

Branch Name:	Electrical Engineering
Program Code:	ET109
Course Name:	Power Quality Management (Department Elective-I)
Course Code:	1ET1090607
Pre-requisite Course:	Fundamentals of Power Systems and Power Electronics

Course Objectives:

1. The student will acquire knowledge of power quality problems persist in the system and their effect on healthy operation.
2. Now a day, industry have been solidified with the help of automation and modern equipment. This usually means electronically controlled, energy-efficient equipment that is often much more sensitive towards system parameters.
3. To aware the new distribution generation technology, which is recently adopted in power system to meet load demand as well as to eliminate disturbances from system.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)								
Lecture	Tutorial	Practical	Credit	Theory				Practical				Total
				University Assessment		Continuous Assessment		University Assessment		Continuous Assessment		
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	-	2	4	28	70	12	30	12	30	08	20	150

Course Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
1	Introduction to Power Quality Definition of power Quality, power quality terminology, power quality issues, Susceptibility Criteria, Responsibility of supplier and users of elect power, Standards.	3	10
2	Power Frequency Disturbance Common power frequency disturbances, voltage sags, cures of low frequency disturbances, voltage tolerance.	3	10
3	Electrical Transients Transient system model, Examples of models & response, Types and causes of transients, Examples of transient wave forms.	4	10
4	Harmonics Definition , number, odd and even harmonics, causes of harmonics, Individual & total distortion, Harmonics signatures, Effect of harmonics, Guide lines for harmonic voltage & current limitation, Harmonic current mitigation.	6	12

5	Grounding & Bonding Introduction, National electric code grounding requirements, Essentials of grounding system, ground electrodes, Earth resistance tests, Earth ground grid system, Power Ground system, Signal reference ground, Signal reference ground methods, Single and multi-point grounding, Ground loops.	6	14
6	Power Factor Introduction, Active and Reactive power, Displacement and true power factor, power factor improvement, correction, penalty, voltage rise due to capacitance, application of synchronous condensers and static VAR compensators.	4	10
7	Electromagnetic Interference Electric and magnetic fields, Electromagnetic interference terminology, Power frequency fields, High frequency interference, EMI Mitigation, Cable shielding to minimize EMI, Health concerns of EMI.	6	14
8	Power Quality Measurement Power quality measurement devices, power quality measurements, Number of test locations, Test duration, Instrument set-up, Instrument set up guidelines.	4	6
9	Distributed Generation and Power Quality Resurgence of DG, DG technologies, Interface to the utility system, Power quality issues, Operating conflicts.	6	14

Reference Books:

1. Power Quality by C.Sankaran, CRC publication, 2008.
2. Electrical Power Systems Quality by Roger C.Dugan , TMH publication, 2006.
3. Harmonics and Power Systems by Francisco C. De La Rosa, CRC Publication, 2013.

List of Experiments:

1. Study and calculation of THD of various types of non-linear loads.
2. Power factor improvement using static VAR compensators.
3. Measurement of rms value of voltage and current using various meters.
4. To study different types of harmonics and their effects.
5. Study the measurement of magnetic and electric field using low frequency electromagnetic field meter.
6. Simulation of passive filter to eliminate different harmonics.
7. Study of harmonic distortion limits in agreement with IEEE 519.
8. Study of power quality monitoring standards such as IEEE 1159 and IEC 61000-4-30.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the major power quality problems.	2 Understanding
CLO2	Use equipment that are required to measure the quality of power	3 Applying
CLO3	Apply and analyze/compare techniques available to mitigate power quality problems.	3 Applying 4 Analyze
CLO4	Analyze guide lines for harmonic voltage & current limitation, Harmonic current mitigation	4 Analyze
CLO5	To identify the power quality issues in electrical power system.	2 Remembering
CLO6	To analyze the new distribution generation technology,	4 Analyze

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1		M			M	L			L		M		L			
CLO2	L		L	M			L			L		M		M		L
CLO3			M		L			M		M			L		L	
CLO4	M			M			L				H		L		L	
CLO5		M				L	M					L		L		
CLO6			M		L				M	L					H	

H: High, M: Medium, L: Low