

Sant Gadge Baba



Amravati University

Department of Lifelong Learning & Extension

Short Term Certificate Course

(3 Month)

Syllabus

For

Certificate Course in Renewable Energy

Paper -1

Introduction to Renewable and Solar Energy

- Renewable Energy and its prospects various RE sources
- Introduction to Solar Energy and Solar Radiation, its importance, Differentiate Solar PV and Solar thermal Energy.
- Solar Resource Measurement, Instrumentation and its applications.

Introduction of Photovoltaic Technology and its applications

Basics of Light to Energy

Conversion Brief History of

Solar / PV cells

Physics of Energy Conversion in Solar Cell (Current and Voltage) Understanding basic terminologies of a PV cell (I-V Curve, Efficiency, FF)

Solar Cells to Module, Module name plate specifications, Module to Array and Basic Structure of PV module

Classification of PV Modules based upon technology Brief on PV Cell/Module

manufacturing process

STC and NOCT test conditions and Characterization of PV Modules

Factors affecting output of a PV module (Temperature, Irradiance, Tilt angle, cell area shading, dust mismatch, PV module configurations, MPPT operation etc.)

PV module defects and degradation in the field (Techniques for identification of effects) PV module testing and Certifications

Standards

Applications of PV, different configurations of PV power system: Stand alone, Grid, Hybrid

system etc

Components of a PV System; Battery, inverter and Charge controllers

- Basics of standalone PV system, Balance of System (BOS)
- Introduction: Batteries, type of batteries, operation and structure
- Basic Terminologies of a Battery, Charging & Discharging Characteristics
- Factors affecting Battery operation and Selection Criteria
- Testing standards for batteries
- Introduction : Inverter, type of inverters, operation, make and specifications
- Basic Terminologies of a Inverter and Characteristics
- Factors affecting inverter operation and Selection Criteria
- Testing standards for inverters
- Basics of Charger Controllers, operation and specifications. DC-DC converters
- Types of charge controllers and selection criteria
- Components of a grid connected SPV system (ACB, DB and cabling)
- Types of wires and selection criteria, wire sizing.
- Other components like : Junction Box, Lightning arresters, grounding etc.

Fundamentals of PV system sizing

- What is sizing, significance and steps involved in sizing?
- Load Estimation, analysis and basics on energy efficiency
- Site survey and assessment, Shading analysis, Customer profiling and Role play.
- Inverter, Battery sizing and its aspects.
- Module sizing and aspects. Lay out diagrams, Spacing of PV strings and placing of each component. Selection of modules, batteries and inverters from the market specifications.
- Various steps involved in sizing of grid connected PV systems.
- Introduction to single line diagram and its significance.
- Listing of various components required for a grid connected and stand alone Solar power plant. (A check list of Each and every component)
- Understanding of various costs (Project heads) involved in the solar projects.

Trouble shooting of PV Modules

- Introduction to instruments used for monitoring performance of PV module.
- Quality assessment of the PV modules delivered at the site.
- Methods/Techniques in identifying various defects in a PV module.
- Measurement of various parameters in a PV module / V string.
- Interpretation of performance data, and troubleshooting of possible defects in PV modu

Troubleshooting of Batteries, Inverters and Charge controllers

- Quality assessment of the batteries inverters and charge controllers delivered at the site.
- Introduction to tools required for batter and inverter maintenance.
- Trouble shooting of Batteries, all types of batteries, Complaints and servicing.
- Trouble shooting of inverters, Complaints and servicing.
- Trouble shooting of Charges 'controllers: Complaints and servicing
- Trouble shooting of other balance of systems: wires, connections, casings, Fuses and relays

Paper - II

Importance of Tools and its applications

- Introduction to various tools used in the power plant installation. Its usage.
- Safe handling of tools

Check list preparations and Pre-requirements of installation.

- Solar PV plant installations check list
- Qualitative and Quantitative assessment of various components in the system
- Safe handling of each component, in the site, during transportation and stocking.
- Essential documentation required for site installations.

Structure Erection and Civil Works

- Brief on civil foundation and erection of supporting structures.
- Fixing the foundation of the structure and, the grounding considerations
- Installation of mechanicals structure
- Foundation: Reinforcement and shutting other balance of systems
- Mechanical safety aspects

- **Installation of Solar Power plant**

Preparation and general considerations for installation.

- Installation of Array support structure and mounting of PV module.
- Interconnection of modules, strings and Combiner boxes.
- Installation of other System components, i.e. Inverter, battery etc.
- Installation of 'AC and DC power distribution boxes.
- General safety consideration in the installation phase of solar power plant

Cable Tray and Cable Laying: SCADA and Control System

- Details of various cable tray and materials used for the same.
Precaution on the cable laying procedures.
- Guidelines for DC and AC cable layout and connections.
- Introduction to SCADA Control System, and their relevance.
- The basic understanding of fault identification scenario on SCADA system.

Commissioning and Testing

- The procedures involved in the commissioning of the power plants.
- Preparation and verification of various check list for commissioning and testing.
- Electrical Testing of PV arrays, inverters and other system components
- Complete System Testing, functional testing and trouble shooting