GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3734504
Semester – III
Subject Name: Power Electronic Converter and Control for Microgrid

Type of course: Engineering Science (ELECTRICAL)

Prerequisite: Power Electronics

Rationale: NA

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction to Microgrid** Concept of Microgrid, A typical Microgrid configuration, Interconnection of Microgrids, Technical and economic advantages of Microgrid, Challenges and disadvantages of Microgrid development, Management and operational issues of a Microgrid, Distributed Energy Resources: Wind energy conversion systems (WECS), Solar photovoltaic (PV) systems, Small-scale hydroelectric power generation, Fuel Cell, Storage devices, Modes of Operation: Grid Connection Mode , Stand-Alone Mode , Battery Charging Mode ,Impact of microgrid in Distribution System	10	20%
2	**Power Electronic Converters for Microgrid** The Two-Level Converter, The NPC Converter, The CHB Converter, Single-Cell and Multi-cell Power converter Topologies , Pulse Width Modulation Strategies, DC-Link Capacitor Current and Sizing in NPC and CHB Inverters,	08	20%
3	**Grid Requirement for PV and WT systems:** **PV Systems:** International Regulations - IEEE 1547 Interconnection of Distributed Generation, Response to Abnormal Grid Conditions, Power Quality standards, Anti-islanding Requirements **WT Systems:** Grid Code, Frequency and Voltage Deviation under Normal Operation, Active Power Control in Normal Operation, Reactive Power Control in Normal Operation, Behaviour under Grid Disturbances	12	30%
4	**Grid Converter Control for WTS:** Model of the Converter, AC Voltage and DC Voltage Control, Grid Current Control: Current Harmonic Requirements, Linear Current Control with Separated Modulation, Voltage Oriented Control and Direct Power Control, Stand-alone, Micro-grid, Droop Control and Grid Supporting	12	30%

Reference Books:

1. Sharkh SM, Abu-Sara MA, Orfanoudakis GI, Hussain B, '*Power electronic converters for microgrids*', John Wiley & Sons, 2014.
2. Teodorescu R, Liserre M, Rodriguez P, '*Grid converters for photovoltaic and wind power systems*', John Wiley & Sons, 2011
3. S. Chowdhury, S.P. Chowdhury and P. Crossley, '*Microgrids and Active Distribution Networks*', The Institution of Engineering and Technology, London, United Kingdom, 2009.
4. Abu-Rub H, Malinowski M, Al-Haddad K, '*Power electronics for renewable energy systems, transportation and industrial applications*', John Wiley & Sons, 2014.

Course Outcome:

Sr. No.	CO statement	Marks % weightage
1	Decide components of typical microgrid system	20
2	Critically evaluate power electronic converter application in microgrid	20
3	Determine the grid requirements of distributed energy resources	20
4	Apply suitable current control technique to distributed energy resources	20
5	Design control structure of Wing Turbine Systems for Microgrid	20

List of Software/Tools:

- ✓ MATLAB along with necessary toolbox
- ✓ PSIM
- ✓ Scilab

List of Open Source Software/learning website:

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