

INSTITUTE	FACULTY OF TECHNOLOGY
PROGRAM	MASTER OF TECHNOLOGY in ELECTRICAL ENGINEERING
SEMESTER	2
COURSE TITLE	POWER QUALITY ISSUES AND MITIGATION TECHNIQUES
COURSE CODE	01PE1206
COURSE CREDITS	4

Objective:

- 1 The objective of this course is to study various power quality issues encountered in power system and different active compensators to mitigate issues.

Course Outcomes: After completion of this course, student will be able to:

- 1 Identify, measure, detect various power quality issues in electrical system
- 2 Analyse the effect of harmonics and non-linearity on electrical equipment
- 3 Design and simulate shunt, series and hybrid active filters
- 4 Apply UPQC and DVR for mitigation of power quality issues

Pre-requisite of course:Power Electronics, Electrical Power System, Electrical Machine

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Introduction Definitions, standards, linear load, non-linear load,, harmonics, power factor, voltage sag, voltage swell,, voltage fluctuation, unbalanced load, transient, EMI, EMC,	5
2	Loads that Cause Power Quality Problems Introduction, Classification of Nonlinear Loads,, Power Quality Problems Caused by Nonlinear Load,, Analysis of Nonlinear Loads,, Modelling, Simulation, and Performance of Nonlinear Loads	5
3	Active Shunt Compensation and Active Series Compensation Classification of DSTATCOMs, Principle of Operation and Control of DSTATCOMs,, Analysis and design of DSTATCOM	8

Contents : Unit	Topics	Contact Hours
4	Shunt Active filter Three phase three wire shunt active filter,, three phase four wire shunt active filter	8
5	Hybrid and Series Active Filter Combined series active and shunt passive filter,, Comparison between hybrid and Pure active filter	8
6	Unified Power Quality Compensators an DVR Classification of Unified Power Quality Compensators,, Principle of Operation and Control of Unified Power Quality Compensators,, Introduction of DVR, Operating principle of DVR, Application of DVR.	8
Total Hours		42

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Experiment No - 01 To study about IEEE 1159 and IEEE 519 standards for various guidelines and practices related to power quality	2
2	Experiment No - 02 To analyze the input current waveform of single phase and three-phase rectifier with different types of loads.	2
3	Experiment No - 03 To simulate converter topology and derive various components of power using instantaneous power theory.	2
4	Experiment No - 04 To design and simulate passive single tuned filter for harmonic compensation	2
5	Experiment No - 05 To simulate and observe the effect of firing angle on input current of AC voltage controller	2
6	Experiment No - 06 To study control strategies of Shunt Active Power Filter based on instantaneous power theory	2
7	Experiment No - 07 To study control strategies of Shunt Active Power Filter based Synchronous Reference Frame Theory	2
8	Experiment No - 08 To study the Dynamic Voltage Restorer for voltage sag and swell	2
9	Experiment No - 09 To simulate hybrid filter for harmonic mitigation	2
Total Hours		18

Textbook :

- 1 Power Quality: Problems and Mitigation Techniques, Bhim Singh, Ambrish Chandra, Kamal Al-Haddad, Wiley publication, NA
- 2 Instantaneous Power Theory and Applications to Power Conditioning, Hirofumi Akagi, NA, NA
- 3 Power Quality, C.Sankaran,, CRC publication, NA
- 4 Harmonics and Power Systems, Francisco C. De La Rosa, CRC Publication, -

References:

- 1 Electrical Power Systems Quality, Electrical Power Systems Quality, Roger C.Dugan, TMH publication, -

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
5.00	10.00	15.00	30.00	20.00	20.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and classroom.
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources:

- 1 https://onlinecourses.nptel.ac.in/noc21_ee103/preview
- 2 <https://archive.nptel.ac.in/courses/108/107/108107157/>
- 3 https://onlinecourses.nptel.ac.in/noc20_ee10/preview