GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRICAL ENGINEERING (07)
POWER QUALITY
SUBJECT CODE: 2740704
M.E. 4TH SEMESTER

Type of course: Engineering Science (Electrical)

Prerequisite: None.

Rationale: NA.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction** Definition of Power Quality, Power Quality Terminologies, Various Power Quality Issues, Susceptibility Criterion, Power Quality Standards: IEEE 519-1992 and IEC 61000-series standards.	5	10
2	**Power Frequency Disturbances & Electrical Transients** Common power frequency disturbances: Voltage Sag, swell and flicker, solutions for low-frequency disturbances, Voltage tolerance criteria, Transient system model, Transient system model and their responses, Power System Transient model, Types and causes of transients.	10	25
3	**Harmonics** Definition, Harmonic number, Odd and Even Harmonics, Harmonic Phase Rotation and Phase Angle relationship, Cause of Voltage and Current Harmonics, Individual and Total Harmonic Distortion	8	20
4	**Grounding and Bonding** Shock and fire hazards, Essentials of Grounded Systems, Ground Electrodes – ground rods, rings & plates, signal reference ground methods, Earth resistance tests, Earth & Power ground systems, Single point and multipoint grounding, ground loops, Isolated ground, electrochemical reactions due to ground grids.	7	15
5	**Power quality issues – power factor & Electromagnetic Interference** Power factor- causes of low power factor, effects and improvement techniques. Electromagnetic Interference – terminology, issues and mitigation techniques	8	20
6	**Power Quality Monitoring** Monitoring Considerations, Historical Perspective of Power Quality Measuring Instruments, Power Quality Measurement Equipment,	7	10

	Assessment of Power Quality Measurement Data, Application of Intelligent Systems, Power Quality Monitoring Standards		

Reference Books:

1. C. Sankaran, "Power quality" , CRC Press, 2002
2. Roger C. Dugan , "Electrical Power Systems Quality" , 2nd Edition, Tata Mcgraw Hill Publication
3. M. H. J. Bollen, "Understanding Power Quality Problems: Voltage sags and Interruptions", Wiley-IEEE Press, 1999
4. S. Chattopadhyay ,M Mitra, S Sengupta, "Electric Power Quality", Springer Publication, 2011
5. Angelo Baggini, "Handbook of power quality", Wiley, 2008
6. Moreno-Munoz, "Power Quality: Mitigation techniques in a distributed environment"

Course Outcome:
After learning the course the students should be able to:

1. Comprehend concept of Power Quality & it's issues for various electrical systems
2. Identify sources of harmonics and understand their effects on power system components
3. Know different techniques for power quality monitoring.

List of Tutorials:

1. Explain various power quality issues and their causes.
2. Effect of step change in input to various circuit configuration including different damping factors of R-L-C circuit.
3. Common causes of voltage sag and swell and their remedies.
4. Simulate various causes of Electrical System transient such as interruption of fault current in cables followed by transmission line, switching of capacitor banks, switching ON and OFF of large loads.
5. Study on various causes of harmonics in distributed system.
6. Earth resistance test and relation of various parameters with resistivity of material.
7. Study on computer port damage due to ground loop currents.
8. Comparison of various methods of EMI mitigation.
9. Recording and analysis of input current of switched mode power supply with single phase input.
10. Comprehensive study on general guidelines for power quality measurement

List of Open Source Software/learning website:

- E-materials available at the website of NPTEL- http://nptel.ac.in/
- MATLAB (Trial version): Software is useful for simulation and analysis of electrical systems

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.