

DEPARTMENT OF PHYSICS

**SYLLABUS  
FOR  
VALUE ADDED COURSE  
(UG LEVEL)**

**RENEWABLE ENERGY AND ENERGY HARVESTING**



**RAMA DEVI WOMEN'S UNIVERSITY**

**Vidya Vihar, Bhubaneswar-751022**

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# RENEWABLE ENERGY AND ENERGY HARVESTING

## COURSE OUTCOME

The students will have understanding of:

- CO1. The basic concept of different sources of energy and their utilisation in generating electrical power
- CO2. Gain the knowledge in different harvesting energy and impact on environment
- CO3. Acquire the knowledge how the energy harvesting solve the global energy challenge without depleting natural resources
- CO4. The applications of energy harvesting devices in remote sensing, wearable electronics, condition monitoring, and wireless sensor networks.

## UNIT I

**Fossil fuels and Alternate Sources of energy:** Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

## UNIT II

**Solar energy:** Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

**Ocean Energy:** Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices, Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.

**Hydro Energy:** Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

## UNIT III

**Wind Energy harvesting:** Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

**Piezoelectric Energy harvesting:** Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power

## References :

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
4. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009

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**ELECTRICAL CIRCUIT NETWORK SKILLS**



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# ELECTRICAL CIRCUIT NETWORK SKILLS

## COURSE OUTCOME

The students will have understanding of:

- CO1.** The basic concept of different electrical circuits, utilisation of the circuits
- CO2.** Gain the knowledge in electrical drawing and solid state devices
- CO3.** Acquire the knowledge electrical wiring which will useful in every day life.
- CO4.** Gain the knowledge of electrical protection from AC and DC source and consequences of careless during the connection of electrical circuits.

## UNIT I

**Basic Electricity Principles:** Defination of Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter.

**Understanding Electrical Circuits:** Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money.

## UNIT II

**Electrical Drawing and Symbols:** Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop. DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers.

**Solid-State Devices:** Resistors, inductors and capacitors. Diode and rectifiers. Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources

## UNIT III

**Electrical Wiring:** Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board.

**Electrical Protection:** Relays, Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device)

**Reference Books:**

1. A text book in Electrical Technology - B L Theraja - S Chand & Co
2. A text book of Electrical Technology - A K Theraja
3. Performance and design of AC machines - M G Say ELBS Edn.