# M.E Semester: 1
# Electrical Engineering (Electrical Power System)
## Subject Name: Power Quality

### A. Course Objective:

- To study causes of degradation of power quality.
- To study remedies of various power quality issues.

### B. Teaching / Examination Scheme

| SUBJECT | | Teaching Scheme | | | | Total Credit | Evaluation Scheme | | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Total | | THEORY | | IE | CIA | PR. / VIVO | |
| CODE | NAME | Hrs | Hrs | Hrs | Hrs | | Hrs | Marks | Marks | Marks | Marks | |
| MEEPS-106 | Power Quality | 3 | 0 | 0 | 3 | 3 | 3 | 70 | 30 | 20 | 0 | 120 |

### C. Detailed Syllabus

| SR No. | Unit No | Topic | No. of Hours | Weightage In Exam |
|---|---|---|---|---|
| 1 | **Unit:1** | **Introduction**<br>Definition of power quality- overview of power quality phenomena- Classification of power quality issues, Power Quality standards | 4 | 10% |
| 2 | **Unit: 2** | **Power Frequency Disturbances**<br>Introduction, Common power frequency disturbances, Cures for Low-Frequency disturbances, Voltage tolerance criteria<br>**Electrical Transients:**<br>Transient System Model, Examples of Transient Models and Their Response, Power System Transient Model, Types and Causes of Transients, Examples of Transient Waveforms | 10 | 20% |
| 3 | **Unit: 3** | **Harmonics**<br>Definition of Harmonics, Odd and Even Order Harmonics, Harmonic Phase Rotation and Phase Angle Relationship, Causes of Voltage and Current Harmonics, Individual and Total Harmonic Distortion, Harmonic Signatures, Effect of Harmonics on Power System Devices, Guidelines for Harmonic Voltage and Current Limitation, Harmonic Current Mitigation. | 08 | 20% |

 

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| 4 | **Unit: 4** | **Power Factor**<br>Introduction, Active and Reactive Power, Displacement and True Power Factor, Power Factor Improvement, Power Factor Correction, Power Factor Penalty, Other Advantages of Power Factor Correction, Voltage Rise Due to Capacitance, Application of Synchronous Condensers, Static VAR Compensators<br><br>**Electromagnetic Interference**<br>Frequency Classification, Electrical Fields, Magnetic Fields, Electromagnetic Interference Terminology, Power Frequency Fields, High-Frequency Interference, Electromagnetic Interference Susceptibility, EMI Mitigation,<br>**Unbalance:**<br>Unbalance in three phase power system, Sources of Unbalance, Effect of Unbalance,<br>**Other issues:**<br>DC Offset, Electric Noise, Voltage Fluctuation, Flicker and Power Frequency Variation | 12 | 25% |
| 5 | **Unit: 5** | **Distributed Generation and Power Quality**<br>Resurgence of DG, DG Technologies, Interface to the Utility System Power Quality Issues Operating Conflicts, DG on Distribution Networks, Siting Distributed Generation, Interconnection<br>**Wiring and Grounding**<br>Resources, Definitions, Reasons for Grounding Typical Wiring and Grounding Problems, Solutions to Wiring and Grounding Problems | 06 | 15% |
| 6 | **Unit:6** | **Measuring and Solving Power Quality Problems**<br>Power Quality Measurement Devices, Power Quality Measurements, Number of Test Locations, Test Duration, Instrument Setup, Instrument Setup Guidelines | 05 | 10% |

## D. Instructional Methods

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures, which may carries five marks in overall evaluation.
- Two internal exams may be conducted and average of the same may be converted to equivalent of 15 marks as a part of internal theory evaluation.

 

- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of five marks in the overall internal evaluation.

- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.

## E. Students Learning Outcomes

- Students should be able to differentiate among various power quality issues and their remedies in the power system.

## F. Recommended Study Materials

- **Text & Reference Books:**

1. Roger C. Dugan, Mark F. McGranaghan and H.WayneBeaty, "Electrical Power System Quality," MC Graw Hill.
2. C. Sankaran, "Power Quality", CRC Press, 2002.
3. Surajit Chattopadhyay • Madhuchhanda Mitra, Samarjit Sengupta, "Electric Power Quality", Power System series, Springer Publication.

 