COURSE OUTLINE

ELEC 332 INDUSTRIAL POWER ELECTRONICS

Prepared By: Robert Jennings

SCHOOL OF ENGINEERING TECHNOLOGY
ELECTRICAL TECHNOLOGY AND ENGINEERING SCIENCE DEPARTMENT
MAY 2015
A. **TITLE**: Industrial Power Electronics

B. **COURSE NUMBER**: ELEC 332

C. **CREDIT HOURS**: 3

D. **WRITING INTENSIVE COURSE**: NO

E. **WEEKS PER SEMESTER**: 15

F. **SEMESTER OFFERED**: FALL and SPRING

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY**: Two hours lecture and two hours laboratory per week

H. **CATALOG DESCRIPTION**: This course is designed to prepare students with industrial power electronics skills necessary to function as technologist. Topics include: Solid States Devices, Photo-Electronics, Inverters, Operational Amplifier circuits including integrator and differentiator applications, Open/Closed Loop Feedback Systems, SCRs, TRIACs, Thyristors, Photosensitive devices, Optically Coupled Devices, Motor Direction Control Inverter circuits and techniques used to develop line voltages and frequencies for Variable Speed AC Inductions Motors.

Note: Credit is given to a student who has taken ELEC 232 with a (C) grade or better.

I. **PRE-REQUISITES/CO-COURSES**:
   Pre-requisite: Electronic Circuits (ELEC 231) or permission of instructor.

J. **GOALS (STUDENT LEARNING OUTCOMES)**

   **By the end of this course, seventy percent of the students will be able to:**

<table>
<thead>
<tr>
<th>Course Objectives (STUDENT LEARNING OUTCOMES)</th>
<th>Institutional SLO*</th>
</tr>
</thead>
</table>
| 1. Determine the D. C. Base, Collector and Emitter currents in a common emitter mode transistor Circuit.       | 2. Critical Thinking  
|                                                                                                               | 3. Professional Competence                              |
| 2. Determine the output voltage of an non–inverting Operational Amplifier circuit with two voltage sources    | 2. Critical Thinking  
| connected to the non-inverting input.                                                                        | 3. Professional Competence                              |
| 3. Determine the gate turn on voltage for a Silicon Controlled Rectifier circuit.                            | 2. Critical Thinking  
|                                                                                                               | 3. Professional Competence                              |
| 4. Determine the output waveform (with proper voltage levels) generated by an operational amplifier integrator | 2. Critical Thinking  
|                                                                                                               | 3. Professional Competence                              |
circuit based on an applied input wave shape.

| 5. Determine the proper 3 phase line voltage for a 60 Hertz rated variable speed AC induction motor operating at 45 Hertz under a constant Volts/Cycle mode? | 2. Critical Thinking  
3. Professional Competence |

* Institutional Student Learning Objectives (SLO)  
(1) Communication (2) Critical Thinking (3) Professional Competence (4) Inter-Intrapersonal Skills

K. TEXT:  
i. Upper Saddle River, New Jersey: Prentice Hall.

L. REFERENCES: As determined by the instructor.

M. EQUIPMENT: As determined by the instructor.

N. GRADING METHOD: A-F

O. MEASUREMENT CRITERIA/METHODS:  
a. Examination  
b. Quiz  
c. Homework  
d. Laboratory Reports.

P. DETAILED COURSE OUTLINE:  

I. Bipolar transistor circuits

II. The Operational Amplifier  
A. The Ideal Operational Amplifier  
B. The Inverting Amplifier  
C. The Non-inverting Amplifier  
D. The Voltage Follower  
E. The Differential Amplifier  
F. The Instrumentation Amplifier  
G. The Voltage to Current Converter  
H. The Current to Voltage Converter  
I. The Comparator  
J. The Schmidt Trigger  
K. The Window Detector  
L. The Integrator  
M. The Differentiator  
N. Electrical Characteristics of a Practical Operational Amplifier

III. Thyristors (Four layer devices)  
A. Shockley Diode Characteristics
B. Silicon Controlled Rectifiers  
C. Silicon Controlled Switches  
D. Diacs Triggering Devices  
E. SCR Applications  
F. Triacs  
G. Triac Applications  

IV. AC Motor Speed Control Systems  
A. Variable-Frequency Inverters  
B. Varying voltage along with frequency  
   1. Using Volts/Frequency control  
C. Cycloconverters  

Q. LABORATORY OUTLINE:

List of Experiments

<table>
<thead>
<tr>
<th>Exp. No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.- PS1</td>
<td>Bi-Polar Circuits - Problem Session #1</td>
</tr>
<tr>
<td>2. -PS2</td>
<td>Bi-Polar Circuits - Problem Session #2</td>
</tr>
<tr>
<td>3.</td>
<td>Op-Amp Slew Rate</td>
</tr>
<tr>
<td>4.</td>
<td>Inverting Amplifiers</td>
</tr>
<tr>
<td>5.</td>
<td>Non-Inverting Amplifiers</td>
</tr>
<tr>
<td>6.</td>
<td>Op-amp Characteristics</td>
</tr>
<tr>
<td>7.</td>
<td>Gain-Bandwidth Product</td>
</tr>
<tr>
<td>8.</td>
<td>Summing Amplifiers</td>
</tr>
<tr>
<td>9.</td>
<td>Comparators</td>
</tr>
<tr>
<td>10.</td>
<td>Integrators</td>
</tr>
<tr>
<td>11.</td>
<td>Differentiators</td>
</tr>
<tr>
<td>12.</td>
<td>DC Motor Direction Control “H” Circuit</td>
</tr>
<tr>
<td>13.</td>
<td>Optoisolators</td>
</tr>
<tr>
<td></td>
<td>1. Inverter Circuit Design (DC to AC)</td>
</tr>
<tr>
<td></td>
<td>2. Motor –Speed Control Circuit</td>
</tr>
<tr>
<td></td>
<td>3. SCR Circuits</td>
</tr>
<tr>
<td></td>
<td>4. TRIAC Circuits</td>
</tr>
<tr>
<td></td>
<td>5. Inductive Sensor Design</td>
</tr>
<tr>
<td></td>
<td>6. Capacitive Proximity Sensor Design</td>
</tr>
</tbody>
</table>