EDO UNIVERSITY IYAMHO
Department of Electrical/Electronic Engineering
EEE 315 Physical Electronics

Instructor: *Engr. (Dr.) Amhenrior Henry E*, email: Amhenrior.henry@edouniversity.edu.ng
Lectures: Tuesday, 8am – 10 am & Wednesday, 1pm – 2pm, Engineering Drawing Studio,
Phone: (+234) 8032107220; Office hours: Wednesday, 8.30am to 9.30am,
Office: First room by the left, right wing, ground floor, Engineering & Medical. Sc. Building.

Teaching Assistants: *None*

General overview of lecture: The purpose of this course is to give students the basic understanding the science behind electronic materials and phenomena and their applications. It is centered mainly on particles responsible for current flow in materials. Areas covered by this course include electrons and electronic structure of matter, conductivity in crystalline solids and semiconductors, theory of energy bands, electron emissions, elementary discrete devices fabrication techniques and IC technology.

Prerequisites: Students are expected to have good knowledge of atomic physics/chemistry and be familiar with some concepts such as free electrons, emissions, atomic model, excitation etc. Students are also expected to have basic mathematical analytic skills in science and related areas.

Learning outcomes: At the end of this course, it is expected that students:

i. will have a better understanding of the electronic structure of electronic materials,
ii. will have a better understanding of the mathematical base of electronics,
iii. will be able to explain the different carriers and transport phenomenon in semiconductors,
iv. will be able to explain various forms of electron emissions and their applications,
v. will understand the meaning of intrinsic and extrinsic semiconductor as well as doping,
vi. will be able to explain the basic step in discrete device and IC fabrications,
vii. understand the areas of applications of physical electronics

Assignments: In this course, we shall have three (3) assignments for each student and a Test after the midway of the semester. The assignments are systematically structured to prepare the students for the Test and the examination at the end of the semester.

Grading: The continuous assessment of this course will have a total of 30% with attendance accounting for 10%, assignment accounting for 10% and Test accounting for 10%. The semester examination will account for 70% of the grade/mark.

Textbook: The recommended textbook for this class are as stated:

1. Title: *Principles of Electronics*
   Authors: V.K. Mehta and Rohit Mehta
   Publisher: S. Chand & Company Ram Nagar, New Delhi-110 055 (Multicolour Illustrative Edition)

2. Title: *Semiconductor Physical Electronics*
   Authors: Sheng S. Li
   Publisher: Springer (Second Edition)
   ISBN 10: 0-387-28893-7
   ISBN 13: 978-0387-28893-2

3. Title: *Semiconductor Physics and Devices- Basic Principles (Fourth Edition)*
   Author: Donald A. Neamen
   Publisher: McGraw-Hill Publishers
   ISBN: 1-558600-320-4

Courseware: - EEE 315 – Physical Electronics

Below is an outline of the courseware for the course EEE 315- Physical Electronics. The materials used in this course are partly from recommended text books.

1: Introduction.
- i. Definition of electronics and physical electronics
- ii. Electronic devices
- iii. Functions of electronic devices

2: Atoms and their structure
- iv. The nucleus
- v. The orbit or shell
- vi. Structure of elements
- vii. The basic parameters of electron
- viii. Valence electron
- ix. Free electron

3: Atomic models
- x. Thomson's atomic model and limitations
- xi. Rutherford atomic model and limitations
- xii. The Bohr atomic model
- xiii. Bohr atomic model limitation

4: Bohr atomic model mathematical analysis
- xiv. Radius of an atomic orbit
- xv. Energy of an electron in an orbit
- xvi. The frequency and wavelength of a particle transiting to another energy level
- xvii. Velocity

5: The line spectral of hydrogen atom
- xviii. What is a series?
- xix. The lyman series
- xx. The balmer series
- xxi. The paschen series
- xxii. The bracket series
- xxiii. The pfund series

6: Quantum number
- xxiv. Principal quantum number
- xxv. Orbital or the azimuthal quantum number

xxvi. Magnetic quantum number
xxvii. Spin quantum number
xxviii. Electronic configuration
xxix. Pauli's exclusion principle

7: Energy levels and energy bands in solids

xxx. Valence band
xxxi. Conduction band
xxxii. Forbidden energy gap
xxxiii. Fermi energy level

8: Classification of solids and energy bands

xxxiv. Insulator
xxxv. Conductor
xxxvi. Semiconductor

9. Electron emission

xxxvii. Types of emission
xxxviii. Field emission
xxxix. Secondary emission
xl. Photoelectric emission
xli. Laws of photoelectric emission

10. Semiconductor

xlii. Bonds in semiconductors
xliii. Energy band description of semiconductors
xliv. Intrinsic and extrinsic semiconductors
xlv. Carriers and transport phenomenon in semiconductors
xlvi. Einstein relations

11. Elementary discrete devices fabrication techniques and IC technology IC

xlvii. IC fabrication process