

Branch Name:	Electrical Engineering
ProgramCode:	ET213
CourseName:	Power Quality Management
CourseCode:	2ET2130105T
Pre-requisiteCourse:	Fundamentals of Power Electronics

Course Objectives:

1. To understand the causes and sources for harmonics generation in power system.
2. To identify different effects and disadvantages of harmonics.
3. To understand various harmonic filters for harmonic distortion.
4. To know power quality problems and their mitigation techniques in power system.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Power quality terminologies Categories & characteristics of power system electromagnetic phenomena for power quality, transients – impulsive & oscillatory, long duration & short duration voltage variations, voltage imbalance, waveform distortion, power frequency variations, power quality terms. Power Quality Standards.	08	20%
2	Harmonics Definition, number, odd and even harmonics, causes of harmonics, Individual & total distortion, Harmonics signatures, Guide lines for harmonic voltage & current limitation, Linear & Non Linear Loads, Harmonic Sources, Harmonic issues for uncontrolled and controlled rectifiers, Standardization of harmonics levels.	08	20%
3	Effect of harmonics on electrical apparatus Effect of harmonic on Transformer - Harmonics in No-Load Exciting Current, Harmonics due to Inrush Current, DC Magnetization Effect on Capacitor, Induction Motor.	06	15%
4	Passive harmonic filters Types, Ac network impedance, Design of filters – single tuned, double tuned & damped filter, filter component ratings.	06	10%

5	Active harmonic filters Advantages, Types – shunt, series & hybrid, current control techniques – instantaneous reactive power theory, synchronous reference frame theory, Fast Fourier Transform (FFT), current controllers for active power filters – hysteresis current control, space vector hysteresis current control, PI based current control.	08	20%
6	Measuring and Solving Power Quality Problems Interface to the Utility System Power Quality Issues, Operating Conflicts, DG on Distribution Networks, Siting Distributed Generation current control, Power Quality Measurement Devices, Power Quality Measurements.	06	15%

Text Books:

- 1.C. Sankaran, “Power quality” , CRC Press,2002.
- 2.Roger C. Dugan , “Electrical Power Systems Quality” , 2nd Edition, Tata Mcgraw HillPublication.

Reference Books:

- 1.Hirofumi Akagi, Edson Hirokazu Watanabe, Mauricio Aredes, “Instantaneous Power Theory and Applications to Power Conditioning”, John Wiley & Sons,2007.
- 2.Harmonics and Power systems By Francisco C. De La Rosa Taylor& Francis group, CRCPress.

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Explain concept of Power Quality & their issues for various electrical systems.	1 Remembering
CLO2	Understand the basic components of harmonic generation.	2 Understanding
CLO3	Describe effects of harmonics on electrical apparatus.	4 Analyze 5 Evaluate
CLO4	Know about the various techniques for harmonic mitigation.	2 Understanding
CLO5	Understand the various power quality issues and disadvantage of it.	2 Understanding
CLO6	Know different power quality improvement methods and devices.	3 Applying

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		L		H		M						M		H		L
CLO2	L			M			L				M		M	L		
CLO3			L		M			M		L		M		M	H	
CLO4				M			L				M		M			L
CLO5	L			M			L		L		M		M			L
CLO6	L				M	M		H				L		L	H	

H: High, M: Medium, L: Low