POWER ELECTRONICS IN RENEWABLE ENERGY SYSTEMS

VI Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB45	Professional Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The students will try to learn:

1. The importance of energy conversion in the present energy scenario and the availability of renewable energy sources for sustainable energy conversion.
2. The use of power semiconductor devices to perform switching action in order to achieve a desired conversion strategy.
3. The hybrid renewable energy resources for grid integration and facilitate developing renewable systems for domestic and industrial applications

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

1. **Recall** the environmental aspects and economic benefits of clean energy systems for production of electricity.
2. **Outline** the operating principles and characteristics of renewable energy sources for sustainable energy conversion
3. **Summarize** the renewable energy conversion systems for reliable operation.
4. **Understand** the power quality issues and mitigation techniques used in grid connected systems for ensuring the quality of power
5. **Choose** the proper power converters and inverters for harmonic reduction in solar photovoltaic systems.
6. **Select** the reliable inverter, battery and array sizing for grid synchronization in renewable energy systems.
7. **Make use of** AC voltage controllers for power factor improvement in wind power generation
8. **Demonstrate** the stand alone and grid connected renewable energy resources for generating quality power.
9. **Analyze** the control and protection of hybrid renewable energy systems for stable operation of power systems.
10. **Develop** the acceptable scheme for extracting maximum power from solar photovoltaic module using maximum power point tracking algorithms.

MODULE-I INTRODUCTION TO RENEWABLE ENERGY SYSTEMS

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission), qualitative study of different renewable energy resources ocean, biomass; Hydrogen energy systems: operating principles and characteristics of: Solar PV, fuel cells, wind electrical systems control strategy, operating area.

MODULE-II	ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION
Renewable energy conversion systems: fundamental principle of operation of self excited induction generator, squirrel cage induction generator, doubly fed induction generator, synchronous generator, permanent magnet synchronous generator; Grid related problems: harmonic reduction and power factor improvement	
MODULE-III	**POWER CONVERTERS**
Solar: Block diagram of solar photo voltaic system, Line commutated converters (inversion mode), boost and buck-boost converters, selection of inverter, battery sizing, array sizing. Wind: three phase AC voltage controllers used in wind energy conversion. Switching devices: AC – DC converters, PWM Inverters, Grid Interactive Inverters-matrix converters.	
MODULE-IV	**ANALYSIS OF WIND AND PV SYSTEMS**
Stand alone operation of fixed and variable speed wind energy conversion systems and solar system, grid connection issues, grid integrated PMSG and SCIG Based WECS-Grid integrated solar system.	
MODULE-V	**HYBRID RENEWABLE ENERGY SYSTEMS**
Need for Hybrid Systems: Range and type of hybrid systems, case studies of wind-PV maximum power point tracking (MPPT), biomass-fuel cell hybrid systems, fuel cell-PV hybrid system and wind-fuel cell hybrid system	

Text Books:

1. Mukund R Patel, "Wind and Solar Power Systems", CRC Press, 1st Edition, 1999.
2. SN Bhadra, D. Kastha, S. Banerjee, "wind electrical systems", OXFORD higher education, 2018

Reference Books:

1. Daniel, Hunt. V Wind Power, A Hand Book of WECS, Van Nostrend Co., Newyork, 2nd Edition, 1998.
2. Publications, 2nd Edition, 2001. G D Rai, "Non- Conventional Energy Resources", Khanna Publishers, 1st Edition, 2002.
3. ArindamGhosh, Gerard Ledwich, "Power Quality Enhancement Using Custom Power Devices", Springer, 1st Edition, 2002.
4. Roger C Dugan, Mark E Mc. Granaghan, Surya Santosoh and H. Wayne Beaty, "Electrical Power Systems Quality", TATA McGraw Hill, 2nd Edition, 2010.

Web References:

1. https://www.NPTEL video lectures.
2. https://www.electrical4u.com.

E- Text Books:

1. https://www.freebookcentre.net
2. https://www.books.askvenkat.com/engineering-textbooks