**LNCT University**
**Diploma EX, III Semester Syllabus**

**RENEWABLE ENERGY SOURCES (DEX-303)**

## COURSE OUTCOMES:

**After Completing the course student should be able to:**

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| CO-1 | Understand the classification, availability, and environmental impact of energy sources, and recognize the global need for transitioning to renewable energy. |
| CO-2 | Explain the principles of solar radiation, and describe the working and applications of solar thermal and photovoltaic systems. |
| CO-3 | Analyze wind energy potential and describe the construction, operation, and limitations of wind energy conversion systems. |
| CO-4 | Classify biomass resources and explain biogas generation and biomass conversion technologies along with their applications. |
| CO-5 | Describe the basic working principles, applications, and challenges of other renewable sources such as small hydro, geothermal, tidal, wave, and hydrogen energy. |

UNIT I: Introduction to Renewable Energy Sources: Energy Basics: Classification of energy sources (renewable vs non-renewable), energy demand and supply scenario. Environmental Aspects: Global warming, climate change, pollution due to fossil fuels. Need for Renewable Energy: Depletion of conventional energy, energy security, sustainability. Overview of Renewable Energy Sources: Solar, wind, biomass, hydro, geothermal, tidal and hydrogen.

UNIT II: Solar Energy
Solar Radiation: Solar constant, solar geometry, solar radiation measurements. Solar Thermal Systems: Solar water heater, solar dryers, solar cooker, solar still. Solar Photovoltaic Systems: Principle of photovoltaic conversion, types of solar cells, components of PV systems. Applications: Solar street lighting, solar pumping, grid-connected PV systems.

UNIT III: Wind Energy
Wind Characteristics: Wind speed and power relationship, wind maps, site selection. Wind Turbines: Types (Horizontal/Vertical), components, performance curves, capacity factor. Wind Energy Conversion Systems: Grid-connected and standalone systems. Challenges and Limitations: Intermittency, storage and land use.

UNIT IV: Biomass and Biogas Energy
Biomass Resources: Agricultural residue, wood, energy crops, animal waste. Biomass Conversion Technologies: Combustion, gasification, pyrolysis. Biogas Technology: Anaerobic digestion, types of biogas plants, slurry management. Applications: Cooking, electricity generation and biofuels (ethanol, biodiesel).

UNIT V: Other Renewable Energy Sources

Small Hydropower: Classification (micro/mini/small), components of hydro plant, site selection. Geothermal Energy: Sources, types of geothermal plants, applications and limitations. Tidal and Wave Energy: Principles, types of tidal energy systems, ocean wave power. Hydrogen as Fuel: Production methods, storage, hydrogen fuel cells. Hybrid Renewable Energy Systems: Concept, need, case studies.