**Course number and name: MTSE: 4070 Electronic Materials**

**Credits and contact hours:** 3 Credits. Tuesday (10:30-11:30am). Other times available on request via e-mail.

**Instructor’s or course coordinator’s name**: Dr. Mohamed El Bouanani

**Text book, title, author, and year**

Principles of Electronic Materials and Devices, 3ed Edition by S.O.Kasap, ISBN: 0-07-295791-3

The Instructor will supply complementary handouts.

1. *Other supplemental materials*

Electronic Properties of Materials, by Rolf E. Hummel (4th Edition, Springer, New York, 2000)

Microchip manufacturing, by S. Wolf, ISBN: 0-9616721-8-8

**Specific Course Information**

1. *Brief description of the content of the course (catalog description)*

Intensive study of electronic, optical and magnetic properties of materials with an emphasis on the fundamental physics and chemistry associated with these materials systems.

1. *Prerequisites or co-requisites*

MTSE 3000, 3001, MATH 3310

1. *Indicate whether a required, elective, or selected elective course in the program*

Required

**Specific goals for the course**

1. *Specific outcomes of instruction*

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| **Specific Course Learning Outcome** |
| 1. Students will learn the concepts of conductivity in electronic materials. |
| 1. Students will learn fundamental physics concepts of Boltzman and Fermi-Dirac statistics in electron and hole charge carriers in semiconductors. |
| 1. Students will learn the electronic properties of intrinsic, extrinsic and degenerate semiconductors. |
| 1. Students will learn fundamental of electronic materials properties used to design functional device applications such as solar cells and thermoelectrics. |
| 1. Students will learn basic integrated circuits fabrication processes to manufacture functional electronic devices. |

1. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes that are addressed by the course.*

This course addresses ABET Student Outcome 7

**Brief list of topics to be covered**

1. Elementary Concepts and Electrical Conduction
2. Modern Theory of Solids

Band theory of solids,

Density of states,

Boltzmann and Fermi-Dirac statistics,

Electron effective mass and Fermi Energy,

1. Semiconductors:

Intrinsic and Extrinsic semiconductors,

Degenerate semiconductors,

Recombination and minority carrier injection,

Schottky Junctions and Ohmic Contacts.

1. Semiconductor Devices:

Basics of a pn junction,

Metal-Oxide-Semiconductor Field Effect Transistor (MOSFET),

Thermoelectrics,

Piezoelectrics,

Light Emitting Diodes (LEDs) and Solar Cells.

1. IC fabrication: brief overview

Integrated-circuit types,

Overview of semiconductor manufacturing and silicon wafer production,

Thin films depositions,

Diffusion and ion implantation,

Oxidation,

Plasma processing,

Lithography