ECEG-6702: Multilayer PCB Design and Technology          Daniel D. Tessema{*daniel@aait.edu.et*}

### Course Objective:

- To create schematic and physical models of electronic devices, circuits and systems

- To design industry standard professional multilayer printed circuit boards

- To study and experiment PCB manufacturing and assembly process

### Course Outline:

1. Introduction to Computer Aided Engineering (CAE) (2 classes)

    1.1. Representing electronic components for a computer system

    1.2. Managing workflow on a CAE suit /Cadence OrCAD and Allegro/

    1.3. Computer Aided Design (CAD) of Electronic systems

    1.4. Computer Aided Manufacturing (CAM) and Industry trends

2. Introduction to Industry Standards (2 classes)

    2.1. Introduction to the standards organizations

    2.2. Classes and types of PCBs

    2.3. Standard fabrication allowances

    2.4. PCB dimensions and tolerances

3. PCB Design for Manufacturing (2 class)

    5.1. PCB assembly and soldering processes

    5.2. Component placement and orientation guidelines

    5.3. Footprint design for manufacturability

4. PCB Design for Signal Integrity (2 classes)

    5.1. Noise, distortion and frequency response

    5.2. Electromagnetic interference and compatibility (EMI and EMC)

    5.3. PCB Electrical characteristics

    5.4. Design and layout techniques to optimize signal integrity

    *Assign1:  Review paper on PCB materials, EMI&EMC and Industry standards*

5. Schematic Design (4 classes)

    3.1. Understanding datasheet of components

    3.2. Creating and maintaining symbolic models from datasheets

    3.2. Single and multi-sheet schematic design

    3.3. Netlist generation for Simulation and layout

    *Project1: Complete Schematic of selected A/D Mixed Signal Systems*

6. Printed Circuit Board Design (4 classes)

    4.1. Creating and maintaining physical models (land patterns)

    4.2. PCB Layer stack-up

    4.3. Parts placement and design rule guidelines

    4.4. PCB routing and routing guidelines

    4.5. Artwork generation for manufacturing

    *Project2: PCB layout of selected A/D Mixed Signal Systems in Gerber RS-274 Format*

7. PCB Assembly and Demonstration (2 classes)

    6.1. Manual and automated assembly processes

    6.2. Industry standards and regulations

    6.3. Surface mount and through-hole assembly techniques

    6.4. Inspection and testing mechanisms

    *Demonstration: The best design will be selected. The PCB will be made, assembled, and tested.*

**Evaluation System:**

Assignments and Projects (70 %), Final exam (30%)

**Textbook:**

Kraig Mitzner, "Complete PCB Design Using OrCAD Capture and PCB Editor", 2nd Ed. Elsevier Inc. 2009

**References:**

[1] IPC Standard IPC-2221, "Generic Standard on Printed Board Design", Revised 2010

[2] H. Johnson, M. Graham, "High Speed Digital Design", 1st Ed, Prentice Hall, 1993

[3] John Ardizzoni, "A Practical Guide to High-Speed PCB Layout", Analog Dialogue, Vol 39, Sep 2005

**Software Tools:**

    Cadence OrCAD V 16.3 or above --- Used for this course (Industry's most used)

    Other Easy and free layout software, such as Eagle, Protel, EzPCB, et ceta