Subject Description Form

Subject Code	EE3003 / EE3003A / EE3003B
Subject Title	Power Electronics and Drives
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To understand the characteristics and operation of power electronics devices. 2. To expose the students to the conversion and utilization of large amount of electrical power using latest power semiconductor devices and modern control techniques. 3. To ensure the students develop an understanding of various drive systems.
Intended Learning Outcomes	Upon completion of the subject, students will: a. Be able to explain major semiconductor devices that can be used as switches, and their electrical characteristics which include basic idealised models as well as extension to some important non-ideal characteristics both verbally and in written form. b. Be able to explain the processes of efficient energy conversion through the use of power semiconductor switches. c. Be able to apply the concepts of switching power conversion to analyse a variety of circuits including: i. DC to DC conversion ii. AC to DC conversion iii. DC to AC conversion d. Be able to present the results of study and experiments in the form of a technical report.
Subject Synopsis/ Indicative Syllabus	1. ***Power electronics fundamentals*****:** Power conversion, energy balance principle, review of fundamentals. 2. ***Power semiconductor devices*****:** Diodes**,** power transistor, MOSFET, SCR, GTO, IGBT, switching characteristics. 3. ***DC-DC converters*****:** Buck, Boost and Buck-Boost DC-DC converters, duty cycle controller, switched mode power supply. 4. ***AC-DC rectifiers*****:** Uncontrolled and controlled single-phase and three-phase rectifiers, terminal characteristics, supply and load interactions. 5. ***DC/AC inverters*****:** Basic single-phase bridge inverters, voltage and frequency control, harmonic reduction. 6. ***Electric drive systems*****:** Introduction to electric drives system, applications for conservation of energy, DC electric drives. **Laboratory Experiment:** 1. DC-DC converters 2. PSIM simulation of power electronic circuits

Teaching/Learning Methodology

Lectures, tutorials, and assignments are effective teaching methods:

1. To provide an overview or outline of the subject.
2. To introduce new concepts and knowledge to the students.
3. To explain difficult ideas and concepts of the subject.
4. To motivate and stimulate students interest.
5. To provide students feedback in relation to their learning.
6. To encourage students responsibility for their learning by extra reference books reading and computer-based circuit simulations.

Laboratory works is an essential ingredient of this subject:

1. To supplement the lecturing materials.
2. To add real experience for the students.
3. To provide deep understanding of the subject.
4. To enable students to organise principle and challenge ideas.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Assignments	✓	✓	✓	
Lectures	✓	✓	✓	
Tutorials	✓	✓	✓	
Laboratory works				✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	✓	✓	✓	
2. Assignments	12%	✓	✓	✓	
3. Midterm tests/Quizzes	16%	✓	✓	✓	
4. Laboratory performance & reports	12%				✓
Total	100%				

The understanding on theoretical principle and practical considerations, analytical skills and problem solving technique will be evaluated. Examination, class tests, assignments, laboratory sections and reports are an integrated approach to validly assess students' performance with respect to the intended subject learning outcomes.

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial	33 Hrs.
▪ Laboratory	6 Hrs.
Other student study effort:	
▪ Laboratory preparation/report	12 Hrs.
▪ Self-study and assignments	54 Hrs.
Total student study effort	105 Hrs.

Reading List and References	**Textbooks:** 1. Power Electronics, a First Course - Ned Mohan, Wiley, 2012 2. Muhammad H. Rashid, Power Electronics: Circuits, Devices and Applications, 3rd Edition, Prentice Hall, 2004 **Reference books:** 1. Robert W. Erickson, Fundamentals of Power Electronics, Springer, 3rd edition, 2020 2. Bimal K. Bose, Power Electronics and Variable Frequency Drives: Technology and Applications, IEEE Press, 1997 3. Philip T. Krein, Elements of Power Electronics, Oxford University Press, 1998 4. R. Krishnan, Electric Motor Drives: Modeling, Analysis, and Control, Prentice-Hall, 2001 5. Ned. Mohan, Electric Drives: An Integrative Approach, Minnesota Power Electronics Research & Education, 2003

July 2023