PPE342DISTRIBUTED GENERATION AND MICROGRID

L	T	P	Cr
3	1	0	3.5

Course Objectives: To impart knowledge about distributed generation technologies, their interconnection in grid, to understand relevance of power electronics in DG, to understand concept of microgrid

DISTRIBUTED GENERATION (DG) TECHNOLOGIES : Introduction, Comparative study between conventional and non-conventional methods of power generation: energy crisis due to scarcity of fossil fuel, distributed generation (DG) overview and technology trend. Working principle, architecture and application of renewable DG technologies: Solar PV, bioenergy, wind energy, hydroelectricity, tidal power, wave energy, geothermal energy etc. Non-conventional technology based DGs: Fuel cells, CHP based microturbine, IC engines, etc. Storage based DGs: Storage technology: Battery, super capacitor, flywheel etc.

INTERCONNECTION ISSUES AND STANDARDS OF DGs. : Concept of distributed generations (DG) or distributed energy resources (DERs), topologies, selection of source, dependence on storage facilities, regulatory standards/ framework, standards for interconnecting DGs to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Grid code and Islanding & non-islanding system

OPERATIONAL FEATURES OF GRID CONNECTED DG SYTEMS : Grid interconnection issues for grid connected operation of various types of DG systems. Constraints on operational parameters: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Reliability, stability and power quality issues involved in grid connected operation of various DGs.

POWER ELECTRONICS AND DG SYSTEMS : Relevance of power electronics in DG applications, Power quality requirements and source switching using SCR based static switches, Distribution system loading, line drop model, series voltage regulators and on line tap changers, power converter topologies, model and specifications for DG applications, issues filter designs, harmonic reduction, Control of DG inverters, phase locked loops, current control and DC voltage control for stand alone and grid parallel operations. Protection of converters, power quality implication, acceptable ranges of voltage and frequency, reactive power compensation and active filtering.

OPERATION, CONTROL AND MODELLING OF MICROGRID : Concept and definition of microgrid, review of sources of microgrids, typical structure and configuration of a microgrid, microgrid implementation in Indian and international scenario, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids, communication infrastructure, modes of operation and control of microgrid: grid connected and islanded mode operation, anti-islanding schemes. Control techniques for voltage, frequency, active and reactive power control of microgrid system, Computer aided Modelling of microgrid.

INTRODUCTION TO RELIABILITY AND MARKET ISSUES OF MICROGRID: Power quality issue, THD reduction techniques, protection and stability analysis of microgrid,

regulatory standards, introduction to microgrid reliability. Features of microgrid economy and market. LVDC Microgrid.

Recommended Books:

1. *Renewable Energy- Power for a sustainable future, third edition, Edited by Godfrey Boyle, Oxford University Press, 2013.*
2. *Amirnaser Yezdani, and Reza Iravani, "Voltage Source Converters in Power Systems: Modeling, Control and Applications", IEEE John Wiley Publications, 2009.*
3. *Dorin Neacsu, "Power Switching Converters: Medium and High Power", CRC Press, Taylor & Francis, 2006. New Delhi.*
4. *Microgrids: Architectures and Control, Nikos Hatziargyriou (Editor), ISBN: 978-1-118-72068-4, 340 pages, December 2013, Wiley-IEEE Press*
5. *Microgrids and Active Distribution Networks, S. Chowdhury, S.P. Chowdhury and P. Crossley, The Institution of Engineering and Technology, London, U.K, 2009.*
6. *Technical literatures- research papers published in power system and power electronics related reputed journals and IEEE standards.*

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes etc.)	25