

**Course Title:** Electrical Power Systems for Renewable Energy (**Elective Course**)

**Course Code** RE-821

**Course Objectives:**

The educational objectives of the course Renewable Power Systems are.

- To demonstrate a comprehensive understanding of various renewable energy sources including solar photovoltaics, wind, hydro, and geothermal and their principles of operation
- To gain the skills and knowledge required to assess, design, and implement renewable power systems including the selection and integration of appropriate technologies, components, and energy solutions.
- Understanding and the functioning of electrical power systems, including generation, transmission, and distribution.
- Explore challenges in maintaining stability and reliability within power systems when integrated with the renewable energy systems.
- To evaluate the environmental and social impacts of renewable energy in power systems to ensure sustainable development and community engagement.
- To develop the ability to engage in independent research analysis and innovation in the renewable power systems field.

**Learning Outcomes.**

This course aims to equip the students with a comprehensive understanding of global energy systems, covering conventional and renewable sources, their historical evolution, and environmental impacts. Students will explore the mechanisms of electricity generation, transmission, and distribution within electrical power systems. Students will possess the knowledge, critical thinking abilities, and practical skills necessary to contribute toward sustainable energy solutions in a rapidly evolving energy landscape. Finally, the graduates get equipped not only with theoretical knowledge of the power systems but also with analytical skills and practical expertise to innovate within the evolving energy landscape, advocating for sustainable and responsible energy practices.

### **Detailed Contents:**

**Energy and Electricity:** The world scene (history, world energy consumption, finite resources, energy security and disparity of use); The environmental impact of Energy use; Generating electricity; The electrical power system.

**Features of Conventional and Renewable Generation:** Conventional sources. Hydroelectric power; Wind power; PV and solar thermal electricity; Tidal power; Wave power; Biomass; Summary of power generating characteristics and combining sources.

**Electric Power Generation and Conditioning:** Conversion of renewable into electrical, Synchronous generator, Transformer, Asynchronous generator, Power electronics,

Applications to renewable energy generators, Renewable Generation in Power Systems, Distributed generation, Voltage effects, Thermal limits, Generation issues, Islanding

**Power Balance and Frequency Control:** , Dynamic frequency control of large systems , Impact of renewable generation on frequency control and reliability ,Frequency response from renewables, Power System Analysis, Transmission system, Voltage control, Reactive power, Load flow, Fault and protection, Time varying and dynamics, The Future Towards a Sustainable Electricity Supply System, Future of wind power, Future of solar, Future of biofuels, Future of hydro and marine power, Distributed generation and the shape of future networks

### **Text/Ref Books:**

- Renewable Energy in Power Systems 2nd Edition, by David Infield (Author), Leon Freris (Author), Wiley.
- Renewable and Efficient Electric Power Systems 2nd Edition by Gilbert M. Masters, Wiley-IEEE Press.
- Electric Renewable Energy Systems by Muhammad H. Rashid (Author) Academic Press