

(8 pages)

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M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2024

Third Semester

Physics — Core

Skill Enhancement Course – II — SOLAR ENERGY
UTILIZATION

(For those who joined in July 2023 onwards)

Time : Three hours

Maximum : 75 marks

PART A — ($15 \times 1 = 15$ marks)

Answer ALL questions.

Choose the correct answer :

1. Which of the following is a method of heat transfer?
 - (a) Convection
 - (b) Radiation
 - (c) Conduction
 - (d) All the above

2. Which of the following is the rate of heat transfer unit?
 - (a) Watt
 - (b) Pascal
 - (c) Joule
 - (d) Newton
3. Which of the following is the unit of coefficient of radiant heat transfer?
 - (a) W/m^2
 - (b) W/mK
 - (c) W/m^2K
 - (d) W/K
4. What is a solar collector?
 - (a) A system to collect heat by absorbing incident solar radiation
 - (b) A system to collect water by absorbing incident solar radiation
 - (c) A system to collect electricity by absorbing incident solar radiation
 - (d) A device to reflect sunlight
5. Aperture area of a solar collector is roughly equal to _____.
 - (a) Coolant area
 - (b) Generator area
 - (c) Absorber area
 - (d) System area

6. What are the components of a flat plate collector?
- (a) Flat box, a plate with reflective coating and fluid circulation passageways, an opaque cover, a circulating fluid
 - (b) Flat box, a dark coloured plate with fluid circulation passageways, an opaque, a circulating fluid
 - (c) Flat box, a dark coloured plate with fluid circulation passageways, a transparent cover
 - (d) Flat box, a dark coloured plate fluid circulation passageways, a transparent cover, a circulating fluid
7. Which of the following is generally used as circulating fluid in tropical and sub-tropical climates?
- (a) A mixture of acetone and water
 - (b) Water or a mixture of water and ethylene glycol solution
 - (c) A mixture of propylene glycol and water
 - (d) Glycerol
8. Which of the following metals are used to make pipes of low cost solar water heating system?
- (a) Gold
 - (b) Copper
 - (c) Polymer
 - (d) Silver

9. Solar pond is used to
- (a) Collect and store the solar energy
 - (b) Reflect the solar energy
 - (c) Divert solar energy
 - (d) None of these
10. Photovoltaic cell converts solar energy into
- (a) Heat energy
 - (b) Electric energy
 - (c) Mechanical energy
 - (d) Chemical energy
11. Which of the following is commonly used material in solar cells?
- (a) Aluminium
 - (b) Germanium
 - (c) Silicon
 - (d) Copper
12. Typical solar cell efficiency is
- (a) Less than 5%
 - (b) 12% to 25%
 - (c) 30% to 40%
 - (d) More than 50%

13. Which of the following is not a fuel cell?
- Hexanone-oxygen cell
 - Methyl-oxygen-alcohol cell
 - Hydrogen-oxygen cell
 - Propane-oxygen cell
14. The reaction occurring at the cathode of hydrogen-oxygen fuel cell is
- $2\text{H}_2 + 4\text{OH}^- \rightarrow 4\text{H}_2\text{O} + 4\text{e}^-$
 - $2\text{H}^2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}(\text{l})$
 - $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$
 - $\text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^- \rightarrow 4\text{OH}^-$
15. A fuel cell is used to convert chemical energy into _____.
- Mechanical energy
 - Solar energy
 - Electrical energy
 - Potential energy

PART B — (5 × 4 = 20 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

16. (a) Describe how solar time is determined.
- Or
- (b) Write notes on the three heat transfer mechanism. Also derive an expression for the rate of heat transfer due to conduction?
17. (a) Illustrate the functions of various components in flat plate collectors.
- Or
- (b) What factors affect the performance of solar flat plate collector?
18. (a) Describe the system components of a solar water heating system.
- Or
- (b) What are the main steps required, in designing of a solar cooling system?
19. (a) Write notes thermo-electric conversion.
- Or
- (b) Write notes on silicon solar cells.

20. (a) What is a fuel cell?

Or

(b) How nanotechnology is used in fuel cell production?

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

21. (a) Write notes on the solar radiation at the earth's surface.

Or

(b) Explain the working principle of Pyroheliometer and Pyranometer with a neat sketch.

22. (a) Describe with a neat sketch the working of a typical solar liquid collector.

Or

(b) Give the physical principles of conversion of solar radiation into heat with a neat sketch? What is greenhouse effect? Why glasses are used in greenhouse?

23. (a) Explain the process of generation of power in solar pond with a neat sketch and also mention its merits and demerits.

Or

(b) Discuss the different types of solar water heaters with a neat sketch.

24. (a) Explain the photovoltaic principle. Describe a basic photovoltaic system for power generation.

Or

(b) What are the different types of photovoltaic solar systems? Draw the schematic diagram of each photovoltaic systems.

25. (a) Describe the methods used for producing hydrogen from solar energy.

Or

(b) Describe the physical and chemical storage of hydrogen.
