MASTER's TECHNICIAN TRAINING

ON

SOLAR PHOTOVOLTAIC

4-8th March, 2013

Agenda

Organized by

National Center for Photovoltaic Research and Education (NCPRE), IIT Bombay

Course Coordinator

Prof. Chetan S. Solanki

Day-1st /4-03-13		Instructor
9.15-10.00 A.M	**Inauguration and Introductory note on the course**	**MNRE/Director**
10-10.45 A.M. (LECTURE)	**Energy Scenario** Energy Scenario of world and special emphasis on INDIA. Different Renewable Energy sources and special emphasis on Solar Energy. Historic trends in cost and production of PV.	**Prof.C.S.Solanki**
10.45-11 A.M.	Tea Break	
11.00 – 11.45 P.M (LECTURE)	**Energy and Power** Definition of energy and power. Units of energy and power. Relation between energy and power. Examples of energy and power. Calculation of energy and power.	**Prof. C.S.Solanki**
11.45 – 12.30 P.M (LECTURE)	**Solar Radiation** Solar radiation, diffuse radiation and direct radiation, global solar radiation, monthly and yearly solar radiation, units of solar radiation	
12.30-1 P.M. (PRACTICAL)	**Introduction to radiation measuring devices** Brief description and demonstration of pyrheliometer and pyranometer, measurement of global and diffuse radiation at that time, other related measurements	**Jim/Shashwat**
1.00-2.00 P.M.	Lunch Break	
2.00-3.00 P.M. (LECTURE)	**Introduction to Solar PV Technology:** Module Designing from cells basics, module manufacturing Parameters of PV module. Voc, Isc, Imp, Vmp, Max.Power Point PV modules and different types modules 1) c-Si (mono and poly) 2) Amorphous-Silicon, CdTe, CIGS	**Prof. C.S.Solanki**
3.00-4.00 P.M. (PRACTICAL)	**PV module parameter measurement:** Measurement of solar PV modules parameters, characterization of PV module, plotting I-V curve. Noting following parameters: Voc,Isc,Imp, Vmp, Max.Power Point, Different type of cells	**Sandeep/Gaurav**
4.00-4.15 P.M.	Tea Break	
4.15-5.30 P.M. (LECTURE)	**Modules and Arrays:** PV module and PV array design considerations, mismatch losses, How module is made from cells and how modules are connected to for particular application? Roof area required for given power rating of modules	**Prof. C.S.Solanki**

Day-2nd /5-03-13		Instructor
9.30-10.00 A.M	**Tutorial/Quiz of previous day knowledge**	
10-00.11 A.M. (PRACTICAL)	**PV modules and Arrays:** Connecting modules in different arrays. Series, parallel series parallel connection and it effect on Voc and Isc. Precautions while connecting them. Importance of connecting same type of modules in an array.	**Sandeep/Gaurav**
11.00-11.15 A.M.	Tea Break	
11.10 – 12.00 P.M (LECTURE)	**Effect of light intensity and temperature** Variation in current with light intensity and variation in voltage with temperature. How current is dependent on light intensity.	**Prof. C.S.Solanki**
12.00-1 P.M. (PRACTICAL)	**Devices for measuring module parameters** Module analyzers **and** current variation with light intensity.	**Sandeep/Gaurav**
1.00-2.00 P.M.	Lunch Break	
2.00-3.30 P.M. (LECTURE)	**Solar Tracking and Energy yield** Importance of solar tracking and its cost analysis. Energy yield calculation of PV system.	**Prof. C.S.Solanki**
3.30-3.45 P.M.	Tea Break	
3.45-4.00 P.M.	QUIZ	
4.00-5.00 P.M. (PRACTICAL)	**Application** Demonstration of DC load running directly using solar PV, for instance LED, DC MOTOR. Series and parallel combination of LEDs, impact on intensity of light output	**Sandeep/Gaurav**
5.00-5.30 P.M	**Site visit to solar water pump**	**Sandeep/Gaurav**

Day-3rd /6-03-13		Instructor
9.30-10.30 A.M (LECTURE)	**Basics of Electricity** Difference in A.C. system and D.C. system and related parameters. Power factor, range of current and voltage in PV systems,	**Prof. S. Doolla**
10-30.11 A.M. (LECTURE)	**Energy Storage devices with detailed analysis (Part 1)** Introduction to batteries, general parameters of batteries useful for technicians, Depth of discharge(DOD), Terminal Voltage ,Life Cycle, Advantages, Disadvantages, General maintenance and precautions General charging and discharging rate.	**Prof.S.Mitra**
11.00-11.15 A.M.	Tea Break	
11.15 – 1.00 P.M (LECTURE)	**Energy Storage devices with detailed analysis (Part 2):** Example and discussion of following batteries, specific features of the batteries a) LEAD ACID b) NI-MH c) LI-ION 2) ULTRA CAPACITOR Load Matching Problems and run time estimation.	**Prof.S.Mitra**
1.00-2.00 P.M.	Lunch Break	
2.00-3.30 P.M. (PRACTICAL)	**Basics of Electricity:** Inverter, Rectifier, Transformer, and D.C. to D.C. Converter will be demonstrated and their effect on signal will be demonstrated. A.C. fan and D.C. fan	**Sandeep/Gaurav/ Student of Prof. Doolla**
3.30-3.45 P.M.	Tea Break	
3.45-5.15 P.M. (PRACTICAL)	**Energy Storage devices:** Cut View of SEALED LEAD ACID BATTERY WILL BE SHOWN. ULTRA-CAPACITOR will be charged directly from PV module and then LOAD will be run with it (LED).	**Sandeep/Gaurav/ Student of Prof. Mitra**
5.15-5.30 P.M.	QUIZ	

Day-4th /6-03-13		Instructor
9.30-11.0 A.M (LECTURE)	**Balance of system(Part 1)** Different type of chargers controllers. Brief technical description, why they are needed, advantages, disadvantages and cost analysis with respect to PV system. 1)linear 2)PWM 3)MPPT	**Prof.K.Chaterjee**
11.00-11.15 A.M.	Tea Break	
11.15 – 1.00 P.M (LECTURE)	**Balance of system (Part 2):** How to give technical specification of following, what capacities are available in the market. Energy Meters Inverters D.C. to D.C converters D.C. Cables and Solar Cables. Connecters. Junction boxes And their interconnection in a PV system. Cost analysis of PV system.	**Prof.K.Chaterjee**
1.00-2.00 P.M.	Lunch Break	
2.00-3.30 P.M. (PRACTICAL)	**Balance of system(Part 1)** : Experiments using Chargers of different type will be performed. Cables, connecters and junction boxes will be shown and proper connections will be taught.	**Sandeep/Gaurav/student of Prof. Chatterjee**
3.30-3.45 P.M.	Tea Break	
3.45-5.15 P.M. (PRACTICAL)	**Balance of system (Part 2):** Experiments on D.C. to D.C. converters and inverters will be performed. And finally P.C.U. will be demonstrated	**Sandeep/Gaurav/ student of Prof. Chatterjee**
5.15-5.30 P.M.	**QUIZ**	

Day-5 /8-03-13		Instructor
9.30-11.0 A.M (LECTURE)	**System Design:(Part 1)** 1KW system design problem will be discussed and designed.	**Prof.C.S.Solanki**
11.00-11.15 A.M.	Tea Break	
11.15 – 12.00 P.M (LECTURE)	**System Design:(Part 2):** System components will be discussed and chosen.	**Prof.C.S.Solanki**
12.00-1.00 P.M.	**System Installation(PART 1)**	**Sandeep/Gaurav**
1.00-2.00 P.M. (PRACTICAL)	LUNCH	
2.00-3.30 P.M.	**System Installation(PART 2)**	**Sandeep/Gaurav**
3.30-3.45 P.M. (PRACTICAL)	Tea Break	
3.45-5.00 P.M.	**System integrated by participants will be reviewed.**	
6 P.M. onwards	**Certificate falicitation/distribution.**	