1- Department, number, and title of course:
   Electrical and Computer Engineering Technology
   ECET 6403/ECET 4904 (Special Topics)
   Applications of Power Electronics
   CRN: 21002 / 21003 Graduate
   CRN: 20914 / 20915 Undergraduate

2- Course Designation:
   Graduate / Senior Elective

3- Course (catalog) description:
   This course combines electric machinery, control and power electronics. The first part of the course is devoted entirely to Power Electronics. The second part is devoted to the application of power electronics in the speed control of electric machinery. Both dc and ac motor drive systems are covered. MATLAB and Spice will be extensively used for computation and verification purposes. Practical and hands-on experience will be gained using practical electric drive systems in the second part of the course.

4- Prerequisites:
   ECET 3500-Survey of Electric Machines, or equivalent

5- Textbook:
   Mihai Puiu-Berezintiu, Florian Misoc,
   Industrial Power Electronics, manuscript (it will be provided by the instructor)

6- Course learning outcomes / expected performance criteria.
   After successful completion of this course, the student should be able to:
   1. Describe the characteristics of power semiconductor devices (Si and SiC)
   2. Describe the operation of different types of AC regulators (Si and SiC)
   3. Determine the voltage, current, and efficiency of AC regulators
   4. Describe the operation of power rectifiers (single-phase and three-phase, Si and SiC)
   5. Determine the voltage, current, and efficiency of power rectifiers
   6. Describe the operation of DC-DC converters (Si and SiC)
   7. Determine the voltage, current, and efficiency of DC-DC converters
   8. Describe the operation of power vacuum tubes
   9. Design and test power electronics circuitry/modules

7- Topics covered.
   1. Power semiconductor devices: power diode, SCR, power BJT, power MOSFET
   2. AC voltage/current regulators: single-phase and three-phase regulators
   3. Power rectifiers: single-phase and three-phase power rectifiers
   4. DC-DC converters: one, two and four quadrant converter
5. Forced-commutation inverters: single-phase and three-phase inverters
6. Silicon-Carbide (SiC) material characteristics
7. Silicon-Carbide devices: Shottky diode, JFET (normally-on/normally-off), IGBT
8. Silicon-Carbide Modules: half-bridge inverters, motor drives, solar inverters
9. High-power vacuum tubes: characteristics, circuits, and applications

8- Class / Laboratory schedule:
1 lecture session per week, 150 minutes per session: M; 6:00-8:30 pm, Q-221
1 lab session per week, 140 minutes: M; 8:40 – 11:00 pm, Q-339

9- Contribution of course to meeting the requirements of Curriculum (Criterion 5)
Engineering Technology/Renewable Energy Topics – 4 Credit Hours

10- Evaluation of Student Performance
Examinations: Each chapter will be concluded with a 10-minutes test. There will be three
50-minutes Term-Exams, and one 120-minutes Final-Exam.
Homework: will be graded, and will be collected every week. All “review questions” and
all “problems” at the end of each chapter are assigned as homework for each respective
chapter. The homework will be presented on engineering paper. No exceptions!
Laboratory: (due to the nature of this course, laboratory experiments and/or projects will
be completed based on availability of specialized equipment and materials). Existing
software will be sufficient for design and simulation of power electronics circuits.
Laboratory Experiments (tentative):
a. The symbols and electrical characteristics of devices in a power electronics circuit
b. DC power electronics commutators
c. AC power electronics commutators
d. Triggering circuits for SCRs and TRIACs
e. AC voltage regulators
f. SCRs controlled rectifiers
g. The study of three-phase PWM inverter
h. SiC JFET DC-DC converters
i. SiC IGBT Half-bridge inverter
j. Vacuum tube radio transmitter

11- Team Project (Graduate Students only)
Teams of Two

12- SPSU Honors Code: www.spsu.edu/honorcode
As a member of the Southern Polytechnic State University community of scholars, I
understand that my actions are not only a reflection on myself, but also a reflection on the
University and the larger body of scholars of which it is a part. Acting unethically, no
matter how minor the offense, will be detrimental to my academic progress and self-
image. It will also adversely affect all students, faculty, staff, the reputation of this
University, and the value of the degrees it awards. Whether on campus or online, I
understand that it is not only my personal responsibility, but also a duty to the entire
SPSU community that I act in a manner consistent with the highest level of academic
integrity. Therefore, I promise that as a member of the Southern Polytechnic State
University community, I will not participate in any form of academic misconduct. I also understand that it is my responsibility to hold others to these same standards by addressing actions that deviate from the University-wide commitment to working, living, and learning in an environment conducive to a quality education. Thus, I affirm and adopt this honor code of Southern Polytechnic State University.

13- Instructor
Florian Misoc, Ph.D., P.E.
Office: Q-148
Phone: (678) 915-7423
e-mail: fmisoc@spsu.edu
Office Hours: As posted
Website: http://educate.spsu.edu/fmisoc/

Calculators: It is preferred that the calculators used for this class be those approved by the Board of Professional Licensure (for examination purpose only)!

No I-Phone, I-Pad, web-enhanced cell-phones are allowed for computations during examinations!

Disclaimer: The current syllabus is a “first-draft” and it is subject to approval by the appropriate committee in the Electrical and Computer Engineering Technology Department (ECET). Thus, changes to the current document will be made throughout the semester, as requested by the ECET committee.