

**SAVITRIBAI PHULE PUNE UNIVERSITY
(Formerly University of Pune)**



**Revised Syllabus for
Certificate Course in Installation of Solar Photovoltaic Systems
from Academic Year 2022-23 onwards**

**FACULTY: FACULTY OF SCIENCE AND TECHNOLOGY
BOARD: ENERGY TECHNOLOGY**

**Centre for Energy Studies
Savitribai Phule Pune University
Pune 411 007**

July 2022

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**Syllabus for Certificate Course in Installation of Solar Photovoltaic Systems
[04 credits]**

[Total 60 contact hours = 40 lectures + 20 practical, tutorials and assignments]

Unit 01- Solar Scenario and Available Technologies [0.5 credits]

Overview of Global Scenario in Renewable Energy, National Action Plan on Climate Change, Jawaharlal Nehru National Solar Mission, State wise Initiatives, Policy Framework Support in India for RE, Exemption from Taxes, Current Status of SPV Industry, Renewable Purchase Obligation, present status in various States, Future possibilities due to RPO, Solar Energy- Principles & Technology, Concepts of Solar PV, Introduction to Solar Energy, Irradiance, Solar Window & tilt angle, Atmospheric effects ,Diffused radiation, Solar air mass, sensitivity of PV materials to various wavelengths, Cell efficiency and fill factor , Response to temperature ,irradiation, Materials used for Solar PV, Latest development of technologies in Solar PV, future trends in solar cell technology, Instruction to components of a solar photovoltaics systems: modules, array, inverters, balance-of-system components, safety devices etc.

Unit 02: Installation of Solar Photovoltaic System [0.5 credits]

Preparing the project management plan. Introduction to Safety of Materials and Materials Handling standards.

Unit 03: Case Study of Grid Connected Systems [0.5 credits]

Case study of a 2 MW SPV Plant –Student to design complete plant with assessment of energy generation on software and prepare Auto Cad drawings.

Unit 04: Installation & Commissioning [0.5 credits]

Project Management-Project organization, Project time line, Important Elements of Supervision, General principles electrical, General principles mechanical, , site engineer's responsibilities.

Stages in solar power plant installations, O & M requirements.

Future Trends- Future trends in solar policies, Trends in solar technology, Automation and innovations in erection and execution and expertise, trends in prices of components, Global trends and involvement.

Unit 05: Project Management [0.5 credits]

Project organisation, project time line, important element of supervision, site Engineer's responsibilities.

Stages in Solar Plant Installations, O & M requirements, Project Financials, Evaluation of cost of a project, Project summary, Project cost break up, financials, sensitivity analysis, Financial Analysis and IRR (Internal Rate of Return) and Preparation of levelised cost sheet.

Unit 06: Experiments [0.5 credits]

1. Ecosense – PV Simulator (9 experiments)

Performance of SPV module:

- a. Current-voltage characteristic curve (I-V Curve) construction
 - b. Physical properties of solar module and temperature dependence
 - c. I-V and P-V characteristics with series and parallel combination of modules
2. Effect of direct and diffuse radiation on crystalline and thin film modules (by using sun meter)
 3. Assemble and dismantle of solar lanterns
 4. Solar water pump system (Day (water pump) + Night (Home lighting))
 5. Understanding of various parts of the inverter (non-working)
 6. Tools and accessories used in solar PV systems and power plants

Unit 07: Group Discussion- On a chosen topic [0.5 credits]

Unit 08: Entrepreneur Awareness [0.5 credits]

Mode of Examination: 3 hours Written test to verify the assimilation of knowledge to candidate and to assess the level of understanding.

Learning Outcomes:

After completing this course, student should be able to:

- 1) Demonstrate knowledge of and apply key solar electric system terms and concepts.
- 2) Size and design a photovoltaic system.
- 3) Mount, ground, position, install, wire and connect a photovoltaic system.
- 4) Test voltage generated by photovoltaic system Operate & Maintain of Solar Power.
- 5) Participants will learn different types of solar PV module and batteries used in solar PV plant.
- 6) Design of solar PV Plant based on estimated loads.

Recommended books:

1. Roger A Messenger and Jerry Ventre, "Photovoltaic Systems Engineering" Second Edition, CRC Press, Taylor & Francis Group, 2004.
2. Antonio Luque, Steven Hegedus, "Handbook of Photovoltaic Science and Engineering" John Wiley & Sons, 2011 .
3. Stuart R. Wenham, "Applied Photovoltaics" , Earthscan, 2007 .
4. Falk Antony, Christian Dürschner, Karl-Heinz Remmers, "Photovoltaics for professionals: solar electric systems marketing, design and installation", Earthscan Solarpraxis AG, 2007.
5. Mary D. Archer, Robert Hill, "Clean Electricity from Photovoltaics", Imperial College Press, 2001
6. Chetan Singh Solanki, "Solar photovoltaics : fundamentals, technologies and applications" 2nd ed, PHI Learning New Delhi, 2011.
