TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATIONS FOR DEGREE IN

BACHELOR OF TECHNOLOGY IN RENEWABLE ENERGY & ENVIRONMENTAL PHYSICS

EME 4240: COMPUTER AIDED DRAWING AND DESIGN

END OF SEMESTER EXAMINATIONS

SERIES: APRIL 2015

TIME: 2 HOURS

INSTRUCTIONS:

- This paper consists of FIVE questions.
- All questions carry EQUAL Maximum marks.
- Attempt any THREE questions
- All symbols have their usual meaning unless specified otherwise
- Use clear and neat sketches

This paper consists of Three printed pages

QUESTION 1 (Compulsory)

a) List and discuss **FOUR** features that make Autodesk Inventor CAD application system. **(8 marks)**

b) Illustrate with sketches the following common assembly constraints:

i) Mate **(2 marks)**

ii) Mate offset **(2 marks)**

iii) Align **(2 marks)**

c) An object in space is translated by (5) units in the z direction of the world coordinate system and then rotated by 900 about the x-axis of the world coordinate system. If a point on the object has coordinates (0, 0, 1) with respect to its model coordinate system, what will be the world coordinates of the same point after the translation and the rotation. **(6 marks)**

QUESTION 2

a) Define the word tolerance. **(2 marks)**

b) Draw a diagram to illustrate each of the following:
   i) Clearance fit **(2 marks)**
   ii) Transition fit **(2 marks)**
   iii) Interference fit **(2 marks)**

c) Fig. Q. 2 shows the sectional assembly of a boss, a bush and a shaft. Normal fit exists between the shaft and bush while press fit exists between the bush and bush and the boss.
   i) Using Data sheet 4500A (selected ISO fits-Hole Basis) extracted from BS4500 provided, calculate the working limits of shaft diameter, bush hole diameter, bush outer diameter and boss hole diameter (AB). **(8 marks)**

   ii) Draw the shaft, the bush and the boss illustrating how these limits are dimensioned. (NOTE: Draw each part separately). **(4 marks)**

QUESTION 3

a) Figure Q. 3 (a) shows a part of a machine to be made. By use of proper symbols, give the following instructions:
   - Surface (i) to be finished to an obligatory roughness value of between 0.2 and 0.8 mirometre.
   - Surface (ii) to be finished to an obligatory roughness of 0.8 micrometre **(6 marks)**

b) Figure Q. 3 (b) shows a part of a machine to be made. By use of proper symbols, give instructions:
   - Surface (iii) to be lapped to 0.05 micrometre of the stated circular lay, over length of 30mm. **(4 marks)**

c) Figure Q.3 (c) shows two views of a part of a machine to be made in 3rd angle orthographic projection. By use of proper symbols, give instructions:
   - Surface (iv) is to be finished by honing in the direction parallel to place to N6.
   - Draw projection symbol. **(6 marks)**

d) Figure Q.3 (d) shows a part of machine to be made. By use of proper symbols, give instructions.
   - Surface (v) should be finished to an obligatory radial grinding lay to the limit of N4. **(4 marks)**

QUESTION 4

a) With the aid of sketches, describe the following modeling systems:
   i) Surface modeling systems. **(3 marks)**
   ii) Solid modeling systems. **(3 marks)**

b) With the aid of sketches, describe the following types of internal representation schemes used in solid modeling:
   i) Sweeping **(3 marks)**
   ii) Constructive Solid Geometry (CSG) **(3 marks)**
   iii) Rounding **(3 marks)**

c) i) Show how the following object in fig. Q. 4 (c) may be respected using CSG.
   ii) What is the main limitation of CSG? **(5 marks)**

QUESTION 5

a) Outline the mathematical principles used in creating the following graphical elements:
   i) Lines **(3 marks)**
   ii) Circles **(3 marks)**

b) Name **THREE** widely acceptable standard CAD data exchange formats. **(3 marks)**

c) Discuss the statement "why can't the information be completely exchanged between CAD tools?". **(5 marks)**

d) Briefly describe the **FOUR** major phases in the history and evaluation of CAD, stating the major events that characterize each phase. **(6 marks)**

APPENDIX

i) Rotation about

$$x = Rot\ (x,\theta) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & -\sin\theta \\ 0 & \sin\theta & \cos\theta \end{bmatrix}$$

ii) Translation

$$\begin{bmatrix} 1 & 0 & 0 & dx \\ 0 & 1 & 0 & dy \\ 0 & 0 & 1 & dz \\ 0 & 0 & 0 & 1 \end{bmatrix}$$