EEEEVAC02 - Solar PV System Design

Unit 1 Basics of Solar Photovoltaics

Solar Technologies: Crystalline technology, thin film technology, Bi-facial technology, Comparison between PV module technologies. Solar PV Module: Rating of Solar PV Module, PV Module Parametersand Efficiency of PV Module. Solar photovoltaic system configuration: Grid Connected solar Power Plant, Grid interactive solar power plant, Off-Grid / Hybrid solar power plant, Schemes of solar power plant.

Unit 2 Components of a Solar PV System

Solar panels: Connection of PV Module in Series and Parallel, Estimation and Measurement of PV Module Power, Selection of PV Module. Inverters: Types of solar inverter, Selection of string /central / off grid inverter, Selection of power conditioning unit (PCU), Sizing of solar inverter for roof top and grid connected projects. Batteries: Battery function, Types of Batteries, Battery parameters, Selection of Battery, Charge Controllers: Functions, PWM charge controllers, MPPT charge controllers.

Unit 3 Design Guide for Solar PV System

Introduction: Energy calculations of a system, Preliminary Planning, Calculating the Energy Yield for a PV Grid-Connected System, Specific Yield. Load calculations: Sizing of Module /Array, Sizing of Storage Battery, Sizing of Charge Controller, Sizing of Wire/ Cable, Sizing of Inverter, Sizing of DC-DC Converter.

Unit 4 Computer Simulations

Simulation of Solar PV system: Modelling of solar PV energy conversion system using MATLAB/Simulink, Solar PV Characteristics, Maximum power point tracking. Case Study: Design of 100kW, 500kw and 1MW solar power plant, economic calculations, performance measurements.

Unit 5 Experimentation

Off grid solar PV system: Demonstration, irradiance and temperature measurement, plotting of characteristics Curves, performance analysis,

Maximum power point tracking, Determination of characteristics Curves using solar array simulator, Cost Estimation of a Solar PV Energy Conversion System.

References:

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Kothari and K.C. Signal, “Renewable Energy Sources and Emerging Technologies”, Second Edition, PHI, New Delhi, 2011.

Rai, “Non-conventional Sources of Energy”, Khanna Publishers, Delhi, 2008.

Sukhatme and J K Nayak, Solar Energy, 4th Edition, McGraw Hill, New Delhi,2017

Tiwari, “Fundamentals Design, Modeling and Application”, GN Solar Energy, Narosa Publishers, New Delhi, 2015.