GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3724511
SUBJECT NAME: Distributed Generation
Semester II

Type of course: Engineering Science (ELECTRICAL)

Prerequisite: -

Rationale: Distributed Energy Resources are connected to the conventional grid to support the energy demand of loads. The installation of Distributed Generators demands investigation on several technical and economical aspects. On the other hand, the control and protection of the Distributed Generator based on the grid condition is vital for the overall system. This course aims at introduction of Distributed Generation in the off-grid and on-grid conditions.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction to Distributed Generation**: Need for Distributed generation , Renewable sources in distributed generation , Current scenario in Distributed Generation, Planning of DGs, Sitting and sizing of DGs, optimal placement of DG sources in distribution systems, Grid integration of DGs, Different types of interfaces, Inverter based DGs and rotating machine based interfaces, Aggregation of multiple DG units.	12	30%
2	**Impact of DG:** Technical impacts of DGs, Transmission systems Distribution systems, De-regulation Impact of DGs upon protective relaying, Impact of DGs upon transient and dynamic stability of existing distribution systems, Steady-state and Dynamic analysis, Limitations of DGs	12	30%
3	**Control of DG:** Voltage control techniques, Reactive power control, Harmonics, Power quality issues, Reliability of DG based systems.	8	15%
4	**Microgrids:** Introduction to micro-grids, Types of micro-grids: autonomous and non-autonomous grids Sizing of micro-grids, Modeling & analysis of Micro-grids with multiple DGs, Micro-grids with power electronic interfacing units, Transients in micro-grids, Protection of micro-grids, Case studies, Advanced topics	10	25%

Reference Books:

1. H. Lee Willis, Walter G. Scott,"Distributed Power Generation – Planning and Evaluation", Marcel Decker Press.
2. M.GodoySimoes, Felix A.Farret, "Renewable Energy Systems – Design and Analysis with Induction Generators", CRC press.
3. Stuart Borlase."Smart Grid: Infrastructure Technology Solutions" CRC Press

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Define distributed generation and microgrid in the context of power system	20
CO-2	Differentiate among different types of DGs	25
CO-3	Analyze the effect of DG on stability of the distribution system and protective relaying	15
CO-4	Compare different control techniques of DG	20
CO-5	Appreciate the role of Microgrid in Power System	20

List of Experiments:

1. Simulate a small Wind Energy Conversion System under off-grid condition
2. Simulate Photovoltaic system under off-grid condition
3. Simulate the off-grid Photovoltaic system with Battery Energy Storage
4. Analyze the effect of DG on stability of distribution system
5. Simulate the voltage control technique in the DG
6. Simulate the reactive power control in distribution system integrated with DG
7. Study on Power Quality Issue due to integration of DG in distribution system

Major Equipment:

1. MATLAB Student Version

List of Open Source Software/learning website:

https://nptel.ac.in/courses/108108034/