TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FOURTH EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING

EEE 2408: INTEGRATED CIRCUITS

END OF SEMESTER EXAMINATION

SERIES: MAY 2016

TIME: 2HOURS

DATE: May 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **five** Questions; Question ONE is compulsory. In addition attempt any Other TWO Questions.

Do not write on the question paper.

Question ONE (Compulsory 30 marks)

a) Integrated Circuits can be classified into three basic classes. State and briefly discuss the three classes. **(6marks)**

b) Define the following terms as used in Integrated Circuit technology **(10marks)**

i) Integrated Circuit
ii) Moore's law
iii) Ion Implantation
iv) Etching
v) Scribing & Cleaving

c) State four advantages of integrated circuits over discrete circuits **(4 Marks)**

d) i) Describe the **three** modes of MOSFET operation. **(8Marks)**

ii) In which of the modes above do the following circuits operate?
I)Digital Circuits.
II)Analog Circuits

e) With reference to integrated circuits design, define **a cell** **(2 Marks)**

Question TWO

a) State the design philosophy of integrated Circuits **(2 Marks)**
b) Explain MOSFETs scaling giving its significance to Moore's law? **(4 Marks)**
c) Diffentiate between **Doping** and **Deposition** with reference to integrated circuit processing technology. **(4 Marks)**
d) i) Sketch an Ion implanter labeling its five important parts.
ii) Describe the operation of the following parts of an ion implanter
I)Ion Source
II)Extraction Assembly
III)Accelerating Column **(10 Marks)**

Question THREE

a) Explain the Top- Down digital system design. **(3 Marks)**
b) Explain any **four (4)** features of good Integrated Circuit design practice. **(8 Marks)**
c) A dice measuring 8mm square is processed from a design process which results to a defect density of $0.8/cm^2$. Calculate the yield (Y) using the negative binomial model. Use $\alpha=0.3$. **(4 Marks)**
d) Differentiate between wet and dry oxidation giving the defining equation for each**.(3 Marks)**
e) Describe the Medium Scale Integration (MSI) in MOSFETs and state one of the applications of MSI scale of integration. **(2 Marks)**

Question FOUR

a) Describe the following stages of Integrated Circuit design
i) Specification
ii) Formulation
iii) Optimization
iv) Technology mapping (**5Mark)**
b) Discuss the following special electronic devices stating their role in integrated circuits
i) Magnetic Bubble Memory
ii) Solid State Lasers
iii) V-MOS **(12Marks)**
c) Calculate the resistance of a diffused resistor given the parameters; Sheet Resistance $R_{\square}=106\Omega/\square$, Length L=1mm, width W=28nm. **(3 Marks)**

Question FIVE

a) Define Computer Aided Design (CAD) as applied in design of Integrated circuits **(2 Marks)**

b) State four (4) advantages of CAD as opposed to hand/ manual process in digital integrated circuit design and analysis. **(4 Marks)**

c) Conductance in Intrinsic semiconductors is approximated by the equation **$\delta = q\mu N$** where

δ →Conductivity
q→Charge of an Electron $=1.6 \times 10^{-19}$ Coulumbs
μ→Charge Mobility
N→Number of Dopants.

Show that Sheet Resistance $R_{\square}$ of a non-uniform diffused layer is given by

$$\mathbf{R_{\square} = q\mu \int_0^{xj} N(x)\,dx}$$

where x is the doping depth. **(6 Marks)**

d) Explain how each of the following devices are realized in Intergrated Circuits, stating a limitation of each of such realized devices.

i) Resistor
ii) Inductor
iii) Diode
iv) Capacitor **(8Marks)**