

<b>COURSE CODE:</b> 1153EE110	<b>COURSE TITLE: POWER SUPPLY QUALITY</b> <i>(Qualitative approach)</i>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**PREAMBLE**

This course provides knowledge on need for power supply quality, factors affecting the power quality, their sources, effects and solutions.

**PRE-REQUISITES**

Basic Electrical Engineering

**COURSE EDUCATIONAL OBJECTIVES:**

To impart knowledge on

- To provide knowledge on importance of power supply quality
- To educate the power quality phenomena, sources and its effects
- To understand the role of power quality standards and charts
- To demonstrate the types of linear and nonlinear loads
- To brief about power conditioning devices and monitoring systems

**COURSE OUTCOMES:**

Upon the completion of the course students will be able to

<b>CO Nos.</b>	<b>Course Outcomes</b>	<b>Level of learning domain (Based on revised Bloom's taxonomy)</b>
CO1	Explain the importance of Power Quality	K2
CO2	Describe about power quality problems, categories, causes and its effects	K2
CO3	Interpret the role of power quality standards and charts	K2
CO4	Demonstrate the various types of linear and nonlinear loads	K2
CO5	Summarize Power Conditioning devices and Power Quality Monitoring systems.	K2

**CORRELATION OF COs AND POs**

<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
CO1			M									
CO2			M									
CO3			M									
CO4	L		H									H
CO5			H	H								M

H-High, M-Medium, L-Low

<b>COURSE CONTENTS</b>		
<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Evolution of Power Quality, Definition – Importance of Power Quality, Voltage Quality, Voltage Versus Current Distortion, Sources of Power Quality Problems, Economic impacts		
<b>UNIT II</b>	<b>POWER QUALITY PHENOMENA</b>	
Categories of Power Quality: Transients, Steady State Variations, Short Duration and Long Duration Voltage Variations, Sags, Swells, Interruptions, Voltage Unbalance, Waveform Distortion, Harmonics, Voltage Fluctuations, Flicker, Power Frequency Variation. Causes, Effects and Solutions		
<b>UNIT III</b>	<b>STANDARDS AND CHARTS</b>	<b>9</b>
Need and Role of PQ standards, Indian Standards, International Power Quality Standards and Charts: IEEE standards, IEC Standards, Total harmonics distortion (THD), Power acceptability curves: Computer Business Equipment Manufacturers Association (CBEMA) curve, Semiconductor Equipment and Materials International group (SEMI) curve, Information Technology Industry Council (ITIC) curve.		
<b>UNIT IV</b>	<b>LINEAR AND NON LINEAR LOADS</b>	<b>9</b>
Fluorescent lighting, Fans, Computer Loads, Switch Mode Power Supplies (SMPS), Uninterrupted Power Supply (UPS), Electronic Ballasts, microprocessor based control systems (PCs, PLCs), Inverters, Battery load, Battery Chargers, Biomedical devices, Network devices		
<b>UNIT V</b>	<b>CASE STUDY</b>	<b>9</b>
Simulation of Power Quality Problems using PQ teaching toy software. Introduction to Mathematical transforms for PQ analysis, Overview of Power Conditioning Devices and Mitigating Equipments. Importance of proper wiring and grounding. Outline of Power Quality Monitoring Systems.		
<b>TOTAL: 45 PERIODS</b>		
<b>TEXTBOOKS:</b>		
<ol style="list-style-type: none"> <li>1. Roger C. Dugan, Mark F. McGranaghan, Surya Santoso and H.Wayne Beaty, “Electrical Power Systems Quality”, McGraw Hill, 2003.</li> <li>2. Math H.J.Bollen, Understanding Power Quality Problems-Voltage sag &amp; Interruptions, IEEE Press,2000</li> </ol>		
<b>REFERENCE BOOKS:</b>		
<ol style="list-style-type: none"> <li>1. G.T. Heydt, 'Electric Power Quality', 2nd Edition. Circle Publications, 1994.</li> <li>2. Arrillaga, N.R. Watson, S. Chen, 'Power System Quality Assessment', New York: Wiley, 1999.</li> </ol>		
<b>EXTENSIVE READING:</b>		
<ol style="list-style-type: none"> <li>1. Electric Power Quality by <a href="http://www.springer.com/engineering/energy+technology/book/978-94-007-0634-7">Surajit Chattopadhyay</a> (<a href="http://www.springer.com/engineering/energy+technology/book/978-94-007-0634-7">http://www.springer.com/engineering/energy+technology/book/978-94-007-0634-7</a>)</li> <li>2. Power Quality by <a href="http://www.fer.unizg.hr/download/repository/Power_Quality.pdf">C. Sankaran</a> (<a href="http://www.fer.unizg.hr/download/repository/Power_Quality.pdf">www.fer.unizg.hr/download/repository/Power_Quality.pdf</a>)</li> <li>3. Power Quality in Electrical Systems by <a href="http://www.lybrary.com/power-quality-in-electrical-systems-p-56147.html">Alexander Kusko</a>, <a href="http://www.lybrary.com/power-quality-in-electrical-systems-p-56147.html">Marc T. Thompson</a> (<a href="http://www.lybrary.com/power-quality-in-electrical-systems-p-56147.html">http://www.lybrary.com/power-quality-in-electrical-systems-p-56147.html</a>)</li> </ol>		

