

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEE76b- SMART GRID TECHNOLOGIES

(Professional Elective-IV)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To learn about recent trends in grids as smart grid
- To understand about smart grid architecture and technologies
- To know about smart substations
- To learn about smart transmission systems
- To learn about smart distribution systems

UNIT – I: Introduction to Smart Grid**10 Hrs**

Working definitions of Smart Grid and Associated Concepts – Smart Grid Functions – Traditional Power Grid and Smart Grid – New Technologies for Smart Grid – Advantages – Indian Smart Grid – Key Challenges for Smart Grid

Smart Grid Architecture: Components and Architecture of Smart Grid Design – Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid designs – Transmission Automation – Distribution Automation – Renewable Integration

Learning Outcomes:

At the end of this unit, the student will be able to

- To understand basic definitions and architecture of Smart grid **L1**
- To understand the need for integration of Renewable energy sources **L2**

UNIT – II: Smart grid Technologies**09 Hrs**

Characteristics of Smart grid, Micro grids, Definitions, Drives, benefits, types of Micro grid, building blocks, Renewable energy resources, needs in smart grid, integration impact, integration standards, Load frequency control, reactive power control, case studies and test beds

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about basic characteristic features of smart grid technologies **L1**
- To know about integration requirements, standards of renewable energy sources in Microgrids **L2**

UNIT – III: Smart Substations**09 Hrs**

Protection, Monitoring and control devices, sensors, SCADA, Master stations, Remote terminal unit, interoperability and IEC 61850, Process level, Bay level, Station level, Benefits, role of substations in smart grid, Volt/VAR control equipment inside substation

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about protection, monitor and control devices in Smart substations **L1**
- To understand about Volt/VAR control equipment inside substation **L3**

UNIT – IV: Smart Transmission**10 Hrs**

Energy Management systems, History, current technology, EMS for the smart grid, Wide Area Monitoring Systems (WAMS), protection & Control (WAMPC), needs in smart grid, Role of WAMPC smart grid, Drivers and benefits, Role of transmission systems in smart grid, Synchro Phasor Measurement Units (PMUs)

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about Energy Management Systems in smart transmission systems **L1**
- To know about role of transmission systems in Smart grid **L2**

UNIT – V: Smart Distribution Systems

10 Hrs

DMS, DSCADA, trends in DSCADA and control, current and advanced DMSs, Voltage fluctuations, effect of voltage on customer load, Drivers, objectives and benefits, voltage- VAR control, VAR control equipment on distribution feeders, implementation and optimization, FDIR - Fault Detection Isolation and Service restoration (FDIR), faults, objectives and benefits, equipment, implementation

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about DSCADA in Smart Distribution Systems **L1**
- To understand about VAR control and equipment on distribution feeders **L2**

Text Books:

1. Stuart Borlase, Smart Grids - Infrastructure, Technology and Solutions, CRC Press, 1e, 2013
2. Gil Masters, Renewable and Efficient Electric Power System, Wiley-IEEE Press, 2e, 2013.

Reference Books:

1. A.G. Phadke and J.S. Thorp, Synchronized Phasor Measurements and their Applications, Springer Edition, 2e, 2017.
2. T. Ackermann, Wind Power in Power Systems, Hoboken, NJ, USA, John Wiley, 2e, 2012.

Course Outcomes:

At the end of this Course the student will be able to

- To be able to understand trends in Smart grids **L1**
- To understand the needs and roles of Smart substations **L2**
- To understand the needs and roles of Smart Transmission systems **L3**
- To understand the needs and roles of Smart Distribution systems **L4**
- To distinguish between SCADA and DSCADA systems in practical working environment **L5**

