Power Electronics and Distributed Generation - Video course

COURSE OUTLINE

Introduction to distribution systems, distribution system equipment, grounding, sequence analysis and fault calculations, relaying requirements for Distributed Generation (DG) systems.

Intentional and unintentional islanding, power converter topologies for grid interconnection, inverter modeling, filtering requirements. Selection of power converter components, DC bus design, considerations for power loss and reliability in the design procedure, thermal cycling of power semiconductor modules, insulation grade selection, and thermal design implications.

Control of grid interactive power converters, synchronization and phase locking techniques, current control, DC bus control, converter faults, grid parallel and stand alone operation. Power quality, voltage unbalance, harmonics, flicker, voltage and frequency windows, and recent trends in power electronic DG interconnection.

COURSE DETAIL

Sl. No.	Topic/s	Number of Hours
1	Distributed Generation (DG) - Overview and technology trends.	2
2	Introduction to distribution systems. Radial distribution system protection: Fuse, circuit breakers, reclosers, sectionalizers.	3
3	Per-unit analysis, fault analysis, sequence component analysis, sequence models of distribution system components. Implications of DG on distribution system protection coordination.	3
4	Power quality requirements and source switching using SCR based static switches.	2
5	Distribution system loading, line drop model, series voltage regulators and on line tap changers.	2
6	Loop and secondary network distribution grids and impact of DG operation.	1
7	Relaying and protection, distributed generation interconnection relaying, sensing using CTs and PTs.	2

NP-TEL

NPTEL

http://nptel.iitm.ac.in

Electrical Engineering

Pre-requisites:

1. Switch mode power electronics, motor drives and a basic undergraduate course on power systems.

Coordinators:

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8	Intentional and unintentional islanding of distribution systems. Passive and active detection of unintentional islands, non detection zones.	3
9	DG planning, cost implications of power quality, cost of energy and net present value calculations and implications on power converter design.	2
10	Power converter topologies and model and specifications for DG applications.	3
11	Capacitor selection, choice of DC bus voltage, current ripple, capacitor aging and lifetime calculations.	3
12	Switching versus average model of the power converter and EMI considerations in DG applications.	2
13	Semiconductor device selection, device aging due to thermal cycling, and lifetime calculations.	3
14	Issues in output ac filter design, filter inductor selection. Insulation aging issues. Packaging issues in the power converter. Calculation of damage due to thermal cycles. Thermal impedance models.	2
15	Control of DG inverters, phase locked loops, current control and DC voltage control for stand alone and grid parallel operations. Protection of the converter.	3
16	Complex transfer functions, VSI admittance model in DG applications.	2
17	Power quality implication, acceptable ranges of voltage and frequency, flicker, reactive power compensation, and active filtering and low voltage ride through requirements.	2
	Total	**40**

References:

1. Technical literature – papers published in power electronics related journals and IEEE standards.
2. Arthur R. Bergen, Vijay Vittal, Power Systems Analysis, Prentice Hall, 1999.
3. Ned Mohan, Tore M. Undeland, William P. Robbins, Power Electronics: Converters, Applications, and Design; Wiley, 2002.