

Branch Name:	Electrical Engineering
ProgramCode:	ET213
CourseName:	Elective:III- Harmonics Measurements & Filtration Techniques
CourseCode:	2ET2130303T
Pre-requisiteCourse:	Power Quality Management.

Course Objectives:

1. To understand the various issues related to power quality in power distribution systems.
2. To identify and analyze different power quality issues.
3. To understand how common power disturbances can effect on circuits, devices and equipment's.
4. To understand the use of passive and active filters for mitigation of harmonics.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
4	4	-	-	4	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Fundamentals of Harmonic Distortion: Linear & Non Linear Loads, Power Quality Indices, Power Quantities under Non sinusoidal situations, Harmonic Sources: Traditional and future sources of harmonics, Standardization of harmonics levels.	08	20%
2	Effects of harmonics on Distribution systems: Effects on capacitors, Transformers, Rotating machines, Lighting Devices, cables, relays, Telephone Interference, Solid state Devices etc.	06	15%
3	Harmonics Measurements: Necessity of harmonic measurement, Measurement procedure.	05	10%
4	Harmonic Filtering Techniques: Passive filter design, single tuned filter, Band pass filter, Tuned harmonic filter design, other methods to decrease harmonic distortion Limits.	07	15%
5	Active Filters: General description of Shunt Active filters, 3-phase, 3-wire shunt active filters, Active filters for current minimization, Active filters for harmonic damping, 3-phase, 4-wire shunt active filters, Hybrid and series active filters, comparison with pure active filters, Combined series and shunt power conditioners, Unified Power Flow Controller (UPFC), Unified Power Quality Controller (UPQC) - basic concepts.	08	20%
6	Harmonic Analysis: Harmonic source representation, Harmonic Propagation facts, flux of harmonic currents, Interrelation between AC system and Load Parameters Analysis methods.	08	20%

Text Books:

1. Harmonics and Power Systems By Francisco C. De La Rosa Taylor & Francis Group, CRC Press.
2. Instantaneous Power Theory and Application to Power Conditioning By Hirofumi Akagi et al., IEEE Press, Wiley-Interscience A John Wiley & Son Publication.

Reference Books:

1. Power System Harmonics, 2nd Edition J. Arrillaga, N.R. Watson, John Wiley & Sons, Ltd ISBN: 0-470-85129-5.
2. Power Electronics Converter Harmonics By Deane A. Paice, IEEE Press.

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the basic concepts about the major role of power electronics in various engineering systems.	2 Understanding
CLO2	Know about basic concept about power electronics circuits which generates the harmonics.	1 Remembering
CLO3	Solve the harmonics related problem related to electrical power system.	5 Evaluate
CLO4	Know about different harmonic filtering techniques.	1 Remembering
CLO5	Applying different techniques for the mitigation of harmonics.	3 Applying
CLO6	Design and analyze the active filter for harmonic mitigation.	4 Analyze 6 Creating

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