

## POWER QUALITY

<b>Course Code</b>	20EE4701C	<b>Year</b>	IV	<b>Semester(s)</b>	I
<b>Course Category</b>	Professional Elective-III	<b>Branch</b>	EEE	<b>Course Type</b>	Theory
<b>Credits</b>	3	<b>L-T-P</b>	3-0-0	<b>Prerequisites</b>	Electrical Power Generation, Transmission & Distribution
<b>Continuous Internal Evaluation:</b>	30	<b>Semester End Evaluation:</b>	70	<b>Total Marks:</b>	100

### Course Outcomes

<b>Upon successful completion of the course, the student will be able to</b>	
<b>CO1</b>	<b>Outline</b> definitions of common power quality phenomena. (L2)
<b>CO2</b>	<b>Identify</b> different PQ phenomena causes and effects (L3)
<b>CO3</b>	<b>Apply</b> mitigation techniques to solve power quality problems (L3)
<b>CO4</b>	<b>Analyze</b> the measured data for PQ monitoring (L4)
<b>CO5</b>	<b>Investigate</b> various power quality problems and submit a report

### Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2	3		3			1	2				2	1	3	1
CO3	2		2		1	1	1				1	1	2	1
CO4		2	2	1		2	2	1			2	2	3	1
CO5			3			3			3	3		3	3	1

### SYLLABUS

<b>Unit No.</b>	<b>Contents</b>	<b>Mapped CO</b>
I	<b>Power Quality-an Overview:</b> Power Quality definition, the power quality evaluation procedure, and General classes of power quality problems: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variations.	<b>CO1 CO2 CO4 CO5</b>
II	<b>Voltage sags and Interruptions:</b> Sources of sags and Interruptions, Estimating Voltage sag performance-Area of vulnerability, equipment sensitivity to voltage sags, transmission system sag performance evaluation, and utility distribution system sag performance Evaluation	<b>CO1 CO2 CO4 CO5</b>

III	<b>Fundamental Principles of Protection:</b> Fundamental principles of protection, solutions at the end user level, Ferro-resonant transformers, magnetic synthesizers, standby UPS, hybrid UPS and superconducting magnetic energy storage (SMES) devices	CO1 CO3 CO4 CO5
I V	<b>Fundamentals of Harmonics:</b> Harmonic distortion, voltage versus current distortion, harmonics versus transients, power system quantities under non-sinusoidal conditions, harmonic indexes, harmonic sources from commercial loads, harmonic sources from industrial loads. Devices for controlling harmonics	CO1 CO2 CO3 CO4 CO5
V	<b>Distributed Generation and Power Quality Monitoring:</b> Resurgence of DG, DG Technologies, Interface to the Utility System, Power Quality issues, operating conflicts. Monitoring Consideration Power quality measurement Equipment	CO1 CO2 CO4 CO5

### Learning Resources

#### Text Books

1. R.C.Dugan, MF.Mc.Granaghan, S.Santoso and HW. Beaty, "Electrical Power Systems Quality", McGraw Hill, Third edition, 2004.
2. Sankaran. C, "Power Quality", CRC Press, 1st Edition, 2017.

#### Reference Books

1. M.H.J.Bollen, "Understanding Power Quality Problems- Voltage sag and Interruptions", IEEE Press, 2001.

#### e-Resources

1. <https://nptel.ac.in/courses/108107157>