NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**B. Tech. in Electrical Engineering**
Semester:	**VII**
Course Code:	4EE202ME25
Course Title:	**Distributed Generation and Microgrid**
Course Type:	**Department Elective-III**
Year of Introduction:	**2025 – 26**

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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. comprehend the concept of distributed generation (BL2)
2. analyse the impact of grid integration and control aspects of distributed generation (BL4)
3. illustrate the structure and configuration of microgrids (BL3)
4. evaluate the operation and control aspects of microgrid (BL5)

Unit	Contents	Teaching hours (Total 45)
Unit-1	**Distributed Generations** Introduction to Distributed Generation (DG), working principles, architecture and application of renewable DG technologies, conventional technology based DGs, storage based DGs, storage technology- battery, super capacitor, flywheel etc. comparison among the DG Technologies, selection of sources and sizing, technical and economic impact of DGs	13
Unit-2	**Impact of DG Integration with Grid** Importance of grid interconnection, regulatory framework, standards for interconnecting DGs to electric power systems, DG installation classes, security issues in DG implementations, grid code, grid interconnection issues, constraints on operational parameters, response to grid abnormal operating conditions, LVRT and synthetic inertia emulation, islanding, stability, power quality and protection issues, reliability	12
Unit-3	**Microgrid Basics** Concept of microgrid, typical structure and configuration of a microgrid, microgrid implementation in Indian and International scenario, AC-DC and hybrid microgrids, power electronics interfaces in DC and AC microgrids, communication infrastructure, energy management in microgrid system.	08

Unit-4	**Operation and Control of Microgrid** Operation of microgrid in islanded and grid connected mode, techniques for voltage, frequency, active and reactive power control of microgrid system, anti-islanding schemes, microgrid stability and microgrid protection, regulatory standards for microgrid and reliability evaluation of microgrid, features of microgrid economy and market	12

Self-Study:
The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Tutorial Work:
This shall consist of at least 06 tutorials based on the above syllabus.

Suggested Readings:

1. H. Lee Willis, Walter G. Scott, *Distributed Power Generation –Planning and Evaluation*, Marcel Decker Press.
2. Math H. Bollen, Fainan Hassan, *Integration of Distributed Generation in the Power System*, Wiley Publication.
3. G. B. Gharehpetian, S. M. Agah, *Distributed Generation Systems: Design, Operation and Grid Integration*, Butterworth-Heinemann Publisher.
4. Hassan Farhangi, Geza Joos, *Microgrid Planning and Design: A Concise Guide*, Wiley-IEEE Press
5. K. R. Padiyar, Anil M. Kulkarni, *Dynamics and Control of Electric Transmission and Microgrids*, Wiley-IEEE Press
6. S. Chowdhury, S. P. Chowdhury, P. Crossley, *Microgrids and Active Distribution Networks*, IET Power Electronics Series
7. Nikos Hatziargyriou, *Microgrids: Architectures and Control*, Wiley-IEEE Press
8. *IEEE standard for interconnection and interoperability of distributed energy resources with associated electric power systems interfaces*. IEEE Std 1547
9. Recent Papers of reputed journals and relevant standards