.

	Hole (mm)	Shaft (mm)		Hole (mm)	Shaft (mm)
(i)	80.030	80.021	(v)	450.063	450.045
	80.000	80.002		450.000	450.005
(ii)	250.115	249.000	(vi)	55.046	54.970
	250.000	249.785		55.000	54.940
(iii)	30.025	29.991	(vii)	100.035	99.988
	30.000	29.975		100.000	99.966
(iv)	150.040	150.068	(viii)	200.046	200.079
	150.000	150.043		200.000	200.060

(12 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 SystemWhich 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

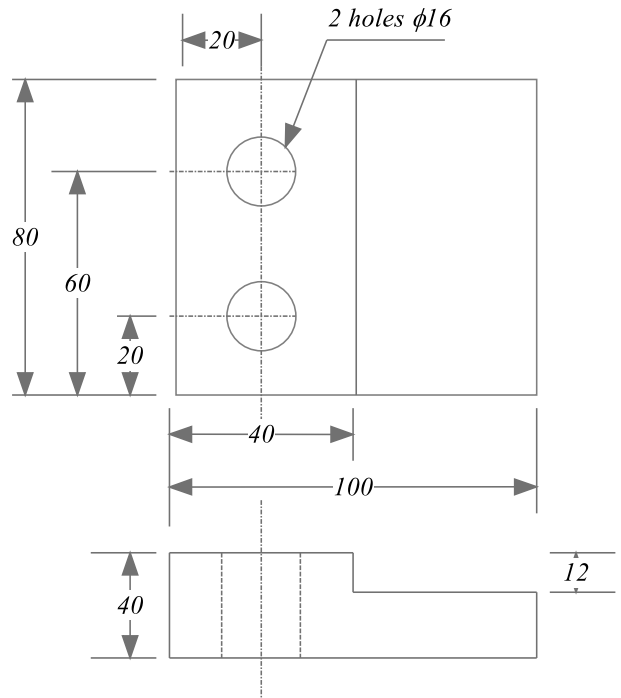


Figure 5