Kingdom of Saudi Arabia Ministry of Higher Education **Qassim University** College of Engineering		المملكة العربية السعودية وزارة التعليم العالي **جامعة القصيم** **كلية الهندسه**

Advanced Industrial Electronics

College:	**College of Engineering**

Department:	**Electrical Engineering Dept.**

First: Course Definition

1- Course Code: 618

2- Units	**3**

3 – Semester	**2nd semester of MSC program**

4 -Prerequisite	**Electronics, Circuit Analysis, Integrated sensors and sensor systems**

5- Co-requisite	**-----**

6- Location (if not on main Campus):

Second: Course Objectives

- Give students an appreciation of the Power electronic circuits and their essential role for a whole array of consumer and industrial electronics products. At the low power end, these may include switched-mode regulated power supplies for hand-held devices, TVs, light fittings, computers and other entertainment systems. At the high power end, there are diverse industrial applications in high voltage DC transmission, grid connections for wind generators and PV systems; Power supplies for telecommunication equipment, Power electronic converters for aircraft actuators and navigation, to name a few.
- To ensure that students know some characteristic properties of Power Electronics which covers steady-state characteristics of various DC-DC, DC-AC, AC-DC and resonant converter circuits.
- Developing the knowledge of Sensors and actuators which are important building block of an industrial Process and shall be discussed to give an idea about the excising possibilities and their usage.
- Students will be taught the basics of PLC with ladder logic and how to deal with input and output power electronic devices from analogue to digital field.

- To make students familiar with the concept of computer modeling of power electronic converters and their control circuits using modern simulation platforms like PSIM or PowerSim in Matlab-Simulink.

Third: Course Specifications

1- Topics to be covered

Subject	No of Weeks	Units
Introduction to Power electronics I: Solid State switching devices (Power Diode, BJT, MOSFET, Thyristor, TRIAC, DIAC, SCR, GTO, IGBT, IGCT)	3	9
Introduction to Power electronics II: Turn ON (Forward voltage triggering, Gate triggering, dV/dt triggering, thermal triggering of Thyristor. (Gate trigger circuits –General block diagram of a Thyristor gate trigger circuit, Resistance firing circuit, Resistance Capacitance firing circuit, Resistor Capacitor full wave trigger circuit. SCR triggering using UJT, PUT. Synchronized UJT triggering) and Turn OFF methods (Class A, B, C, D, E, F) of Thyristor.	3	9
Sensors and Actuators: Sensors (Temperature, pressure, flow, level, position, speed, motion sensors), Actuators (valves, relays, contactors, variable frequency drives, dc drives, motors).	3	9
Industrial Convertors: AC-DC current converters (rectifiers), AC- AC current convertors (AC coppers), DC- DC current convertors, DC-AC current convertors (inverter).	2	6
Programmable Logic Controller: Concept of Relay logic, Ladder logic Fundamentals, PLC building blocks, PLC programming, Wiring techniques and I/O interface	3	9

2- Course components (Total hrs in the Semester): 42

Lecture	Exercise	Others
42	8	---

3- Intended Learning Outcomes of the Course (ILO's)

a. *Knowledge*

i) Description of the knowledge to be acquired-:

- To apply the fundamental knowledge from Basic Electronics and circuit analysis to understand the working principle of power electronics.
- To comprehensively understand the physics of semiconductors electronics.
- To understand the physical basis and the use of typical industrial sensors.

- To gain updated knowledge in the most advanced technique to interface and control electronic and electrical devices by using programmable logic controller.

ii) Teaching strategies to be used to develop that knowledge

- Lectures
- Assignments, at home
- Discussions in the Class
- Case study Report (data collection, internet search, and reporting)

iii) Methods of assessment of knowledge acquired

- **Quizzes:** to assess understanding of the course knowledge.
- **Assignment reports:** to assess ability to answer some comprehensive questions.
- **Midterm Exams:** to assess understanding of the course knowledge.
- **Final Exam:** to assess understanding of the course knowledge.

b- Cognitive (Intellectual) Skills

i) Cognitive skills to be developed

- The ability to analyze, and determine the micro Fabrication.
- The ability to select the suitable technology,
- The ability to control the synchronous machines.

ii) Teaching strategies to be used to develop these cognitive skills

- Lectures
- Assignments, at home
- Discussions in the Class
- Literature Survey Report (data collection, internet search, and reporting)

iii) Methods of assessment of student's cognitive skills

- **Quizzes:** to assess understanding of the course knowledge.
- **Assignment reports:** to assess ability to answer some comprehensive questions.
- **Midterm Exams:** to assess understanding of the course knowledge.
- **Final Exam:** to assess understanding of the course knowledge.

c. Interpersonal Skills and Responsibility

i) Description of the interpersonal skills and capacity to carry responsibility to be develope

- Team work
- Ideas development and sharing with others

ii) Teaching strategies to be used to develop these skills

- Assignments, at home
- Discussions in the Class
- Case study Report (data collection, Internet search, and reporting)

iii) Methods of assessment of student's interpersonal skills and capacity to carry responsibility

- Unified reports and Seminars: to assess the integration done by the student in a unified report and presentations.
- Oral Group Exams: to assess interactive and communication abilities.

d. Communication, Information Technology and Numerical Skills

i) Description of the skills to be developed in this domain

- Use of the internet search
- Technical report writing

ii) Teaching strategies to be used to develop these skills

- Assignments, at home
- Assignment Reports (data collection, Internet search, and reporting)

iii) Methods of assessment of students numerical and communication skills

- Assignment Reports: to assess technical report writing abilities.
- Discussion Groups: to assess interactive and communication abilities.

e. Psychomotor (if applicable) & Other Non-cognitive Skills

i) Description of the psychomotor or other skills to be developed and the level of performance required

Not Applicable

ii) Teaching strategies to be used to develop these skills-

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iii) Methods of assessment of student's psychomotor skills

4- Student Assessment Schedule

Serial	*Assessment tool (test, group project, examination etc.)*	*Week due*	*Weight*

1	Quiz 1 Review of electronics	2	1%
2	HW 1 introduction	3	2%
3	Extended Quiz on Power Electronics 1	4	3%
4	Quiz 2 on Power electronics 2	5	1%
5	HW 2 on Selected topics in power electronics	5	2%
6	Extended Quiz on power electronics	6	3%
8	**Midterm Exam I**	7	**15%**
9	Quiz 4 on Sensors and Actuators	8	1%
10	HW4 on Sensors and Actuators	9	2%
11	Extended QUIZ on Sensors and Actuators	9	3%
12	**Presentation** on Selected Sensors and Acutuators	10	3%
14	**Midterm Exam II**	11	**15%**
15	QUIZ on industrial Convertors	12	1%
16	**Presentation** on industrial convertors	13	3%
17	Quiz 6 PLC	14	1%
18	**Project** on PLC programming	14	4%
19	**Final**	15	**40%**

5- Student Support

1. Office hours per week are offered by the instructor to aid the students and support them.
2. Tutorial arranged to help in understanding the course material

6- Learning Resources

i) Essential Books (References)

- William C. Dunn, “Introduction to Instrumentation, Sensors, and Process Control”, Artech House, Inc., 2006.
- Jacob Fraden, “Hand book of modern sensor: Physics, designs and applications”, 3rd Edition, springer, 2004.
- John R. Hackworth and Frederick D. Hackworth, Jr.,“Programmable Logic Controllers: Programming Methods and Applications”, 1st Edition, 2002.

ii) Course Notes

Lecture notes on semiconductor material physics, providing a deeper treatment than that available in lecture, will be distributed in class.

iii) Recommended Books

- A. Kilian, “Modern Control Technology: Components and Systems”, 2nd ed., Delmar Thomson Learning, 2007.

- Thomas E. Kissell, "Industrial Electronics: Applications for Programmable Controllers, Instrumentation and Process Control, and Electrical Machines and Motor Controls", Prentice Hall, 3rd ed., 2002.
- T. J. Maloney, "Modern Industrial Electronics", 5th ed., Prentice Hall, 2001.
- D. R. Patrick, S. W. Fardo and Marcel Dekker, "Industrial Electronics, Devices and Systems", October 2000.
- L.A. Bryan and E.A. Bryan, "Programmable Controllers Theory and Implementation", 2nd Edition, An Industrial Text Company Publication, 1997.

iv) Electronic Books & Web Sites:

- All recommended books are available online and soft copies can be proveided

v) Periodicals

- Will be selected based on the research projects assigned during the course of study

7- Course Evaluation and Improvement Processes

i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching

- Course related discussions with students at the end of each section
- Introduction of class representative who convey feed backs to the teacher which helps teacher to build an appropriate strategy to improve the teaching and learning process.
- Course evaluation and suggestions form filled after first midterm exam for teacher feedback
- Official course evaluation forms should be compiled and results should be shared with the professor.
- Observing the students opinions recorded in the college student site
- Appeal box
- Carrying out extensive questioners by a sample of the distinguished students just after the graduation from the college.

ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department

A key to effective teaching evaluation is to collect data from multiple sources (triangulation), making sure that all education-related activities are rated by the people best qualified to rate them.

Peer Ratings: A far more effective procedure is for two or more reviewers to use standardized checklists to rate instructional materials and at least two class observations independently and then to reconcile their ratings.[1-3]

Student Ratings: Faculty performance evaluations should take into account student ratings collected over a period of several years, with relatively little weight being attached to ratings of someone's first semester of teaching.

The Teaching Portfolio: Just as some performance assessment data can best be provided by students and some by peers, certain important information can only be supplied by the faculty member being reviewed. Instructors should assemble materials summarizing all of their education-related activities, including developing new courses and redesigning old ones, developing and evaluating innovative instructional methods, advising and mentoring students, writing new texts and courseware, providing instructional development to faculty colleagues and graduate students, and carrying out educational research. All of these materials except those related to educational research should be incorporated into a teaching portfolio, along with summaries of student ratings over the past two or three years, peer ratings, and reference letters from alumni and colleagues at other institutions who are familiar with the instructor's educational activities. The portfolio provides a solid basis for evaluating the faculty member's teaching performance and contributions to education.[4–6] [7]

1. Brent, R., and R.M. Felder, "A Protocol for Peer Review of Teaching," Proc. 2004 An. ASEE Meet., ASEE, June (2004),
2. Chism, N. Van Note, Peer Review of Teaching, Anker Publishing, Bolton, MA (1999)
6. Weimer, M., J.L. Parrett, and M. Kerns, How am I Teaching? Magna Publications, Madison, WI (1988)
4. Seldin, P., The Teaching Portfolio: A Practical Guide to Improved Performance and Promotion/Tenure Decisions, 2nd ed., Anker Publishing
Co., Bolton, MA (1997)
5. Edgerton, R., P. Hutchings, and K. Quinlan, The Teaching Portfolio: Capturing the Scholarship in Teaching, American Association for
Higher Education, Washington, DC (1991)
6. Felder, R.M., "If You've Got It, Flaunt It: Uses and Abuses of Teaching Portfolios," Chem. Eng. Ed., 30(3), 188 (1996)
7. http://www.crlt.umich.edu/tstrategies/tseot.php

iii) Processes for Improvement of Teaching

- The following framework is one that you could use to document strategies you use and assess how they work. The framework follows the familiar "plan, do, check, act cycle" which is a continuous improvement process used in business, industry, government, and higher education.

Plan: Concept - The concept that you plan to teach

Strategy - The teaching strategy that you plan to use

Date - The day you plan to use the strategy

Materials Needed - The teaching materials that you will need

Time Needed - Plan your teaching activity so that you can accomplish all your goals

Feedback - Decide on a strategy to obtain student feedback. Consider fast feedback, written reports and observing students' reactions

Do: Execute your plan

Check: Review student evaluations

Act: Decide on what you would do next time. Stick with the strategy? Change?

iv) Processes for verifying standards of student achievement (e.g. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)

- Not required

v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

As per procedure of academic council

- Assessment and evaluation of the level of achieving the course outcomes through a continuous improvement process (part of a quality assurance system established by the university),
- Consequently, actions are to be taken to improve the course delivery when necessary.
- Review of the course objectives, outcomes and curriculum each 2 years.