COURSE CODE: **1152EE136**	COURSE TITLE: **SOLAR ELECTRIC SYSTEMS**	L	T	P	C
		3	**0**	**0**	**3**

COURSE CATEGORY:

Program Elective

PREAMBLE :

This course helps to understand Solar Cells and Its Technologies, Photovoltaic Principles Fabrication Technology

COURSE OUTCOMES :

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

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Explain about Renewable Energy resources and importance.	K2
CO2	Outline the process of photovoltaic power generation.	K2
CO3	Outline the process of power generation using wind energy sources.	K2
CO4	biomass and biogas production techniques.	K2
CO5	Explain the fundamentals and applications of Geothermal energy, tidal energy, MHD and fuel cells.	K2

CORRELATION OF COs AND POs

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1											L	L
CO2		H	H					M	M			
CO3		H										
CO4			H		H	L	H				L	L
CO5		L			L			M	M		L	L

COURSE CONTENT:

UNIT I	**SOLAR CELLS AND ITS TECHNOLOGIES**	**9**

solar cells: working of solar cells, I-V characteristics, conversion efficiency, losses in solar cells, high efficiency solar cells, quantum dots, multi junction solar cells.

Solar cell technologies: Material selection, solar cell fabrication, amorphous, single and poly crystalline silicon solar cells, thin film solar cells, organic solar cells, first-, second- and third-generation solar cells, advantages, drawbacks, latest developments; concentrated PV systems. Testing, standardization and evaluation of solar cells.

UNIT II	**PHOTOVOLTAIC PRINCIPLES**	**9**

Solar Cell Physics: p-n junction: homo and heterojunctions, Metal-semiconductor interface; The Photovoltaic Effect, Equivalent Circuit of the Solar Cell, Analysis of PV Cells: Dark and illumination characteristics; Figure of merits of solar cell; Efficiency limits; Variation of efficiency with band-gap and temperature; Efficiency measurements; High efficiency cells,

Types of Solar cells.

UNIT III	SOLAR CELL FABRICATION TECHNOLOGY	9

Preparation of metallurgical, electronic and solar grade Silicon; Production of single crystalSilicon: Czokralski (CZ) and Float Zone (FZ) method: Procedure of masking, photolithography and etching; Design of a complete silicon, GaAs, InP solar cell; Highefficiency III-V, II-VI multi-junction solar cell; a-Si-H based solar cells; Quantum well solar cell, Thermo-photovoltaics.

UNIT IV	SOLAR PHOTOVOLTAIC SYSTEM DESIGN	9

Solar cell array system analysis and performance prediction; Shadow analysis: Reliability; Solar cell array design concepts; PV system design; Design process and optimization; Detailed array design; Storage autonomy; Voltage regulation; Maximum tracking; Use of computers in array design; Quick sizing method; Array protection and trouble shooting.

UNIT V	SPV APPLICATIONS	9

Centralized and decentralized SPV systems; Stand alone, hybrid and, grid connected system, System installation, operation and maintenances; Field experience; PV market analysis and economics of SPV systems. The Recent developments in Solar cells, Role of nano-technology in Solar cell. Solar thermal electric system. Lighting, refrigeration, telecommunications, aerospace, agriculture, fencing, water purification, navigation, defence, offshore, etc.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Renewable Energy Engineering and Technology – A Knowledge Compendium, ed. VVN Kishore ,TERI Press, 2008.
2. CS Solanki: Solar Photovotaics – Fundamentals, Technologies and Applications, PHI Learning, Kindle Edition - Jul 21, 2011

REFERENCE BOOKS:

1. SM Sze, Kwok K Ng: Physics of semiconductor devices, 3rd Edition, John Wiley & Sons, 2007.
2. MA Green: Solar Cells Operating Principles, Technology, and System Applications, Prentice-Hall,1981
3. MA Green: High Efficiency Silicon Solar Cells, Trans Tech Publications.
4. SJ Fonash: Solar Cell Device Physics, Academic Press, 1982.
5. Handbook of photovoltaic science and engineering, ed. Antonio Luque and Steven Hegedus , John Wiley and Sons.
6. Anna Mani, S Rangarajan: Handbook of Solar Radiation Data for India, 1980 Allied Publishers, 1980.
7. Richard C Neville, RC Neville, Bas Van Der Hoek: “Solar Energy Conversion: The Solar Cell”, Elsevier Science & Technology.
8. Peter Würfel : “Physics of Solar Cells: From Basic Principles to Advance Concepts” ,Wiley-VCH.