



NATIONAL INSTITUTE OF SOLAR ENERGY
(An autonomous Institute of Ministry of New & Renewable Energy)

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SYLLABUS
FOR APPLICANTS FOR ON LINE/CBT EXAMINATION
FOR THE POST OF
DIRECTOR/SCIENTIST 'D'
AND
DEPUTY DIRECTOR / SCIENTIST C'

I. Solar Resources

1. Solar resources overview, SUN as a source of energy, nature of its radiation;
2. Solar resources measuring equipment;
3. Solar constant, air mass, declination angle, incident angle;
4. Various types of solar radiation and its definition, wave lengths; SUN Spectrum
5. Solar Potential in India/ World
6. Ground and satellite radiation measuring technique, advantages and limitations;
7. Radiation Data Bases –MNRE, SRRA. NREL, METEONORM, NASA and TMY

II. Solar Thermal

General Science;

Law of Thermodynamics, Heat and mass transfer relating to solar thermal, Fluid Dynamics (Laminar flow, Turbulent Flow)

1. **Types of Solar Thermal Technologies** i.e. fixed concentrating (Point and line focus), their advantages and limitations.
2. **Solar Thermal Components, materials, selective coating, cavity receiver.**
3. **Solar Thermal Technology Performance:**
 - i. optical efficiency
 - ii. convection losses
 - iii. Radioactive losses
 - iv. Variables affecting the performance of solar thermal technologies.
4. **Solar thermal power plant.**
 - i. Technology
 - ii. Rankine cycle (Efficiency, isentropic loss)
 - iii. Organic Rankine Cycle (working fluids)
 - iv. Bryton Cycle (Air & CO₂)

5. Solar thermal cooling technologies.

- i. Types of thermal cooling technologies, their advantage and limitations
- ii. Coefficient of Performance
- iii. Refrigerant/ working fluid on various solar thermal cooling systems

1. Solar thermal storage system.

Type of thermal storage i. e. Sensible Storage, Phase change material (PCM) Storage, Thermo-chemical Storage, etc. PCM storage type, operating temperature specific heat and other properties.

2. Solar Thermal Potential for power generation and process heat in India.

3. Solar desalination systems.

III. Broad Topics

- i. All Solar Cells Fabrication and Characterisation Technologies, and related equipment;
 - ii. Different solar Cell material testing and characterization techniques, and related equipment;
 - iii. Different Technologies PV Modules including thin film, crystalline and other technologies. Fabrication, measurement techniques and equipment.
 - iv. PV power plant designing , commissioning and performance monitoring (ON Grid, Off Grid and hybrid);
 - v. Power generation, transmission and distribution; problems related to high solar power injection.
 - vi. Solar PV power plant engineering including smart grids;
 - vii. Design of low and high DC voltage PV systems;
 - viii. Storage batteries including lead acid; Li-ion, NIHM and other technologies. Their chemistry, testing and performance evaluation along with required instrumentation. Charging algorithm and controllers.
 - ix. Reliability and performance evaluation PV modules as per National Standard/ International Standards IEC 6125/ 61646/ 61853/ 61701/ 62804/ 61730-1, 2, and equivalent BIS Standards.
 - x. Degradation mechanism in solar cells and modules under different field conditions.
 - xi. Advances in development and fabrication of degradation resistant cells and modules.
 - xii. Testing Certification of PV System & components and BOS
 - xiii. Power Electronics related to SPV systems.
 - xiv. LED based PV lightening system, design, and development and performance evaluation as per different categories of requirements.
 - xv. Different kind of LED technologies, their spectro- radiometric measurement, lumen testing , view angle, LM 79 and other testing procedure and related equipment
 - xvi. Selection appropriate PV Technology and other Components for different climate conditions and applications
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