Master trainer workshop for"1 Million Soul"
(2013-2015)

The purpose of this workshop is to impart Basic Knowledge of Solar PV systems and the assembly of SOUL. While delivering lecture the teacher should keep in mind the level of students and he should try to explain the topic in very simple terms. Insights of each topic should be explained and as many oral questions should be asked as possible.

Emphasize should be put on Standard procedures for assembly.

After attending this workshop each participant should have a basic know how of the PV system and should be an expert in assembling the "SOUL"

"The *Real Test of One's Understanding Of A topic is How Much can One Make an Average Student of his Class Understand It "*

MODULE 1

Energy Scenario	(1) Meaning and need of energy (2)Uses of energy in day to day life (3) Different forms of energy (4) Energy situation in India.(5) Efficient use of Energy
Category	☑ Theory ☑ Tutorial ☒ Hands On
Learning Objectives	• Stating conditions where we need energy. • Stating conditions of how energy is used to do work. • Stating situations where energy is used in day to day life. • Differentiating between different forms of energy. • Stating condition of energy scenario of India. • Explaining electrical energy and its generation cost in India. • Explaining how use of electrical energy can be minimized.
Learning Outcome	1. Ability to understand need and use of energy. 2. Ability to energy in different forms. 3. An understanding of energy situation in India. 4. An understanding of efficient use of energy.
Viva Voca	*1) In present scenario what according to you is the source of energy?* *2) Which is more preferable an incandescent bulb or and LED?*
Duration	**1.30 hours**

MODULE 2

Energy and Its Units	(1) Electrical Energy and its generation (2) Solar energy and its advantages (3) Units of energy (Electrical) (4) Effective use of Electrical energy in day to day life.
Category	☑ Theory ☑ Tutorial ☒ Hands On
Learning Objectives	• Explaining units of electrical energy. • Need of renewable energy (Solar energy) and its importance. • Explaining how use of electrical energy can be minimized. • Monthly Electrical energy bill calculation
Learning Outcome	1. Ability to understand electrical energy and its generation. 2. Ability to understand effective use of electrical energy. 3. Ability to understand potential and reach of solar energy. 4. Ability to calculate money spent in running an electrical device on daily and monthly basis.
Problems and exercises	**Problem 1**: *How much energy will a bulb of 100 w, 20w and 5 w rating consume when turned on for 6 hours every day?* **Problem 2**: *In the above question, what will be the(a) the energy consumed by bulb in one month (b) energy consumed in one year (c)Money spent to run this bulb for a month and a year.*
Duration	**1.30 hours**

MODULE 3

Electrical Parameters (V,I and P) and their Units	(1) Meaning of voltage and measurement voltage (2)Units of voltage (3)Meaning of current and measurement of current (4) Units of current (4) Meaning of power (5) Units of power (6) Relation between voltage, current and power (7) Relation and difference between power and energy (8) Relation between voltage, current and energy.
Category	☑ Theory ☑ Tutorial ☑ Hands On
Learning Objectives	• Describing Voltage and its units. • Measuring voltage using multi-meter. • Describing current and its units. • Measuring current using multi-meter. • Describing power and its units. • Establishing mathematical relation between power, voltage and current. • Establishing mathematical relation between voltage, current and energy.
Learning Outcome	1. Ability to understand and measure voltage. 2. Ability to understand and measure current. 3. Ability to understand and calculate power required. 4. Ability to calculate energy spent by a device of particular voltage and current rating.
Problems and exercises	**Problem 1***: How much power will a bulb of 230V - .45 A ,230 V - .087A and 3.6V -1.4A rating need when turned on for 6 hours every day?* **Problem 2***: In the above question, what will be the(a) the energy consumed by bulb in one month (b) energy consumed in one year (c)Money spent to run this bulb for a month and a year*?
Duration	**2 hours**

MODULE 4

Basic Arithmatic and Unit Inter-Conversions	(1) Basic Multiplication and Division (2) Inter-Unit Conversions
Category	☑Theory ☑Tutorial ☒ Hands On
Learning Objectives	• Ability to find voltage of battery when it Energy is given. • Ability to understand mV , V and kV. • Ability to understand mA and A. • Ability To understand mW , W and kW. • Ability to convert mm to cm to M.
Learning Outcome	5. Ability to convert mV to Volts and vice-Versa. 6. Ability to convert mW to W to kW and vice versa.
Problems and exercises	**Problem 1***: Convert* *1) 2.8 w to Kw* *2) 1kW to watts* *3) 1200mA to A.* *4) 4 cm to mm.* ***Problem2****: Find Energy consumed by LED in kWh with 3.2V forward voltage and drawing 120 mA current for 5 Hours?* **Problem3**: *Find the current (in mA) drawn by a fan of 75W running at 230V?*
Duration	**1 hour**

MODULE 5

Battery (Nimh)	(1) Battery as a energy storage device (2)Battery voltage and charge storage rating (3) Series and Parallel Connection of battery (4) Depth of Discharge
Category	☑ Theory ☑Tutorial ☑Hands On
Learning Objectives	• Stating conditions where we need to store energy. • Stating how battery stores energy by using water tank analogy. • Explaining importance of battery voltage and charge rating. • Stating conditions where voltage or current needs to be changed. • Stating importance of depth of discharge. • Explaining how to make series and parallel connections.
Learning Outcome	1. Ability to understand importance of energy storage device. 2. Ability to understand importance of battery voltage and charge rating. 3. Ability to measure battery voltage using multi-meter. 4. Ability to make series and parallel battery connections. 5. Ability to make series or parallel connections of battery as per requirement of voltage or current.
Problems and exercises	**Problem 1***: How much energy is stored in a 2.4V 1200mAh battery?* **Problem 2:** *A .5w Load is connected to a battery of 2.4 V, 1200 mAh for 4 hours calculate the energy required to fully charge the battery? (assuming after fully charged battery voltage is 2.4V)* ***Problem 3:*** *How should we connect 12V 7Ah batteries to run a 40W, 24 V DC fan? Also how much current and energy is consumed by the fan it runs for 20 hours a day?*
Duration	**1 hour**

MODULE 6

Solar Module	(1) Solar module as an energy converter (2)Parameters of solar module Vmp, Imp, Pm (3) Effect of sunlight on output current (4) Series and parallel connections of solar panels (5) Designing basic solar PV system
Category	☑Theory ☑ Tutorial ☑ Hands On
Learning Objectives	• Explaining solar panel as a energy converter. • Defining Vmp, Imp and Vm. • Stating importance of sunlight and area of solar modules in output power rating. • Stating importance of series or parallel connections. • Explaining different Solar PV systems(with battery back and without back up)
Learning Outcome	1. Ability to understand importance of solar panels. 2. Ability to understand importance panel voltage and current rating. 3. Ability to measure panel voltage and current using multi-meter. 4. Ability to differentiate between working and faulty panels. 5. Ability to make series and parallel connections. 6. An understanding of effect of sunlight on output. 7. Ability to understand the name plate readings on panel. 8. Ability to design basic Solar PV system.
Problems and exercises	**Problem 1***: How much energy can a panel of 1W generate in 4 hours?*
Duration	1 hours

MODULE 7

LED	(1) LED as an effective source of light (2)Operating Voltage and current of LED (3)LED testing
Category	☑Theory ☑ Tutorial ☑ Hands On
Learning Objectives	• Explaining LED as an economical source of light. • Explaining operating voltage and drain current of LED. • Testing of LED using multi-meter.
Learning Outcome	1. Ability to understand benefits of LED as a source of light. 2. Ability to test the LED using multi-meter. 3. Ability to identify faulty LED.
Problems and exercises	**Problem 1***: How much energy will a LED of .5W consume if it runs for four hours every day in a year?*
Duration	**1 hours**

MODULE 8

Lecture -7	Electronic circuit (PCB): (1) What is PCB (2) Need of electronic circuit (3) Benefits of electronic circuit for battery and LED protection. (4) Efficiency of PCB
Learning Objectives	• Explaining PCB as a smart system. • Explaining importance of OV,UV and DC-DC conversion • Explaining efficiency of an electronic device. • Testing charge indicator. • Testing PCB by connecting all the components VIZ battery, LED and Panel
Learning Outcome	1. Ability to Test charge indicator PCB. 2. Ability to test PCB on the whole. 3. Ability to find efficiency of the PCB using multimeter.
Exercise	Find the efficiency of the PCB using multimeters.
Duration	**1 hours**

Assembly of SOUL

Module 1

Lecture -1	Testing of Components: (1) Testing of battery (2)Testing of LED (3) Testing of Panel (4) Testing of Panel
Learning Objectives	• Understanding good and faulty battery. • Understanding good and faulty battery. • Understanding good and faulty panel. • Testing PCB for charging indicator.
Learning Outcome	1. Ability to Test battery using multi meter. Battery is good if battery voltage is between 1.8V to 2.7V 2. Ability to test LED using. Connect red probe of multimeter to +ve terminal and black probe to –VE terminal of led and if LED glows its is good otherwise **faulty** 3. Ability to test solar panel. Check if voltage and current of panel is within 99% of rated voltage and current of panel. 4. Ability to test PCB by connecting panel to it. 5. Connect panel and if charge indicator turns red charge indicator is ok. 6. Connect battery and LED and push the ON/OFF button several times to check the switch.
Duration	**2 hours**

Please Fill the data sheet given below:

SR.No	Component	Rated	Measured
1	Battery		
2	Panel		

Please Tick mark.

SR.No	Component	Working	Faulty
1	Charge indicator		
2	Switch		

MODULE 2

Assembly of Components	Step by step procedure to assembly of components to make SOUL.
Learning Objectives	• Explaining the importance of step by step assembly of SOUL.
Learning Outcome	1. Each participant should be able to assemble the "SOUL" efficiently.
Procedure	1) Connect goose neck to HEAD and BASE of the SOUL. 2) Pass the LED through goose neck. 3) Fit the PCB at proper place taking care of charge indicator, charging point and switch. 4) Connect the LED to PCB. 5) Solder the battery to PCB. (**Please refer MODULE 2a for soldering**) 6) Put right screws at right place. 7) Screw the cover of base and head.
Duration	**3 hours**

MODULE 2a

SOLDERING	Proper soldering
Learning Objectives	• Explaining the importance and methods of proper soldering.
Learning Outcome	2. Each participant should be able to solder properly.
Procedure	1) Switch on the solder Gun. 2) Wait till solder gun he hot. 3) Twist the wire which is to be soldered such that there are no loose strands 4) Tin the properly twisted wire which is to be soldered. 5) Touch the tip of gun to the point which is to be soldered. 6) Use small amount of solder metal. 7) Connect the wire to be soldered. 8) After 10-15 seconds try to pull the soldered wire to conform the joint.
Duration	**3 hours**

MODULE 3

FINAL TESTING OF SOUL	Final SOUL Testing.
Learning Objectives	• To conform the proper functioning of SOUL**.**
Learning Outcome	1. Each participant should be able to check the SOUL made by them**.**
Procedure	1) Connect the Panel and check charge indicator**.** 2) Push the ON/OFF button to check if LED is working or not and repeat it 5-10 times. 3) Check the mode control and repeat it 5-10 times. 4) Use small amount of solder metal.
Duration	**half hours**

MODULE 4

PACKAGING	Pack the SOUL as per guide lines
Learning Objectives	• To conform the proper packaging of SOUL**.**
Learning Outcome	2. Each participant should be able to pack the SOUL made by them**.**
Duration	**half hours**

REFRENCES: