

I Year I Semester

Code: 17PE204

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CUSTOM POWER DEVICES

(Common to PE, P&ID, PE&ED, PE&D, PE&S, EM&D, PE&PS)

Prerequisites: Concept of power electronics and concept of reactive power compensation.

Course Educational Objectives:

1. To understand the various power quality issues and their effects on the distribution circuits.
2. To understand principle of working of various custom power devices.
3. To understand the other custom power devices and their applications to power system.

UNIT I-Introduction

Custom Power and Custom Power Devices - power quality variations in distribution circuits – Voltage Sags, Swells, and Interruptions - System Faults – Over voltages and Under voltages - Voltage Flicker - Harmonic Distortion - Voltage Notching - Transient Disturbances - Characteristics of Voltage Sags.

UNIT II-Overview of Custom Power Devices

Reactive Power and Harmonic Compensation Devices - Compensation Devices for Voltage Sags and Momentary Interruptions - Backup Energy Supply Devices - Battery UPS – Super Conducting Magnetic Energy Storage systems - Flywheel – Voltage Source Converter - Multilevel converters.

UNIT III-Reactive Power and Harmonic Compensation Devices

Var control devices - Static Var Compensator – Topologies - Direct Connected Static Var Compensation for Distribution Systems – Static Series Compensator - Static Shunt Compensator (DSTATCOM) - Interaction with Distribution Equipment and System - Installation Considerations.

UNIT IV- High-Speed Source Transfer Switches, Solid State Limiting, and Breaking Devices:

Source Transfer Switch - Static Source Transfer Switch (SSTS), - Hybrid source transfer switch –High-speed mechanical source transfer switch - Solid state current limiter - Solid state breaker.

UNIT V-Application of Custom Power Devices in Power Systems

P-Q theory – Control of P and Q – Dynamic Voltage Restorer (DVR) – Operation and control – Interline Power Flow Controller (IPFC) – Operation and control – Unified Power Quality Conditioner (UPQC) – Operation and control. Recent custom power devices.

Course Outcomes:

After completion of this course the students will be able to:

- Analyse the effect of various power quality issues in distribution system and their mitigation principles.
- Describe the operation of custom power devices for reactive power & harmonic compensation.
- Analyse high speed transfer switches.
- Analyse the operation and control of custom power devices in power system applications.

Text Books:

1. Guidebook on Custom Power Devices, Technical Report, Published by EPRI, Nov 2000
2. Power Quality Enhancement Using Custom Power Devices – Power Electronics and Power
3. Systems, Gerard Ledwich, Arindam Ghosh, Kluwer Academic Publishers, 2002.

Reference Books:

1. Power Quality, C. Shankaran, CRC Press, 2001
2. Instantaneous power theory and application to power conditioning, H. Akagi et al., IEEE Press, 2007.
3. Custom Power Devices - An Introduction, Arindam Ghosh and Gerard Ledwich, Springer, 2002
4. A Review of Compensating Type Custom Power Devices for Power Quality Improvement,
5. Yash Pal et al. Joint International Conference on Power System Technology and IEEE Power India Conference, 2008. POWERCON 2008.