

| <b>B. E. ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                          |                             |                              |                         |
|--|--------------------------|-----------------------------|------------------------------|-------------------------|
| <b>CHOICE BASED CREDIT SYSTEM (CBCS) AND OUTCOME BASED EDUCATION (OBE)</b>   |                          |                             |                              |                         |
| <b>SEMESTER – VIII</b>   |                          |                             |                              |                         |
| <b>ELECTRICAL POWER QUALITY (PROFESSIONAL ELECTIVE)</b>  |                          |                             |                              |                         |
| Course Code  | 18EE825                  | CIE Marks                   | 40                           |                         |
| Teaching Hours/Week (L:T:P)  | (3:0:0)                  | SEE Marks                   | 60                           |                         |
| Credits  | 03                       | Exam Hours                  | 03                           |                         |
| <b>Course Learning Objectives:</b>   |                          |                             |                              |                         |
| <ul style="list-style-type: none"> <li>• Review definitions and standards of common power quality phenomena.</li> <li>• Understand power quality monitoring and classification techniques.</li> <li>• Investigate different power quality phenomena causes and effects.</li> <li>• Understand different techniques for power quality problems mitigation.</li> <li>• Understand the various power quality phenomenon, their origin and monitoring and mitigation methods.</li> <li>• Understand the effects of various power quality phenomenon in various equipment.</li> </ul> |                          |                             |                              |                         |
| <b>Module-1</b>  |                          |                             |                              |                         |
| <b>Introduction:</b> Power quality-voltage quality, power quality evaluation procedures term and definitions: general classes of power quality problems, transients, long duration voltage variation, short duration voltage variations, voltage imbalance, waveform distortion, power quality terms.  |                          |                             |                              |                         |
| <b>Module-2</b>  |                          |                             |                              |                         |
| <b>Voltage sags and interruptions:</b> Sources of sags and interruptions, estimating voltage sag performance, fundamental principles of protection, motor starting sags.   |                          |                             |                              |                         |
| <b>Transient over voltages:</b> Sources of transient over voltages, principles of over voltages protection, utility capacitor switching transients.  |                          |                             |                              |                         |
| <b>Module-3</b>  |                          |                             |                              |                         |
| <b>Transient over voltages:</b> Fundamentals of harmonics: Harmonic distortion, voltage versus transients, harmonic indexes, harmonic sources from commercial loads, harmonic sources from Industrial loads, effects of harmonic distortion, intra harmonics.  |                          |                             |                              |                         |
| <b>Module-4</b>  |                          |                             |                              |                         |
| <b>Applied harmonics:</b> Harmonic distortion evaluations, principles for controlling harmonics, harmonic studies, devices for controlling harmonic distortion, harmonic filters, standards of harmonics.  |                          |                             |                              |                         |
| <b>Power Quality Benchmark:</b> Introduction, benchmark process, power quality contract.   |                          |                             |                              |                         |
| <b>Module-5</b>  |                          |                             |                              |                         |
| <b>Power quality benchmark:</b> power quality state estimation, including power quality in distribution planning.  |                          |                             |                              |                         |
| <b>Distributed generation and quality:</b> DG technologies, interface to utility system, power quality issues, interconnection standards.  |                          |                             |                              |                         |
| <b>Course Outcomes:</b> At the end of the course the student will be able to:  |                          |                             |                              |                         |
| <ul style="list-style-type: none"> <li>• Define Power quality; evaluate power quality procedures and standards.</li> <li>• Estimate voltage sag performance; explain principles of protection and Sources of transient over voltages.</li> <li>• Identify various sources of harmonics, explain effects of harmonic distortion.</li> <li>• Evaluate harmonic distortion, control harmonic distortion.</li> <li>• Estimate power quality in distribution planning. Identify power quality issues in utility system.</li> </ul>  |                          |                             |                              |                         |
| <b>Question paper pattern:</b>   |                          |                             |                              |                         |
| <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question will be for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub- questions) from each module.</li> <li>• Each full question will have sub- question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module.</li> </ul>   |                          |                             |                              |                         |
| <b>Sl No</b>   | <b>Title of the Book</b> | <b>Name of the Author/s</b> | <b>Name of the Publisher</b> | <b>Edition and Year</b> |
| <b>Textbook</b>  |                          |                             |                              |                         |

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|------------------------|---|---------------------------------------|--------------------------------|------|
| 1                      | Electric Power Quality  | Dugan, Roger C                        | McGraw-Hill                    | 2003 |
| <b>Reference Books</b> |   |                                       |                                |      |
| 1                      | Electric Power Quality  | G.T.Heydt                             | Stars in a circle publications | 1991 |
| 2                      | Understanding power quality problems voltage sags and interruptions | Math H. J. Bollen.                    | IEEE Press                     | 2000 |
| 3                      | Power quality in power systems and electrical machines              | Ewald F Fuchs, Mohammad, A.S., Masoum | Academic Press, Elsevier       | 2009 |

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