IPS Academy

INSTITUTE OF ENGINEERING & SCIENCE

(A UGC Autonomous Institute affiliated to RGPV)

Electrical and Electronics Engineering Department

Curriculum of PG 3rd Sem. (Sp. in Power Electronics) in Electrical and Electronics Engineering Department

2nd Year 3rd Semester

S. No.	Course Code	Course Title	Hrs./ week			Credits
			L	T	P	
1	PSEC-EEE301	Elective III	3	0	0	3
2	LLC- EEE 301	Business Communication	1	0	0	1
3	SBC- EEE301	Dissertation Phase- I	0	0	20	10
					Total credits	14

Professional Elective (PSEC-EEE301)
(A) Grid Interface of Energy Sources
(B) Power Electronics Supply System & Design
(C) Non-Conventional Energy Sources and Energy Conservation

Subject Code	Name of the Subject	L : T : P (hrs.)	Credits
PSEC-EEE301 (A)	Grid Interface of Energy Sources	3: 0 : 0 (3 hrs.)	3 Credits

Course Objective: The objective of this course is to make students familiar with different renewable sources and converters.

Prerequisites: Power Electronics, Power System, Electrical machine

Module1(8 Hours)

Introduction to renewable sources: world energy scenario, Wind, solar, hydro, geothermal, availability and power extraction. Introduction to solar energy: Photovoltaic effect, basics of power generation, P-V & I-V characteristics, effect of insolation, temperature, shading; Modules, connections, ratings; Power extraction (MPP), tracking and MPPT schemes; standalone systems, grid interface, storage, AC-DC loads..

Module2(10 Hours)

Power converters for solar: Micro converter, DC-DC buck/boost/buck-boost /flyback /forward/cuk, bidirectional converters; Inverters: 1ph, 3ph inverters Multilevel Neutral point clamp, Modular multilevel, CSI; Control schemes: unipolar, bipolar.

Module 3(8 Hours)

Single phase and three-phase back Controllers. Triggering techniques for power factor and harmonic controls. Design and analysis of phase control circuits. Solid state transfer switches. Concept of three-phase to single phase and single phase to three-phase cyclo-converter. Effect of source inductance. Concept of PWM techniques single and multiple pulse form. Working of STATCON, SVC, UPS, SMPS

Module 4(8 Hours)

Intro to wind energy: P-V, I-V characteristic, wind power system: turbine-generatorinverter, mechanical control, ratings; Power extraction (MPP) and MPPT schemes. PLL and synchronization, power balancing / bypass, Parallel power processing; Grid connection issues: leakage current, Islanding mode, harmonics, Mitigation of harmonics, filters, passive filters, Active filters, active/reactive power feeding, unbalance.

Module 5(8 Hours)

Generators for wind: DC generator with DC to AC converters; Induction generator with & w/o converter; Synchronous generator with back to back controlled/ uncontrolled converter; Doubly fed induction generator with rotor side converter topologies; permanent magnet based generators. Battery: Types, charging discharging.

Course Outcomes:-After successful completion of course students will be able to:

CO 1: Explain renewable energy sources and optimization of Solar Energy tapping in PV systems.

CO 2: Demonstrate different power converter for Solar (PV Systems).

CO 3: Application of single phase and three phase controller with different controlling techniques.

CO 4 Explain wind energy generators and their synchronization with grid network.

CO 5: Explain different topology of wind generators.

Text/ Referencesbooks:

1. Sudipta Chakraborty, Marcelo G. Sim303265es, and William E. Kramer. Power Electronics for Renewable and Distributed Energy Systems: A Sourcebook of Chetan Singh Solanki, Solar Photovoltaics: fundamentals, Technologies and Applications, Prentice Hall of India, 2011.

2. N. Mohan, T.M. Undeland& W.P. Robbins, Power Electronics: Converter, Applications & Design, John Wiley & Sons, 1989

3. Remus Teodorescu, Marco Liserre, Pedro Rodriguez, Grid Converters for Photovoltaic and Wind Power Systems, John Wiley and Sons, Ltd., 2011

Subject Code	Name of the Subject	L : T : P (hrs.)	Credits
PSEC-EEE301 (B)	Power Electronics Supply System & Design	3: 0 :0 (3 hrs.)	3 Credits

Course Objective: The objective of this course is to make students familiar with analysis and design of different converter, soft switching of converter and ups

Prerequisites: Basic Electronics,Power Electronics

Module1(8 Hours)
Review of basic power electronics principles, Introduction to various power electronics supplies. Performance parameters for power electronics supplies and their measurement.

Module2(10 Hours)
DC to DC converters: Analysis and design of cuk converters, two quadrant and full bridge non- isolated converters, Isolated converters, i.e., flyback, forward, push-pull, half- bridge, full bridge Zeta, and SEPIC topology, block diagram of converter control, modeling such as averaged model, linearized and state space model Design of DC inductor, Concept of integrated magnetic

Module 3(8 Hours)
Soft switching DC to DC converters, zero current switching topologies, zero voltage switching topologies, generalized switch cell, ZCT and ZVT DC converters, design and simulation

Module 4(8 Hours)
Pulse width modulation rectifiers, properties of ideal rectifiers, Realization of near deal rectifiers, CCM boost converter, DCM flyback converters, control of current waveforms, AC Choppers: Modeling and analysis of AC choppers, harmonics control using symmetrical and asymmetrical waveform pattern, design and simulation.

Module 5(8 Hours)
Static un-interruptible power supply, on-line, off-line and line interactive UPS, modes of operation, batteries and converters selection and design for UPS, performance evaluation of UPS, power factor correction techniques, control of UPS.

Course Outcomes:-After successful completion of course students will be able to:

CO 1: Understand various types of power electronics devices and their performance.
CO 2: Analyze and design of different converter
CO 3: Demonstrate with different switching technique topologies.
CO 4 Model and analyze AC choppers and PWM technology.
CO 5: Explain different types of UPS operation and performance evaluation.

Text/ References books:

1. R. W. erickson and D. Maksimovic, “Fundamentals of Power Electronics”, Springer Science & Business Media, 2013.
2. Y.S Lee, “Computer Aided Analysis and Design of Switch Mode Power Supplies”, Marcel Dekker, New York 1993.
3. IssaBatarseh, “Power Electronics Circuits”, John Wiley & Sons Inc 2004.
4. Ned Mohan, “Power Electronics: Converters, Applications, and Design”, John Wiley & Sons Inc 2003.
5. M. H. Rashid, “Power Electronics Circuits, Devices and Applications”, third edition Pearson Education India, 2009.

Subject Code	Name of the Subject	L : T : P (hrs.)	Credits
PSEC-EEE301 (C)	Non-Conventional Energy Sources and Energy Conservation	3: 0 : 0 (3 hrs.)	3 Credits

Course Objective: The objective of this course is to make students familiar with Non-Conventional Energy Sources, energy audit.

Prerequisites: Power Electronics, Power System, Electrical machine

Module1(8 Hours)

Renewable Energy Systems: Energy Sources, Comparison of Conventional and non-conventional, renewable and non-renewable sources, statistics of world resources and data on different sources globally and in Indian context, significance of renewable sources and their exploitation energy planning, Energy efficiency and management.

Module2(10 Hours)

Wind Energy System Wind Energy, Wind Mills, Grid connected systems, system configuration, working principles, limitations, effects of wind speed and grid conditions. Grid independent systems - wind-battery, wind-diesel, and wind-hydro biomass etc. wind operated pumps, controller for energy balance. Small hydro system grid connected system, system configurations, working principles and limitations, effect of hydro potential and grid conditions, synchronous versus induction generators for standalone systems, use of electronic load controllers and self-excited induction generators. Wave Energy Systems: System configuration, grid connected and hybrid systems.

Module 3(8 Hours)

Solar Radiation Extraterrestrial solar radiation, terrestrial solar radiation, Solar thermal conversion, solar photo tonic systems. Solar cell material and efficiency. Characteristic of PV panels under varying insulation. PV operated lighting and water pumps, characteristics of motors and pumps connected to PV panels. Biomass Energy System: System configuration, Biomass engine driven generators, feeding loads in stand-alone or hybrid modes, Biomass energy and their characteristics.

Module 4(8 Hours)

Electric Energy Conservation: Energy efficient motors and other equipment: Energy saving in Power Electronic controlled drives, electricity saving in pumps, air-conditioning, power plants, process industries, illumination etc. methods of Energy Audit measurements systems; efficiency measurements. Energy regulation, typical case studies, various measuring devices analog and digital.

Module 5(8 Hours)

Study of typical energy converters such as high performance motor special generators driven by bio gas engines. Wind turbines etc., mini-hydro generators, modern state of the art and futuristic systems in this area.

Course Outcomes:- After successful completion of course students will be able to:

CO 1: Analyze different typesof conventional and non-conventional energy sources, energy efficiency and its management.
CO 2: Explain wind energy system in grid connected and grid independent systems.
CO 3: Demonstrate solar system solar panel and Biomass Energy System.
CO 4 Understand the electric energy conservation and energy auditing.
CO 5: Explain different types of energy converters.

Text/ References books:

1. John Twidell& Toney Weir, Renewable Energy Resources, E & F N Spon.
2. El-Wakil, Power Plant Technology, McGraw Hill.
3. Rai G D, Non-conventional Energy Resources, Khanna.
4. F Howard E. Jordan, "Energy-Efficient Electric Motor & their Application-II", Plenum Press, New York, USA.
5. S.P. Sukhatme: Solar Energy, TMH-4e, MEPE – 302 (A) Computer Aided Power

2nd Year 4th Semester

Subject Code	Name of the Subject	L : T : P (hrs.)	Credits
SBC – EEE 401	Dissertation Phase – II	0: 0 : 32 (32 hrs.)	16 Credits