Subject Description Form

Subject Code	EE6521
Subject Title	Industrial Power Electronics
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To provide power electronics engineers with in depth knowledge of the industrial power electronics. 2. To provide latest development in power supplies, industrial power electronics system and their applications in renewable energy systems. 3. To develop a skill in power electronics design including passive components, packaging and standards 4. To enable students to understand the power quality issues and the active and reactive power flow 5. To encourage students to advance in-depth research on new converter technologies to meet new requirements in the context of smart city and smart grid with high penetration of renewable energies and electric vehicles.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Acquire an in-depth understanding of power supply concept and design and be able to analyse the industrial needs for static power conversion. b. Apply the international standards to power electronics design. c. Have a global view on recent development on power electronics and facilitate applications of power electronics in various industries d. Work in teams and independently when conducting power electronics design and testing.
Subject Synopsis/ Indicative Syllabus	1. ***Industrial power systems:*** Static power systems, battery systems, AC systems, DC systems and AC-DC power conversion. 2. ***Power conversion:*** Soft-switching, power factor correction, inverter configurations and static converters. 3. ***Special environment power electronics:*** Power electronics distribution system, industrial guidelines, variable speed and constant frequency systems, actuation systems, brushless drives and other applications of power electronics in industry 4. ***Industrial power supplies:*** Converter topologies, decentralized power, power modules, electro-magnetic compatibility, international standards and reliability. 5. ***Power quality improvement:*** Fourier analysis of voltage current waveforms, total harmonic distortion, passive/active filters, rectifier, power quality issues, reactive power compensation. 6. ***Magnetics and capacitors:*** High frequency inductors and transformers, winding techniques, core loss analysis, optimization of magnetics and power capacitors. **Laboratory Experiments:** Selected topics in computer simulation, Motor drive, DC-DC and AC-DC power converters

Teaching/Learning Methodology

Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiences on design and practical applications are given through experiments and mini-projects, in which the students are expected to solve design problems with real-life constraints and to attain pragmatic solutions with critical and analytical thinking. Interactive laboratory sessions are introduced to encourage better preparation and hence understanding of the experiments. Experiments are designed to supplement the lecturing materials so that the students are encouraged to take extra readings and to look for relevant information.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	✓	✓	✓	
Tutorials	✓	✓		
Experiments				✓

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. Test	20%	✓	✓	✓	
3. Laboratory performance / report	20%				✓
Total	100%				

One end-of-semester written examination; one mid-semester-test; one end-of-semester test; laboratory performance evaluation (including punctuality, initiative, and technical reasoning); and laboratory report on a particular experiment.

Student Study Effort Expected

Class contact:	
▪ Lecture/tutorial	30 Hrs.
▪ Tutorial/Student presentation	3 Hrs.
▪ Laboratory	6 Hrs.
Other student study effort:	
▪ Laboratory and presentation preparation/report	15 Hrs.
▪ Self-study	66 Hrs.
Total student study effort	120 Hrs.

Reading List and References

Reference books:

1. A. M. Trzynadlowski, Introduction to Modern Power Electronics, Third Edition, Wiley, 2015.
2. M.Cirrincione, M. Pucci, G. Vitale, Power Converters and AC Electrical Drives with Linear Neural Networks, CRC Press, 2012.
3. N. Mohan, Power Electronics: A First Course, John Wiley & Sons, 2012.
4. F.P. McCluskey, High temperature Electronics, CRC Press, 1997
5. K.W.E. Cheng, Classical Switched Mode and Resonant Power Converters, The Hong Kong Polytechnic University, 2002