NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B. Tech. in Electrical Engineering**
Semester:	**VI**
Course Code:	**3EE211DE24**
Course Title:	**AC/DC Microgrid**
Course Type:	**Disciplinary Minor (Elective Course-I)**
Year of Introduction:	**2024 – 25**

L	T	Practical component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLOs):

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

1. illustrate the concept of microgrids **(BL3)**
2. model the converters for microgrids **(BL3)**
3. analyse the dynamics and control techniques in microgrids **(BL4)**
4. appraise the stability and protection aspects of microgrids **(BL5)**

Contents: **Teaching Hours: 45**

Unit-I **Concept, overview and types of microgrid** **08**

Overview, concept, typical structure and configuration of a microgrid, microgrid implementation in Indian and International scenarios, AC and DC microgrids, features of microgrid economy and market.

Unit-II **Modelling of converters, renewable energy sources, energy storage systems** **14**

Power electronics interfaces in DC and AC microgrids, modeling of DC-DC converter, DC-AC converters and AC-DC converters for microgrids, modeling of renewable energy sources and energy storage systems for microgrid.

Unit-III **Microgrid dynamics, operating modes, standards and control techniques** **10**

Operational aspects of microgrid in islanded and grid connected mode, techniques for voltage, frequency, active and reactive power control of microgrid system, regulatory standards for microgrid.

Unit-IV **Stability and protection aspects of microgrid** **13**

Linear and nonlinear stability system in microgrid, anti-islanding schemes, microgrid stability and microgrid protection, reliability evaluation of microgrid, energy management in microgrid system.

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.

Laboratory Work:

This shall consist of at least 08 laboratory experiments / simulations based on the above syllabus.

Suggested Readings:

1. Fusheng Li, Ruisheng Li, Fengquan Zhou, Microgrid Technology and Engineering Application, Elsevier.
2. Nikos Hatziargyriou, Microgrids Architectures and Control, John Wiley Sons.
3. Manuela Sechilariu, Fabrice Locment, Urban DC Microgrid: Intelligent Control and Power Flow Optimization, Butterworth-Heinemann.
4. Hassan Bevrani, BrunoFrançois, Toshifumi Ise, Microgrid Dynamics and Control John Wiley Sons.
5. Hassan Farhangi, Geza Joos, Microgrid Planning and Design: A Concise Guide, Wiley-IEEE Press.
6. S. Chowdhury, P. Crossley, Microgrids and Active Distribution Networks, Institution of Engineering and Technology.
7. K. R. Padiyar, Anil M. Kulkarni, Dynamics and Control of Electric Transmission and Microgrids, Wiley-IEEE Press.
8. S. Chowdhury, S. P. Chowdhury, P. Crossley, Microgrids and Active Distribution Networks, IET Power Electronics Series.
9. IEEE standard for interconnection and interoperability of distributed energy resources with associated electric power systems interfaces." IEEE Std 1547
10. Recent Papers of reputed journals and relevant standards

Suggested List of Experiments:

	Title of Experiment	Hrs.
1.	Study of system-level microgrid simulation from simple one-line diagram	2
2.	Design and simulation of an isolated DC microgrid with storage	4
3.	Design and simulation of wind powered AC microgrid	2
4.	Study of various types of power electronics converters used in AC-DC microgrid	2
5.	Design of suitable MPPT technique for solar powered DC microgrid	4
6.	Design and simulation of AC-DC hybrid microgrid system with storage units	2
7.	Analysis of the microgrid dynamic operation in interconnected system	2
8.	Islanded operation of an inverter-based microgrid using droop control	2
9.	Stability analysis in simplified model of a small scale microgrid	2
10.	Power management in renewable generation based microgrid	2

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. academic year 2024 - 25 and onwards