Unit 1 – Section 1

Section 1 (marks 5-8)

1. Illustrate the difference regions solar spectrum and the process associated with it. How visible light energy is used in photoconversion devices

2. Discuss the role and opportunities in solar industries for scientist and engineers

3. Compare the solar energy with other renewable in terms of implementation and market.

4. Demonstrate the various processes of light-matter interactions

5. List various merits and challenges in solar energy conversion system

6. What are different solar energy conversion technologies. Illustrate briefly any three different solar energy conversion systems

7. What is recombination losses. Illustrate the various device limitations in photoconversion devices

8. Describe the commercial realization any three solar energy conversion technologies

9. Illustrate the various initiatives required for wide implementation of solar energy technologies.

10. Write a note on various stages involved in solar energy market with a proper flow diagram

11. Illustrate the use of machine learning tools in solar industries for selection of materials and manufacturing.

12. Describe with the flow diagram of carbon dioxide capture and conversion with solar energy

Unit 2 (Section 2 &3)

Section 2

1. Discuss the process of band formation in materials. How the band gap is important for solar energy conversion
2. How the band structure of semiconductor is different from metals and semiconductor. Describe few methods for band gap modulation
3. Describe the importance of heterojunction and discuss the various types of heterojunctions and its importance
4. Illustrate the structure and operating principle of p-n junction photovoltaic cell. Mention few device limitations.
5. What are importance of semiconductor selection in solar devices. Mention few name of different semiconductors and various applications.
6. How transparent substrates are important in solar cell. Mention few transparent conducting substrates
7. Depict the structure of p-n junction solar cell, Perovskite solar cell and Dye sensitized solar cell with appropriate labelling. Compare their efficiencies
8. Discuss the importance of metal oxide semiconductors (MOS) and polymer
9. Discuss the importance and applications of transparent conducting substrates.
10. What are importance and advantages of thin films in photovoltaics

Section 3

1. Draw the structure of tandem solar cell and illustrate its characteristics and how it is advantageous over single cell photovoltaics
2. Illustrate the PV installation with all required components. Why the cost factors increase in commercial installation.
3. Depict the structure of organic solar cells. Describe the advantages and disadvantages compared to inorganic solar cells
4. Mention the different types of solar cells. Demonstrate the thermophotovoltaics construction and its advantages over normal PV cells.
5. Draw the structure of perovskite solar cells and mention its advantages over silicon solar cells. Mention the important implementation of solar technology in locomotives
6. Compare the organic and inorganic photovoltaics in terms of their advantages and disadvantages

Unit 3 (section 4,5)

Section 4

1. Describe the importance of texture, light absorption probability, recombination loss characteristics in solar cells.
2. Illustrate five important testing parameters of solar cells with neat i-v diagram
3. Describe fill factor, efficiency and i-v characteristics of solar cells
4. Illustrate the importance of solar angle and describe the solar simulator in analysis of solar cells
5. How solar simulator used in study of solar irradiance. Discuss the uses of solar simulator in other fields
6. What are factors that affect the solar cell degradation, explain methods to minimize the degradation of solar panels.
7. Explain the importance of solar angle and solar cell performance
8. Illustrate the fill factor, max power in solar cell characteristics with a neat I-V curve

Section 5

1. What are different solar energy conversion processes. What is artificial photosynthesis. Compare efficiency with photosynthesis
2. Compare the photocatalytic and photoelectrochemical preparation of clean fuels.
3. Draw the structure of photoelectrosynthesis cell and illustrate the importance of semiconductor photoelectrodes
4. Illustrate the construction, working and importance of dye sensitized solar cells
5. What are solar batteries. Discuss the importance of carbon dioxide conversion technologies.

Unit 4 (Section 6,7 &8)

Section 6

1. Describe the principle and importance of solar to thermal conversion technologies
2. Distinguish between photovoltaics and solar to thermal conversion technologies. Illustrate the thermomechanical solar energy conversion
3. Depict schematically the solar to thermal conversion in boiler. Discuss the importance of design of solar collectors
4. Discuss the design structure of flat plate solar collectors.
5. How solar thermoelectric system work. Differentiate it with solar to thermal convertors
6. Write a note on solar ponds and solar greenhouse
7. Illustrate the different schemes of solar assisted desalination. Discuss the advantages

Section 7

1. Discuss the principle of light emitting diode with device structure
2. Compare the advantages of LED light over incandescent lamp. Depict the structure of organic light emitting diode
3. Describe the advantages of LED screen displays

Section 8

1. Describe the importance and advantages of thin film fabrication. How band gap changes with nanostructured thin films
2. Mention the methods of thin film fabrication. Compare the principles of physical and chemical vapour deposition and their advantages
3. What is tandem solar cells and its advantages. How the thin film fabrication is important in preparation of tandem solar cells.
4. What are effects of size reduction. Describe few applications of flexible thin film electronics
5. Draw structure of laser sensing thin film device. Describe the applications of stretchable – flexible electronics