Renewable Energy and Power Evacuation

Program Description

Course Name	**Renewable Energy and Power Evacuation**
Course Name as on Certificate	**Certification in Renewable Energy and Power Evacuation**
Certificate Type	Certificate of Completion by IITM Pravartak and L&T EduTech
Certificate Issued by	IIT MADRAS and L&T EduTech
Course Description	With the ever-increasing demand for electric power and imminent exhaustion of fossil fuels, tapping the renewable energy sources for power generation seems the most obvious solution to bridge the demand and supply gap. This course on Renewable Energy and Power Evacuation discusses the available Renewable Energy options and the challenges faced in harnessing the power from these sources. The course further elaborates on how to generate power from solar and wind power plants commercially and technologically viable. The learner is taken through the various energy-storage technologies available with specific detailing on battery technology and its advancements. Case Studies on large scale implementation of solar plants and wind power plants are deliberated using software tools like PVSyst and SAM. Do it yourself problem statements from industry on Solar PV design using MATLAB/PVSyst/SAM is also provided to the learners to get hands on experience on the subject. **Objective:** ➢ Create awareness and understanding of the Fossil fuel dependency in current power generation scenario and the need to migrate to cleaner and renewable energy sources ➢ Explain various forms of renewable energy ➢ Illustrate the design aspects involved in renewable power generation, especially from Solar and Wind energy Sources ➢ Illustrate the energy storage strategies including Battery and Hydrogen storage ➢ Illustrate how grid Integration is done for the energy generated from Renewable Energy Sources
Educational Qualification	• Students pursuing Diploma / UG / PG Programs in Elecrical & Electronics and other allied domains • Faculties in the field of Elecrical & Electronics and other allied domains Working professionals in the above domains
Pre Requisites	Basics of Electrical Engineering
Course Content	**See Enclosed Progamme details – as Annexure 1**
Pedagogy	Online Self paced E-Learning Content

Assessment	One Final Assessment		
Programme Faculty	**Mr. Jembu Kailas KK, Lead Subject Matter Expert – L&T EduTech** Mr. Jembu Kailas KK is the Lead Subject Matter Expert (SME) in Electrical Engineering at L&T EduTech. He holds a B.E. degree in Electrical & Electronics Engineering and have 36 years of experience in designing, engineering, planning, and executing electrical projects. He is a member of IEEE, National Building Code, and QIC, as well as a member of IEEMA. He has presented 10 papers at national and international conferences. His expertise lies in electrical substations, power distribution, and industrial and building electrification.		
Duration	Weeks: 14 ; Hours : 28hrs		
Class Schedule	Self Paced		
Programme Highlights/USPs	**Do it yourself problem statements from industry on Solar Project using PVSyst and SAM Software**		
Total Fees		**Total Fees**	
	Total Programme Fee	Rs. 5,100/- inclusive of Tax	Total Programme Fee

ANNEXURE 1

Proposed Course outline / programme / plan - Unit wise syllabus details.

Unit – I: The Need for Sustainability
Global Warming and Net Zero Emissions, Exhaustion of Fossil Fuels, The Present power scenario, Carbon Sequestration, Mitigation and Neutrality, Global Carbon Footprint, Commitments at COP-26 Glasgow Conference, Environmental, Social and Governance (ESG), Innovation in Architecture and Construction, Consumer Goods and Energy, Innovation in Life Sciences, Transportation and Mobility Various Forms of Renewable Energy: Geo-Thermal Energy, Tidal Energy, Biomass Energy, Solar Energy, Wind Energy, Hybrid Energy

Unit – II: Solar Power Generation, Challenges and Typical Sizing Calculations with Case Study
Solar Power Generation: Photo Voltaic (PV) Cells – Theory and Principles, Types and Modules, Electrical Performance Characteristics of Photovoltaic Cells, Photo Voltaic Panel Tilt angles and Optimising Energy Capture, Photo Voltaic System – Power System Configurations, Charge Controller and Inverters, Cost and Economics, Statistics and Future Outlook, Concentrated Solar Power (CSP), Determination of PV Module Characteristics using MATLAB Software. Solar Power Challenges and Typical Sizing Calculations: Advantages of Solar Power, Solar Power Challenges and Mitigation, Solar Panel Sizing Calculation, Sizing of Converter for Solar Panel, PV System Standards and Softwares, Demonstration of System Advisor Model (SAM) and PVSyst softwares, Design and Simulation of Grid Connected PV Solar System and Off-grid Connected/Standalone PV Solar System, with Shading effects using PVSyst, SAM Softwares. Solar Power Generation case study: Feasibility of Mega Scale Solar Power Generation in Deserts, Power Export: Generation in African Desert and Export to Europe, Case Study of Morocco Solar Power Generation, Under Sea Power Cables for Evacuation of Power, Case Study of Rajasthan/Gujarat for Mega Solar Parks, Intention of International Solar Alliance

Unit – III: Wind Power Generation, Challenges and Typical Sizing Calculations
Wind Power Generation: History of Wind Power, Different Types of Wind Turbines, Wind Power Plants and Components, Theory and Calculations related to Wind Power, Wind Turbine Sizing, Wind Energy – Global Wind Atlas. Wind Power Generation Challenges and Typical Sizing considerations: Advantages of Wind Power, Challenges for Wind Power, On-shore and Off-shore Technology, Wind Farm Optimized Spacing, Wind Turbine Power Evacuation, Power Evacuation for Wind Farms.

Unit – IV: Energy Storage
New Developments in Solar & Wind Technology: Solar Chimney, Thin Film Solar PV Cells, Spherical Solar Cells, Perovskite Solar Cells, Agri Voltaics, Bladeless Wind Power Technology, New Designs of Wind Power Generators under Development. Storage of Reliable Renewable Power: Need for Storage, Electrochemical Storage, Battery Storage, Thermal Energy Storage, Compressed Air Energy Storage, Liquid Air Energy Storage, Pumped Hydro Storage, Mechanical Storage. Types of Batteries, Battery Sizing and Super Capacitors: Battery – Basics and Technology, Specifications and Parameters, Li-Ion Batteries, Battery Charging Principle, Battery Sizing Calculations. Hydrogen as a Storage Medium: Introduction to Green Hydrogen Technology, Generation of Green Hydrogen, Storage and Delivery, Status of Green Hydrogen – World and India.

Unit – V: Impact of Renewable Power on Grid and FACTS
Impact of Renewable power on Grid: Renewable Energy Forecasting, Connection of Renewable Power Source to Power Grid, Load Dispatch Management, Harmonic Components in Renewable Power and its ill effects in Grid Integration, Variation in Power Generation and Change in Direction of Flow, Dedicated Green Corridors, Renewable Energy Tariff and Time of Day (TOD) Metering Concept, Power Purchase Agreements (PPA). Need for Flexible AC Transmission (FACTS): Integration of Renewable in Grid, Typical FACTS Devices, Synchronous Condensers, Switching Devices, Shunt Capacitors, Transformer controlled Reactors, Static VAR Compensators (SVC), Static Synchronous Compensators (STATCOM).