

P.R. GOVERNMENT COLLEGE (A), KAKINADA
III B.Sc Physics Paper – VIII(C) – Semester – VI
w.e.f. 2017 - 18 ADMITTED BATCH

Course Code : Elective Paper VIII(C 1)

No. of credits : 03

Elective Paper VIII(C 1): Solar Thermal and Photovoltaic Aspects

No. of Hours per week: 03

Total Lectures:45

UNIT-I (5 hrs)

1. Basics of Solar Radiation: Structure of Sun, Solar constant, Concept of Zenith angle and air mass, Definition of declination, hour angle, solar and surface azimuth angles; Direct, diffuse and total solar radiation, Solar intensity measurement –pyrheliometer.

UNIT – II (5 hrs)

2. Radiative Properties and Characteristics of Materials: Kirchoff's law – Relation between absorptance, emittance and reflectance; Selective Surfaces - preparation and characterization, Types and applications; Anti-reflective coating.

UNIT-III (8 hrs)

3. Flat Plate Collectors (FPC) : Description of flat plate collector, Liquid heating type FPC, Energy balance equation, Efficiency, Temperature distribution in FPC, Definitions of fin efficiency and collector efficiency, Evacuated tubular collectors.

Unit-IV (9 hrs)

4. Solar photovoltaic (PV) cell: Physics of solar cell –Type of interfaces, homo, hetero and schottky interfaces, Photovoltaic Effect, Equivalent circuit of solar cell, Solar cell output parameters, Series and shunt resistances and its effect on cell efficiency; Variation of efficiency with band-gap and temperature.

UNIT-V (9 hrs)

5. Solar PV systems: Solar cell module assembly – Steps involved in the fabrication of solar module, Module performance, I-V characteristics, Modules in series and parallel, Module protection –Solar PV system and its components, PV array, inverter, battery and load.

UNIT-VI (9 hrs)

6. Solar thermal applications: Solar hot water system (SHWS), Types of SHWS, Standard method of testing the efficiency of SHWS; Passive space heating and cooling concepts, Solar desalinators and driers, Solar thermal power generation.

Reference Books:

1. Solar Energy Utilization, G. D. Rai, Khanna Publishers
2. Solar Energy- Fundamentals, design, modeling and applications, G.N. Tiwari, Narosa Pub., 2005.

3. Solar Energy-Principles of thermal energy collection & storage, S.P. Sukhatme, TataMc-Graw Hill Publishers, 1999.
4. Solar Photovoltaics- Fundamentals, technologies and applications, Chetan Singh Solanki, PHI Learning Pvt. Ltd.,
5. Science and Technology of Photovoltaics, P. Jayarama Reddy, BS Publications, 20

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Cluster Elective Paper VIII(C 1): Solar Thermal and Photovoltaic Aspects

No. of credits : 03

Note:- Set the question paper as per the blue print given at the end of this model paper.
Time: 2 1/2 Hrs. Max. Marks: 60

Section	Questions to be given	Questions to be answered	Marks
A	5	3	3 x 10M = 30M
B	9	6	6 x 5 M = 30M
Total	14	9	60M

Blue Print

Module	Essay Questions 10 marks	Short Questions 5 marks	Marks allotted
I	---	2	10
II	1	---	10
III	1	1	15
IV	1	2	20
V	1	2	20
VI	1	2	20
Total			95

QUESTION BANK

SUBJECT: PHYSICS

PAPER: VIII C1

SEMESTER: VI

SOLAR THERMAL AND PHOTOVOLTAIC ASPECTS

UNIT – I (Basics of Solar Radiation)

Short Questions – 5 M

1. Briefly explain about Pyro heliometers.
2. Define solar constant also derive the value for solar constant.
3. Explain the structure of Sun.
4. Explain the concept of Zenith angle and Air mass in brief.
5. Define Declination, Hour angle, Solar and Surface azimuth angles.
6. Explain Direct, diffuse and total solar radiation in brief

UNIT – II (Radiative properties and characteristics of Materials)

Essay Questions – 10 M

7. Define Kirchhoff's law and also derive the relation between absorptance, emittance and reflectance
8. Write a note on selective surfaces preparation and characterization, explain its types.
9. Write a note on Anti reflective coating.

UNIT – III (Flat Plate Collectors)

Essay Questions – 10 M

10. Give the description of flat plate collector and explain about Liquid heating type FPC
11. Discuss about temperature distribution in FPC

Short Questions – 5 M

12. Write a note on energy balance equation and efficiency of FPC
13. Define fin efficiency and collector efficiency.
14. Write a note on evacuated tubular collectors.

UNIT – IV (Solar Photovoltaic (PV) cell)

Essay Questions – 10 M

15. Explain variation of efficiency with band –gap and temperature
16. Discuss various types of interfaces

Short Questions – 5 M

17. Explain Photo Voltaic Effect.
18. Draw the equivalent circuit of solar cell and write the solar cell output parameters

19. What are Series and shunt resistances and explain its effect on cell efficiency.
20. Write a short note on solar cells.

UNIT – V (Solar PV systems)

Essay Questions – 10 M

21. Write down the steps involved in the fabrication of solar module
22. Explain solar PV system and its components

Short Questions – 5 M

23. Write about solar module protection.
24. Explain performance and I-V characteristics of a solar module.
25. Write a note solar modules in series and parallel combinations

UNIT – VI (Solar thermal applications)

Essay Questions – 10 M

26. Explain different types solar hot water systems (SHWS).
27. Explain standard method of testing the efficiency of SHWS.

Short Questions – 5 M

28. Explain Solar thermal power generation.
29. Write short note on solar desalinators and drier.
30. Write a note on Passive space heating and cooling concepts