FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Electrical Engineering)**

Semester: **VIII**

Course Code: **202050804**

Course Title: **Power Quality and Management**

Course Group: **Professional Elective Course-V**

Course Objectives: Quality of power can have a direct impact on many industrial consumers. There has recently been a great emphasis on revitalizing industry with more automation and more modern equipment. This usually means electronically controlled, energy-efficient equipment that is often much more sensitive to deviations in the supply voltage. This worsens the quality of power. The electric utility is concerned about power quality issues as well. This course would make the students aware about the various issues affecting the power quality as well as techniques available to improve the quality of power.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50 / 18	50 / 17	25/9	25/9	150 / 53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction to Power Quality:** Definition of power Quality, power quality terminology, power quality issues, Susceptibility Criteria, Responsibility of supplier and users of elect power, Standards	03
2	**Power Frequency Disturbance:** Common power frequency disturbances, voltage sags, cures of low frequency disturbances, voltage tolerance	03

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3	**Electrical Transients:** Transient system model, Examples of models &response, Types and causes of transients, Examples of transient waveforms	**05**
4	**Harmonics:** Definition , number, odd and even harmonics, causes of harmonics, Individual & total distortion, Harmonics signatures, Effect of harmonics, Guidelines for harmonic voltage & current limitation, Harmonic current mitigation	**06**
5	**Grounding & Bonding:** Introduction, National electric code grounding requirements, Essentials of grounding system, Ground electrodes, Earth resistance tests, Earth ground grid system, Power Ground system, Signal reference ground, Signal reference ground methods, Single and multi-point grounding, Ground loops	**06**
6	**Power Factor:** Introduction, Active and Reactive power, Displacement and true power factor, power factor improvement, correction, penalty, voltage rise due to capacitance, application of synchronous condensers and static VAR compensators	**04**
7	**Electromagnetic Interference:** Electric and magnetic fields, Electromagnetic interference terminology, Power frequency fields, High frequency interference, EMI Mitigation, Cable shielding to minimize EMI, Health concerns of EMI	**09**
8	**Power Quality Measurement:** Power quality measurement devices, power quality measurements, Number of test locations, Test duration, Instrument setup, Instrument set up guidelines.	**06**

List of Practicals / Tutorials:

1	To study power quality terminology.
2	To Study Power Quality Standards
3	To study use of Power Quality Measurement Equipment.
4	Simulate Power Quality Analysis Disturbances Model.
5	Study, Simulate and calculate THD and IHD of various types of non-linear loads.
6	To study & simulate causes of Transients.
7	To study & measure current harmonic of commercial load(bulb, fluorescent light and led bulb).
8	To study & check power quality of supply current and voltage of power supply (SMPS, Rectifier etc...)
9	To study & measure Supply current Transient of 1-phase & 3-phase IM.
10	To Study, Simulate and Measure Power factors of different loads and improvement methods.
11	To study and Simulate Variable frequency drives and measure the power quality disturbances.
12	Simulation and analysis of Dynamic Voltage Restorer (DVR).

Reference Books:

1	Power Quality by C.Sankaran, CRC publication
2	Electrical Power Systems Quality by Roger C.Dugan , TMH publication
3	Harmonics and Power Systems by Francisco C. De La Rosa, CRC Publication
4	Understanding Power Quality Problems by Math H. Bollen, Wiley-IEEE Press, 1999

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Supplementary learning Material:	
1	https://nptel.ac.in/courses/108106025 (Power Quality in Power Distribution Systems)

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Internal Evaluation: The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
10%	40%	30%	10%	10%	0%	

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.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand the major power quality problems	30
CO-2	To Study the production of voltages sags & Power Frequency Disturbance.	25
CO-3	Understand and analyze harmonics Electromagnetic Interference in power systems.	30
CO-4	Use equipment that is required to measure the quality of power.	15

Curriculum Revision:	
Version:	2.0
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	June-2025

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