Revision Guide:

Unit 1: Safety

Safety – Fall arrest system make up of harness, lifeline, anchor and shock absorbing lanyard

Unit 2: Electrical Principles

Power = V x I watt

Energy = P x t(hr) watt-hour

Unit 3: Solar resource

Photons is used in generating DC current from the sun in the form of visible light.

For solar photovoltaic system, **electricity is converted from the visible light**. Spectrum of Solar radiation (visible light) used for by solar panel to convert to electricity

Tilt angle of PV in Singapore (1 deg north of equator) – 10 deg

Calculation of Altitude of Sun and Tilt angle of particular latitude

Location of the sun at different seasons. Like Mar 21, June 21, Sept 21, and Dec 21

Unit 4: Grid Tied vs Off Grid

Components of off grid PV system – PV array, charge controller (DC load), Battery, Inverter (AC load).

Component used to store energy in off grid PV system.

Component not used in Grid Tied PV system – Charge Controller

Unit 5: Solar Fundamentals, Cells, Modules

Modules in a string – voltage and current output.

Modules in Parallel or strings in parallel

Given Vmp, Imp, Voc, & Isc of module find Pmax

Factors affecting the performance of PV module

- Irradiance affects the current output of PV module (directly proportional)
- Temperature affects the voltage output of PV module (inversely proportional)

Finding output power using efficiency, area and specific irradiance.

Unit 6: Batteries

Number of batteries to setup battery bank (e.g given 12V 20Ah and require 24V 100Ah) 10nos.

Finding battery capacity from Voltage, Ah and DoD.

Unit 7: Off Grid Controllers and Inverters

PWM charge controller data show – battery state of charge

Series parallel connections of PV module and batteries

Unit 8: Off Grid PV system sizing

Calculation of Grid Tied PV system given PV panel data and MPPT inverter data

Unit 9: Grid Tied PV system and components

Grid tied MPPT inverter provide remote monitoring of the PV system performance and error status.

MPPT inverter must meet anti-islanding capability and produce pure sine wave in order to connect to the grid.

Grid Tied component used to store multiple relevant electrical parameters.

Different type of meters used Grid Tied PV system

Unit 10: Site Survey

Design Criteria

Objective of Site survey

Unit 11: Grid Tied System design

Sizing the number of panels can be installed on roof in specific configuration.

Sizing of Grid Tied PV system – given specification of PV module and inverter

Unit 12: Cable sizing and String protection

Largest fuse rating for PV module string base on Isc. (e.g. Isc is 6 A $1.5I_{SC} < fuse\ rating < 2.4I_{sc}$ 15 A)

Cable size calculation

Unit 13: Installation Testing and Commissioning

Code of practice used for the installation of PV System – SS638

Unit 14: Maintenance and Troubleshooting

Code of practice for maintenance of Grid Tied PV system - SS601

Point of common connection – have dual supply warning sign

Insulation resistance test voltage calculation

Inverter can be faulty even though all isolators, breakers, and fuses passed their functional test and are all close.

Infrared imaging inspections on PV system should be done when solar panel are under load and irradiance should be 400 W/m^2. Infrared image camera - Instrument used to detect hotspot on PV panels.