Unit-I

1. A PV module is formed by connecting:

A) Solar cells only in parallel
B) Solar cells only in series
C) Solar cells in series and/or parallel combinations
D) Batteries in series
Answer: C

2. A PV array consists of:

A) Single solar cell
B) Collection of PV modules connected together
C) Battery bank only
D) Inverter only
Answer: B

3. The primary function of a solar cell is to convert:

A) Heat energy into electrical energy
B) Electrical energy into light energy
C) Solar energy into electrical energy
D) Mechanical energy into electrical energy
Answer: C

4. Partial shading of a PV module generally causes:

A) Increase in power output
B) No effect on output
C) Reduction in power output and possible hot spots
D) Increase in voltage only
Answer: C

5. Hot spots in PV modules occur mainly due to:

A) High wind speed
B) Partial shading of cells
C) Low temperature
D) Excessive battery charging
Answer: B

6. The diode connected across a PV module to prevent hot spots is called:

A) Zener diode
B) Rectifier diode

C) Bypass diode
D) Tunnel diode
Answer: C

7. The function of a bypass diode is to:

A) Increase PV voltage
B) Protect shaded cells from overheating
C) Store electrical energy
D) Improve battery efficiency
Answer: B

8. A blocking diode in a PV system prevents:

A) Current flow during daytime
B) Reverse current flow from battery to PV module
C) MPPT operation
D) Inverter switching
Answer: B

9. The Power Conditioning Unit (PCU) is used to:

A) Store solar energy
B) Convert and regulate electrical power
C) Measure solar radiation
D) Cool PV panels
Answer: B

10. The main objective of Maximum Power Point Tracking (MPPT) is to:

A) Increase battery size
B) Operate the PV system at maximum power output
C) Reduce solar irradiance
D) Increase inverter losses
Answer: B

11. The maximum power point of a PV module varies mainly with:

A) Temperature and irradiance
B) Battery size only
C) Inverter rating only
D) Load resistance only
Answer: A

12. Which MPPT technique periodically perturbs the operating point and observes the power change?

A) Incremental Conductance Method
B) Fuzzy Logic Method
C) Perturb and Observe Method
D) Open Circuit Voltage Method
Answer: C

13. In the Perturb and Observe (P&O) method, if power increases after perturbation, the next perturbation is:

A) Reversed
B) Continued in the same direction
C) Stopped permanently
D) Doubled immediately
Answer: B

14. One disadvantage of the Perturb and Observe method is:

A) High complexity
B) Oscillation around the maximum power point
C) Need for expensive sensors
D) No tracking capability
Answer: B

15. The Incremental Conductance (IC) method is based on:

A) Battery voltage only
B) Relationship between incremental conductance and instantaneous conductance
C) Inverter frequency
D) Solar panel color
Answer: B

16. At the Maximum Power Point (MPP), the Incremental Conductance condition is:

A) $dI/dV = 0$
B) $dI/dV = I/V$
C) $dI/dV = -I/V$
D) $dI/dV = V/I$
Answer: C

17. Compared to the P&O method, the Incremental Conductance method:

A) Has lower tracking accuracy
B) Cannot track changing weather conditions
C) Provides better tracking under rapidly changing irradiance
D) Requires no sensors
Answer: C

18. The main function of a battery charge controller is to:

A) Increase solar irradiance
B) Protect batteries from overcharging and deep discharge
C) Generate AC power
D) Measure temperature only
Answer: B

19. During battery charging, the charge controller disconnects the PV source when:

A) Battery voltage exceeds the preset limit
B) Battery is completely discharged
C) Solar irradiance decreases
D) Load current increases
Answer: A

20. Deep discharge protection in a battery controller prevents:

A) Excessive charging
B) Reverse current flow
C) Battery damage due to excessive discharge
D) Increase in PV voltage
Answer: C

Answer Key

1-C, 2-B, 3-C, 4-C, 5-B, 6-C, 7-B, 8-B, 9-B, 10-B, 11-A, 12-C, 13-B, 14-B, 15-B, 16-C, 17-C, 18-B, 19-A, 20-C.

Fill in the Blank Questions (PV Module, PV Array, MPPT, Battery Charge Controller)

1. A photovoltaic (PV) cell converts _____ energy directly into electrical energy.
   Answer: solar
2. A group of interconnected solar cells forms a PV _____.
   Answer: module
3. Several PV modules connected together form a PV _____.
   Answer: array
4. The reduction in output power due to obstruction of sunlight on some cells is called _____ shading.
   Answer: partial

5. _____ diodes are connected across PV cells/modules to protect them from hot spots.
   Answer: Bypass

6. A _____ diode prevents reverse current flow from the battery to the PV module.
   Answer: Blocking

7. The device used to convert and regulate power from a PV system is called a Power _____ Unit (PCU).
   Answer: Conditioning

8. MPPT stands for Maximum Power Point _____.
   Answer: Tracking

9. The operating point at which a PV module delivers maximum power is called the Maximum Power _____ (MPP).
   Answer: Point

10. The _____ and Observe method is one of the most widely used MPPT techniques.
    Answer: Perturb

11. In the Incremental Conductance method, the condition at MPP is dI/dV = _____.
    Answer: –I/V

12. The Perturb and Observe method may cause _____ around the maximum power point.
    Answer: oscillations

13. A battery charge controller protects the battery from _____ charging.
    Answer: over

14. Deep discharge protection prevents excessive _____ of the battery.
    Answer: discharging

15. The performance of a PV module is mainly affected by solar irradiance and _____.
    Answer: temperature

Additional Challenging Fill in the Blanks

16. The current generated by a PV array increases when modules are connected in _____.
    Answer: parallel

17. The voltage generated by a PV array increases when modules are connected in _____.
    Answer: series

18. Partial shading can create localized heating known as _____ spots.
    Answer: hot

19. The Incremental Conductance method compares incremental conductance with _____ conductance.
    Answer: instantaneous

20. The primary objective of MPPT is to maximize the _____ extracted from the PV system.
    Answer: power