19MEO302 – Solar Energy Utilisation

Time: 1½ Hours Maximum Marks: 50
Answer All Questions

SET - A

✓ PART A – Answer All Questions (5 × 2 = 10 Marks)

Q.No	Question	Simple Answer	Marks
1	Why is doping needed in solar cells?	Doping adds impurities to silicon to create p-type and n-type regions for better conductivity.	2
2	What is fill factor?	It shows solar cell efficiency.	2
3	Why is Clean Development Mechanism (CDM) needed?	Allows developed nations to invest in clean energy projects in developing countries.	2
4	What is payback period?	Time taken to recover the cost of a solar system through savings.	2
5	Sensible vs Latent heat storage?	Sensible: Heat by temperature rise. Latent: Heat by phase change (e.g., ice to water).	2

✓ PART B – (2 × 13 = 26 Marks) & (1 × 14 = 14 Marks)

Q6. (a) What is solar cell? Explain the working with sketch. (13 Marks)

Part	Description	Marks
Definition	Converts sunlight to electricity using photovoltaic effect	2
Working principle	Light → e-h pair → movement in p-n junction → electric current	4
Energy conversion	Shows light energy to electrical energy conversion	2
Neat sketch	Proper diagram showing solar cell structure	3
Presentation & structure	Clear explanation and flow	2

Q6. (b) Describe manufacturing process of solar cells. (13 Marks)

Step	Description	Marks
Silicon purification	Extraction and cleaning of raw silicon	2
Wafer formation	Ingot making and slicing into wafers	3
Doping	Adding impurities to create p-n junction	2
Coating & contacts	Anti-reflective layer and metal contacts	2
Final assembly	Panel encapsulation and testing	2
Sketch	Neatly labeled diagram	2

Q7. (a) Write about solar vehicle & green environment. (13 Marks)

Part	Description	Marks
Introduction	What is a solar vehicle and components	3
Working principle	Solar panel → Battery → Motor → Wheels	3
Green benefits	Zero pollution, renewable energy use	3
Real-time examples	Example like Lightyear One, solar rickshaws	2
Future importance	Role in clean transportation	2

Q7. (b) Working of BIPV & its future need. (13 Marks)

Part	Description	Marks
What is BIPV	Solar PV integrated into building parts	3
How it works	Captures sunlight and produces electricity	3
Diagram	Proper sketch with labeling	3
Benefits	Space-saving, aesthetics, green building	2
Future value	Smart cities, net-zero buildings	2

Q8. (a) PV Cell construction, working & application. (14 Marks)

Part	Description	Marks
Construction	Layers: glass, coating, p-n junction, contact	3
Working	Sunlight → e-h pair → electricity generation	4
Real-time applications	Rooftop systems, solar lamps, water pumps	3
Sketch	Labeled diagram showing PV cell	2
Presentation	Structured and clear explanation	2

Q8. (b) Thermal storage – Sensible & Latent Heat. (14 Marks)

Part	Description	Marks
Why storage is needed	Solar is intermittent; storage ensures availability	2
What is thermal storage	Stores heat for later use	2
Sensible heat storage	Uses materials like water/stones; stores heat by temp change	3
Latent heat storage	Uses phase change materials; stores heat during melting/freezing	3
Comparison	Point-wise or tabular comparison	2
Real-life applications	Solar heaters, power plants	2

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Time: 1½ Hours Maximum Marks: 50
Answer All Questions

SET – B

✓ PART A – Answer All Questions (5 × 2 = 10 Marks)

Q.No	Question	Simple Answer	Marks
1	Factors contributing to solar cell efficiency?	Material quality, light absorption, temperature, reflection losses, and surface area.	2
2	PV vs. other solar technologies?	PV: Converts light to electricity. Others: Use heat (e.g., solar thermal for heating/water).	2
3	Why is energy storage needed?	To store excess energy from sunlight for use during night or cloudy periods.	2
4	What is thermal energy storage?	Method to store solar heat using materials like water, salt, or phase change materials.	2
5	Define payback period.	Time required to recover solar system investment via energy savings.	2

✓ PART B – (2 × 13 = 26 Marks) & (1 × 14 = 14 Marks)

Q6. (a) Need and working of PV cells + case study (13 Marks)

Part	Description	Marks
Need for PV cells	Clean, renewable, reduces carbon footprint	3
Working principle	Photovoltaic effect – sunlight → e-h pairs → current	3
Diagram	Neat sketch of PV cell	3
Case study	Simple example: Tata Solar rooftop, BIPV in airports	2
Presentation	Well-structured flow and clarity	2

Q6. (b) Manufacturing process of solar cells (13 Marks)

Step	Description	Marks
Silicon purification	Raw silicon → pure form	2
Wafer preparation	Ingot slicing into thin wafers	3
Doping	Adding impurities for p-n junction	2
Coating & contacts	Anti-reflective coating, metal lines	2
Assembly & testing	Encapsulation, quality control	2
Diagram	Sketch with labeling	2

Q7. (a) Necessity of thermal storage (13 Marks)

Part	Description	Marks
Need for thermal storage	Ensures availability when sunlight is not present	2
Sensible heat storage	Temperature rise (e.g., water, stones)	3
Latent heat storage	Phase change (e.g., paraffin, salt hydrate)	3
Examples	Solar water heater, CSP plants	3
Structure & clarity	Logical explanation	2

Q7. (b) Solar vehicle and green environment (13 Marks)

Part	Description	Marks
Definition of solar vehicle	Uses solar energy for motion	2
Working	Solar panel → battery → motor	3
Environmental benefits	Low pollution, renewable energy	3
Real-world examples	Lightyear One, Mahindra e-rickshaws	3
Presentation	Coherent structure	2

Q8. (a) PV cell construction, working & real-time use (14 Marks)

Part	Description	Marks
Construction	Layers: glass, coating, p-n junction, contacts	3
Working principle	Sunlight → electron-hole → current	3
Neat sketch	Clearly labeled	3
Real-time application	Rooftops, traffic lights, lamps	3
Presentation	Organized explanation	2

Q8. (b) Solar Vehicle + BIPV for green environment (14 Marks)

Part	Description	Marks
Solar vehicle	Concept, working, benefits	4
BIPV – what & how	Solar integrated into buildings (walls, roofs)	3
Importance for green future	Reduces fossil fuel use, space-saving	3
Real examples	Tesla Solar Roofs, Indian airport BIPV	2
Structure & neatness	Logical structure and clarity	2