SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

B. Tech.- III Semester-VI	
Subject Name: Power Quality Issues and Mitigation Techniques	**Subject Code: BTEL14631**

Type of course:	**Professional Elective Course (Electrical Engineering)**
Prerequisite:	Fundamentals of courses like Power Systems, Power Electronics, Electrical Machines
Rationale:	The term power quality is used to describe the non-stationary disturbances, which cause the major malfunctioning of the electrical equipments. Operation of the electric loads without the proper power causes the electrical devices or loads to malfunction, fail prematurely, or completely non-operational. Good power quality can be defined as a steady supply voltage that stays within the prescribed range, steady AC frequency close to the rated value, and smooth voltage curve waveform. This course helps students in understanding the various power quality issues, significance of power and power factor in single-phase and three-phase systems supplying nonlinear loads. Moreover, it helps in understanding the conventional passive and active compensation techniques used for power factor correction and load voltage regulation. Furthermore, the course includes the power quality improvement in SMPS, drive systems, and renewable energy systems.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	**T**	**P**	**C**	**TEE**	**CA1**	**CA2**	**TEP**	**CA3**	**150**
3	0	2	4	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

PEC: Professional Elective Course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	**Power Quality Introduction** Power Quality definition, Classification of Power Quality Problems, Causes of Power Quality Problems, Effects of Power Quality Problems on Users, Classification of Mitigation Techniques for Power Quality Problems	**7**	**15**
2.	**Power Quality Standards & Monitoring** Power Quality Standards and Monitoring, Power Quality Terminologies, Power Quality Definitions, Power Quality Standards, Power Quality Monitoring	**5**	**10**
3.	**Causes of Power Quality Issues** Nonlinear Loads, Classification of Nonlinear Loads, Power Quality Problems Caused by Nonlinear Loads, Analysis of Nonlinear Loads, Modeling, Simulation, and Performance of Nonlinear Loads	**6**	**10**
4.	**Passive Power Filters** Introduction to Passive Power Filters, Classification of Passive Filters, Principle of Operation of Passive Power Filters, Analysis and Design of Passive Power Filters, Limitations of Passive Filters, Parallel Resonance of Passive Filters with the Supply System and its Mitigation,	**7**	**20**
5.	**Active Power Filters** Introduction to Shunt Active Power Filters, Classification of Shunt Active Power Filters, Principle of Operation and Control of Shunt Active Power Filters, Analysis and Design of Shunt Active Power Filters, Modeling, Simulation, and Performance of Shunt Active Power Filters Introduction to Series Active Power Filters, Classification of Series Active Power Filters, Principle of Operation and Control of Series Active Power Filters, Analysis and Design of Series Active Power Filters, Modeling, Simulation, and Performance of Series Active Power Filters Hybrid Power Filters	**10**	**25**
6.	**Compensation Techniques** Reactive power compensation using traditional techniques, Active Shunt Compensation: DSTATCOMs, Classification, Principle of Operation and Control and Analysis and Design of DSTATCOMs, Active Series Compensation: Classification, Principle of Operation and Control and Analysis and Design of Active Series Compensator, DVR.	**10**	**20**

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Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	**20**	**20**	**20**	**15**	**10**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference/Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Power Quality Problems and Mitigation Techniques	Bhim Singh, Ambrish Chandra, Kamal Al-Haddad	Wiley	2014	First
2	Power Quality	C. Sankaran	CRC Press, New York	2001	
3	Electric Power Systems Quality	R. C. Dugan, M. F. McGranaghan and H. W. Beaty	McGraw Hill, New York	2006	Second
4	Power System Quality Assessment	J. Arrilaga, N R Wattson and S. Chen	John Wiley & Sons	2000	
5	Power Electronics Control In Electrical System	E. Acha, V.G. Agelidis, O. Anaya Lara, T.E.J. Miller	Newnes, Woburn	2002	
6	Power Electronic Converter Harmonics-Multipulse Methods for Clean Power	D.A. Paice	IEEE Press, New York	1996	
7	Reactive Power Control in Electric Systems	T.J.E. Miller	John Wiley Sons, Toronto	1982	

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Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Explain and identify power quality various issues review definitions and standards.	**20**
CO-2	Investigate and classify various causes responsible for poor power quality and their effects.	**20**
CO-3	Explore and identify suitable techniques to address power quality issues.	**20**
CO-4	Model and performance analysis for passive and active filters.	**25**
CO-5	Model and performance analysis for compensation techniques.	**15**

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	1	1	1	1	1	1	1	1	3	1	2	2	-	1
CO-2	1	2	2	1	1	1	1	2	1	2	1	2	2	1	2
CO-3	1	3	3	1	1	2	1	2	1	2	1	2	3	1	2
CO-4	1	1	3	3	3	1	1	1	1	1	1	1	3	3	2
CO-5	1	1	3	3	3	1	1	1	1	1	1	1	3	3	2

LIST OF EXPERIMENTS:

1) Identify various power quality issues
2) Study power quality standards
3) Study Power analyser for measurement of various parameter
4) Simulation of Non-linear Loads and calculation of THD and IHD
5) Simulation and measurement of harmonics for various non-linear loads
6) Measurement of power factor and correction using passive techniques
7) Measurement of high frequency noise with oscilloscopes having high sampling rates
8) Measurement of true RMS value of voltage and current using true RMS meters
9) Design of passive power filter
10) Modelling and simulation of Active Power Filters
11) Study of DSTATCOM
12) Study of IEEE-81 for Grounding and Earthing

List of Open Source/learning website:

1) https://onlinecourses.nptel.ac.in/noc23_ee63/preview
2) https://onlinecourses.nptel.ac.in/noc23_ee27/preview

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