

Subject Code: 1ET2130302	Subject Title: Elective:III- Harmonics Measurements & Filtration Techniques
Pre-requisite Subject	Power Quality Management.

Course Objective: After learning the course, the students should be able to:

- Understand various issues related to power quality in power distribution systems.
- Understand the basic definition and terms used in power quality.
- Understand how to analyze power quality issues.
- Understand how common power disturbances can affect circuits, devices and equipments etc.
- Understand use of passive and active filters for mitigation of harmonics

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.	
4	-	2	6	24	60	16	40	12	30	08	20	150

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
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%

Course Outcome:

This course provides the basic concepts about the major role of power electronics in various engineering systems. It explains the basic concept about power electronics circuits introduces harmonics and also provides the solution to the power system, harmonics related problems and different techniques for the mitigation of harmonics etc.

List of 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 Jhon Willey & Son Publication.

List of 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 Deare A Paice, IEEE Press.

List of Experiments:

1. Simulation and analysis of single phase bridge rectifier as a non-linear load.
 2. Performance and analysis of single phase bridge rectifier as a nonlinear load.
 3. Simulation of three phase un-controlled rectifier as a nonlinear load.
 4. Analysis of three phase un-controlled rectifier as a nonlinear load.
 5. Simulation of three phase controlled rectifier as a nonlinear load.
 6. Analysis of three phase controlled rectifier as a nonlinear load.
 7. Simulation of passive filter.
 8. Analysis of passive filter.
 9. Simulation of shunt active filter.
 10. Analysis of shunt active filter.
- Term paper IEEE Transaction / Journal paper HMFT related.