

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC307	Power Electronics & Instrumentation	3-0-0-3	2015
<b>Prerequisite:</b> EC205 Electronic Circuits			
<p><b>Course objectives:</b> The purpose of this course is:</p> <ol style="list-style-type: none"> <li>1. To provide an insight on the concepts of Power Electronics and Electronic instruments.</li> <li>2. To study the applications of Power electronics such as Switched mode regulators and inverters.</li> <li>3. To develop understanding of the concept of Transducers and Digital instruments.</li> </ol>			
<p><b>Syllabus:</b> Power semiconductor switches and its static and dynamic characteristics. Switched mode regulators, SMPS, Switched mode inverters, UPS. Performance characteristics of instruments, Measurement of passive components, Different Transducers, Digital Instruments.</p>			
<p><b>Expected outcome:</b> The student should able:</p> <ol style="list-style-type: none"> <li>1. To understand the concepts of Power Electronics and the various applications.</li> <li>2. To get an insight on various electronic instruments, their configuration and measurements using them.</li> <li>3. To understand the principle of operation of Transducers</li> </ol>			
<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. Umanand L., Power Electronics Essentials and Applications, Wiley India, 2015.</li> <li>2. Rashid M. H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, Third Edition, New Delhi.</li> <li>3. Bell D. A., Electronic Instrumentation and Measurements, Oxford University Press, 2003.</li> </ol>			
<p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Mohan N. and T. M. Undeland, Power Electronics: Converters, Applications and Design, John Wiley, 2007.</li> <li>2. Mandal, Power Electronics 1e, McGraw Hill Education India, 2014</li> <li>3. Nakra, Instrumentation, Measurement and Analysis, 4e, Mc Graw –Hill Education New Delhi, 2016</li> <li>4. Daniel W. Hart, Power Electronics, McGraw Hill, 2011.</li> <li>5. Doebelin E., Measurement Systems, 5/e, McGraw Hill, 2003.</li> <li>6. Helfrick A. D. and W. D. Cooper: Modern Electronic Instrumentation and Measurement Techniques, 5/e, PHI, 2003.</li> <li>7. Patranabis D., Principles of Electronic Instrumentation, PHI, 2008.</li> </ol>			

Course Plan			
Module	Course content	Hours	Sem. Exam Marks
I	Linear Electronics versus Power Electronics - Power semiconductor switches.	1	15
	Power diodes-structure, static and dynamic characteristics	2	
	Power transistors - Power BJT, Power MOSFET, GTO and IGBT	3	
	Steady state and switching characteristics of Power BJT, Power MOSFET and IGBT.	2	
II	Introduction to Switched mode regulators	1	15
	Buck, Boost and Buck-Boost DC-DC converters	2	
	Waveforms and expression of DC-DC converters for output voltage, voltage and current ripple under continuous conduction mode. (Derivation not required)	1	
	Isolated converters - Flyback, Forward, Push Pull, Half Bridge and Full Bridge Converters - waveforms and governing equations. (Derivation not required)	3	
<b>FIRST INTERNAL EXAM</b>			
III	Overview of SMPS, Switched mode inverters- Principles of PWM switching schemes.	2	15
	Single phase inverters - half bridge, full bridge and push pull.	2	
	UPS - on line and off line.	1	
	Three phase inverters - PWM and Space vector modulation in three phase inverters.	3	
IV	Generalized configurations of instruments - Functional elements. Classification of instruments	1	15
	Generalized performance characteristics of instruments - Static characteristics and Dynamic characteristics.	2	
	Measurement of: resistance using Wheastone's bridge, inductance using Maxwell-Wien bridge, and capacitance using Schering's bridge.	2	
<b>SECOND INTERNAL EXAM</b>			
V	Transducers - Classification, Selection of transducers.	1	20
	Resistance transducers - Principle of operation, strain gauge.	2	
	Inductive Transducers: LVDT.	2	
	Capacitive transducers - different types, capacitor microphone, Hall Effect transducer, proximity transducers.	2	
VI	Electronic Multimeter, Audio Power Meter, RF power meter	2	20
	Digital Instruments - Basics, digital measurement of time, phase, frequency and digital voltmeter.	2	

	Frequency synthesizer, Spectrum analyzers, Logic State analyzers (block diagram only).	1	
	Digital storage oscilloscope – Working Principle, controls and applications.	2	
<b>END SEMESTER EXAM</b>			

**Question Paper Pattern**

The question paper consists of three parts. Part A covers modules I and II, Part B covers modules III and IV and Part C covers modules V and VI. Each part has three questions. Each question can have a maximum of four subparts. Among the three questions one will be a compulsory question covering both the modules and the remaining two questions will be as one question from each module, of which one is to be answered. Mark pattern is according to the syllabus with 100 % for theory.