

7th Semester

7th Semester	REL7D003	Smart Grid	L-T-P 3-0-0	3 Credits
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Module-I:**(10 hours)**

Evolution of Electric Power Grid, introduction to smart Grid, Concept, definitions, architecture and functions of Smart Grid. Need of Smart Grid. Difference between conventional & smart grid. Opportunities & Challenges of Smart Grid, Introduction to Smart Meters, Real Time Pricing, Smart Appliances. Automatic Meter Reading (AMR). Outage Management System (OMS). Home & Building Automation, Substation Automation, Feeder Automation, Smart Sensors, Geographic Information System (GIS). Intelligent Electronic Devices (IED) & their application for Monitoring & Protection.

Module-II:**(10 hours)**

Phasor Measurement Units (PMU), Wide Area Measurement System (WAMS), Wide-Area based Protection and Control Micro-grid concepts, need and application, Issues of Interconnection. Protection & control systems for micro-grid. Storage systems including Battery, SMES, Pumped Hydro. Compressed Air Energy Storage.

Module-III:**(10 hours)**

Variable speed wind generators, fuel-cells, micro-turbines. Integration of renewables and issues involved, Advantages and disadvantages of Distributed Generation. Power Quality & EMC in smart Grid. Power Quality issues of Grid connected Renewable Energy Sources. Power Quality Conditioners for micro-grid. Web based Power Quality monitoring, Power Quality Audit.

Books:

- [1] Ali Keyhani, "Design of Smart power grid renewable energy systems", Wiley IEEE,2011
- [2] Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRCPress, 2009.
- [3] Stuart Borlase, "Smart Grid: Infrastructure,Technology and solutions " CRC Press
- [4] Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley.
- [5] Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power Driving Sustainability: 1", Artech House Publishers July 2011
- [6] Mladen Kezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert "Substation Automation (Power Electronics and Power Systems)", Springer

Digital Learning Resources:

Course Name: Introduction to Smart Grid
 Course Link: <https://nptel.ac.in/courses/108/107/108107113/>
 Course Instructor: Prof. N.P. Padhy and Prof. Premalata Jena, IIT Roorkee