EE822 SOLAR PV SYSTEMS

Course Objectives:

- To understand the concepts, operation, MPPT techniques, power conditioning and certain applications of Solar PV systems.
- Learn how to advance the current technology of the solar energy systems for making the process economical, environmentally safe and sustainable. Be able to serve industries or academia involved in sustainable energy engineering.

Course Outcomes:

- Appraise the need and possibility of extracting solar energy converting into electrical energy using PV cell.
- Design and analyze PV array under partial shading conditions.
- Design and analyze stand alone and electrical grid connected PV system.
- Be able to comprehend the challenges in sustainable energy processes, perform design of photovoltaic systems for different applications meeting residential and industrial needs, predict and test performance

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Introduction to solar PV system: History of photovoltaics, Photovoltaic effect, Photovoltaic cell, Equivalent circuit, Electrical characteristics, PV terminology, Maximum Power point Tracker.

Partial Shading of PV Arrays: Causes, Effect of partial shading on PV power, Hot spots,

Bypass Diode, PV characteristics, Interconnection Schemes, Series and Parallel connection, Total Cross Tied (TCT), Honey Comb(HC), Bridge Linked (BL), Reconfiguration Techniques, Electrical Array Reconfiguration Techniques, Su Do Ku based Reconfiguration Technique,

Maximum Power Point Tracking Algorithm: Direct Methods, Differentiation Method, Feedback voltage or current method, Perturb and Observe method, Incremental Conductance method, Parasitic Capacitance method, Indirect Methods, Curve fitting method, look up table method, Open circuit voltage sensing method, Short circuit current sensing method, Artificial Intelligence Techniques, Artificial Neural Network, Fuzzy Logic, Genetic Algorithm, Algorithm for non-uniform insulation conditions, Fibonacci Search method, Short Current pulse method, Two stage method.

Power Conditioning For PV System: Maximum Power Point Trackers, Buck Converter, Boost Converter, Buck Boost Converter, Cuk Converter, SEPIC Converter, Charge Controller, Shunt controller, Series controller, Inverters, Inverter operation, Power Quality Standards, Grid interconnection techniques.

Application of Solar PV and Energy Storage: Standalone systems, Roof top system, Street lighting systems, PV water pumping systems, Grid connected systems, Central inverter, String inverter, Module inverter, Need for energy storage in PV systems, Selection of PV battery, Battery charging and discharging characteristics, Battery life time, Battery protection and regulation.

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