



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of Mechanical & Automotive Engineering
UNIVERSITY EXAMINATION FOR:
BSc. Mechanical Engineering
EMG 2504 : COMPUTER AIDED DESIGN AND MANUFACTURING
SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: SEPTEMBER 2018
TIME: 2 HOURS
DATE: Pick Date Sep 2018

Instruction to Candidates:

You should have the following for this examination

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

This paper consists of **FIVE** questions. Attempt question **ONE** and any other **TWO** questions.

Maximum marks for each part of a question are as shown.

Do not write on the question paper.

Question ONE

- a) Describe **FIVE** objectives that manufacturing engineers are required to achieve in order to become competitive and explain how computer integrated manufacturing can aid them. (10 marks)
- b) Describe the characteristics of the **THREE** principal ways in which 3-D modelling is achieved in computer aided design software. (6 marks)
- c) Explain **FIVE** types of analysis that can be carried out with the aid of finite element analysis tools. (10 marks)
- d) Write a simple program for the machining of the taper shown in figure 1 on a CNC lathe and explain the code (dimensions are in mm). (4 marks)

Question TWO

- a) Explain the following **SIX** common representations in solid modeling:
- i) Spatial Enumeration
 - ii) Cell Decomposition
 - iii) Boundary Representation
 - iv) Sweep Methods
 - v) Primitive Instancing
 - vi) Constructive Solid Geometry (CSG)
- (12 marks)
- b) With the aid of appropriate diagrams explain the concept of feature based design as applied in computer modelling.
- (6 marks)
- c) Describe the process through which extrude and revolve commands are used to generate 3-D models from 2-D sketches in design software.
- (2 marks)

Question THREE

- a) Explain the importance of modelling and simulation in modern manufacturing technology.
- (4 marks)
- b) Describe briefly the functions of the **THREE** modules found in most finite element analysis packages i.e.:
- i) Preprocessing
 - ii) Analysis
 - iii) Post-processing
- (6 marks)
- c) Develop the matrix equations that could be used to carry out a typical finite element analysis on the double spring system shown in figure 2.
- (10 marks)

Question FOUR

- a) State **SIX** advantages that were realized when computers were integrated with numerical control machine tools.
- (6 marks)
- b) With the aid of appropriate diagrams describe the operation of the following types of systems for machine control
- i) Semi-closed loop
 - ii) Closed loop

(6 marks)

c) Explain the differences in structure and function between CNC machines through the **FOUR** generations of their development.

(8 marks)

Question FIVE

a) Highlight **FOUR** functions that are carried out by robots in modern manufacturing facilities.

(4 marks)

b) Describe **EIGHT** criteria that can affect the choice of robot for any particular manufacturing process.

(8 marks)

c) Explain the following methods commonly used to program robots :

- i) Guiding
- ii) Teach pendant
- iii) Off-line programming
- iv) On-line programming

(10 marks)

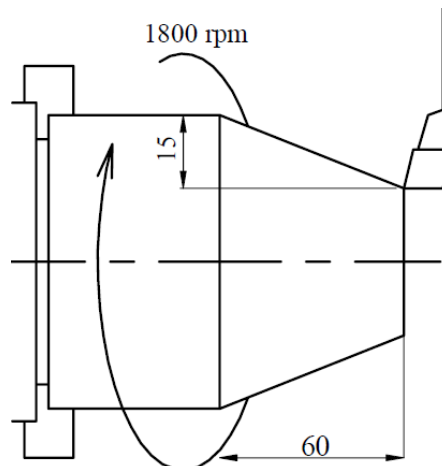


Figure 1

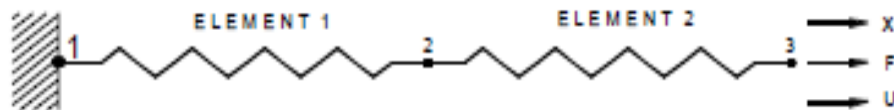


Figure 2