

CONCEPTS OF POWER QUALITY

Course Code	23EE2702A	Year	IV	Semester(s)	I
Course Category	Open Elective-IV	Branch		Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Concepts of Power Systems
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand the concepts, causes, impacts, and basic mitigation methods of major power quality classification, including transients, voltage variations, harmonics, DG integration, and monitoring, in both utility and end-user contexts. (L2)
CO2	Apply principles of transient overvoltage protection and voltage regulation, based on the PQ problems, to address issues in utility and end-user systems. (L3)
CO3	Apply harmonic analysis techniques and voltage regulation methods to evaluate and mitigate waveform distortion and flicker. (L3)
CO4	Analyze the causes, impacts, and mitigation strategies for harmonics, transients, and voltage variations using appropriate devices and filtering methods. (L4)
CO5	Apply monitoring methods, harmonic mitigation, and distributed generation solutions to address power quality issues in distribution networks. (L3)

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	PSO1	PSO2
CO1	2										2		
CO2	2	3				1					2	2	1
CO3	2	3	2								2	2	1
CO4	2	3									2	2	1
CO5	2	3				1					2	2	1

SYLLABUS		
Unit No.	Contents	Mapped CO
I	Introduction-Terms & Definitions Overview of power quality – Concern about the power quality – General classes of power quality and voltage quality problems – Transients – Long–duration voltage variations – Short–duration voltage variations – Voltage unbalance – Waveform distortion – Voltage fluctuation –Power frequency variations – Voltage Sag – Voltage Swell.	CO1 CO2
II	Transient over Voltages Sources of Transient over voltages - Principles of over voltage protection- Devices for over voltage protection – Utility Capacitor Switching Transients - Utility System Lightning Protection – Managing Ferro resonance – Switching Transient Problems with Loads.	CO1 CO2 CO4
III	Long – Duration Voltage Variations Principles of regulating the voltage – Devices for voltage regulation – Utility voltage regulator application – Capacitor for voltage regulation – End user capacitor application – Regulating utility voltage with distributed resources –flicker.	CO1 CO2 CO3
IV	Harmonic distortion and solutions Voltage distortion verses current distortion –Harmonic indices: THD - TDD and True Power Factor– Sources of harmonics – Effect of harmonic distortion – Impact on capacitors– transformers– motors and meters – Concept of Point of common coupling – Passive and active filtering – Numerical problems.	CO1 CO3 CO4 CO5
V	Distributed Generation and Monitoring Resurgence of distributed generation – DG technologies – Interface to the utility system – Power quality issues and operating conflicts – DG on low voltage distribution networks. Monitoring Power quality monitoring and considerations – Historical perspective of PQ measuring instruments – PQ measurement equipment – Assessment of PQ measuring data.	CO1 CO5

Learning Resources
Text Books
1. Electrical Power Systems Quality - Dugan R C - McGranaghan M F - Santoso S - and Beaty H W - Second Edition - McGraw–Hill - 2012 - 3rd edition. 2. Electric power quality problems –M.H.J.Bollen IEEE series-Wiley india publications - 2011. 3. Power Quality Primer - Kennedy B W - First Edition - McGraw–Hill - 2000.

Reference Books
1. Understanding Power Quality Problems: Voltage Sags and Interruptions - Bollen M HJ - First Edition - IEEE Press; 2000. 2. Power System Harmonics - Arrillaga J and Watson N R - Second Edition -John Wiley & Sons - 2003. 3. Electric Power Quality control Techniques - W. E. Kazibwe and M. H. Sendaula - Van Nostrand Reinhold - New York. 4. Power Quality C.Shankaran - CRC Press - 2001 5. Harmonics and Power Systems –Franciso C.DE LA Rosa–CRC Press (Taylor & Francis) 6. Power Quality in Power systems and Electrical Machines–EwaldF.fuchs- Mohammad A.S.Masoum–Elsevier.
E-Resources
1. https://nptel.ac.in/courses/108106025 2. https://nptel.ac.in/courses/108107157