GLOBAL INITIATIVE OF ACADEMIC NETWORKS
(GIAN)

Course on

Basic Principles and Applications of Photovoltaic Devices

December 10-20, 2018
Discipline of Metallurgy Engineering and Materials Science,
Indian Institute of Technology Indore- 453552. INDIA.

Overview:

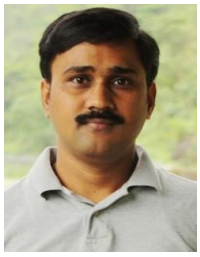
Over the last twenty years, solar energy has emerged to become a most useful energy resource among various new and renewable energy resources and has attracted the interest of increasing numbers of students and researchers. Photovoltaics is a simple and elegant method of harnessing the sun's energy. Photovoltaic devices (solar cells) are unique in that they directly convert the incident solar radiation into electricity, with no noise, pollution or moving parts, making them robust, reliable and long lasting. Solar cells are based on the same principles and materials behind the communications and computer revolutions, and this course covers the operation, use and applications of photovoltaic devices and systems.

Modules	A: Lectures :December 10-20, 2018 B: Tutorials/labs : December 10-20, 2018
Target Audience	Executives, engineers and researchers from manufacturing, service and government organizations including R & D laboratories. • Student students at all levels (B. Tech./M. Sc./M. Tech./Ph. D) or Faculty from reputed academic institutions and technical institutions.
Fees	Participants from abroad: US $500:00 Academic Institutions: INR 2,000 Industry/Research Organizations: INR 10,000 The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility. The participants will be provided with accommodation on payment basis.

The Fauclty	**Visiting Faculty:** Prof. J. H. Kim Photonic and Electronic Thin Film Laboratory Department of Materials Science & Engineering

JIN HYEOK KIM is professor of Materials Science in Chonnam National University, South Korea. His research interest includs research interest includes the fabrication and characterization of compound thin film solar cells, especially $Cu_2ZnSn(S,Se)_4$ thin films, using various methods, such as sputtering, electro-deposition, sol-gel, nano-particles. I am also trying to study on the synthesis of metal-chalcogenide and metal-oxide thin films by physical, chemical, electrochemical methods and their applications in transparent conducting oxides, gas sensors, energy storage devices, etc. More details are available on http://pvsolar.chonnam.ac.kr/

PARASHARAM M. SHIRAGE is Associate professor in Metallurgy Engineering and Materials Science, Indian Insititute of Technoloyg Indore. His research interest includes next genration solar cells, gas and humidity sensors, energy storage (battery and supercapcitors), bio-sensors, electrochemistry, thin film growth and applications, utilization of high pressure to synthesize novel materials, novel superconductors search, isotope effects, point contact spectroscopy, microwave studies, nano-materials for technological applications, *etc*. More details are available on (http://www.iiti.ac.in/people/~pmshirage/)



DR. RUPESH S. DEVAN is Assistant Professor in Metallurgy Engineering and Materials Science, Indian Institute of Technology Indore, India. His research interest included synthesis and characterization of metal-oxide nanostructures and polymers for engineering energy applications. He also concentrates on the synthesis of nano-hetero-architectures and core-shell nanostructures for fabrication of energy conversion/storage devices, displays, smart windows

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and resistive switching devices. More details are available on https://rupesh76.wixsite.com/rupesh	

Tentative Lectures Schedule:

Course Structure

Day & Subject	Schedule	Time	Subject
Day1 2018.12.10. Introduction	Lecture 1	10:00 ~ 11:00	Global Warming and Renewable Energy
	Lecture 2	11:15 ~ 12:15	Solar Energy and Greenhouse Effect
	Break	12:15~ 13:00	
	Lecture 3	13:00 ~ 14:00	Properties of Sunlight
Day2 2018.12.11 Basics	Lecture 4	10:00 ~ 11:00	Introduction to Semiconductor Materials
	Lecture 5	11:15 ~ 12:15	Charge Carriers in Semiconductor
	Break	12:15~ 13:00	
	Lecture 6-7 **Tutorials**	13:30 ~ 16:00	Tutorials
Day3 2018.12.12 P-N Junctions	Lecture 8	10:00 ~ 11:00	Generation and Recombination of Charge Carriers
	Lecture 9	11:15 ~ 12:15	Charge Carrier Transport
	Break	12:15~ 13:00	
	Lecture 10-11 **Tutorials**	13:30 ~ 16:00	Tutorials
Day4 2018.12.13 P-N Junctions & Diode Equation	Lecture 12	10:00 ~ 11:00	P-N Junction and Diode Equation
	Lecture 13	11:15 ~ 12:15	Ideal Diode Equation Derivation
	Break	12:15~ 13:00	
	Lecture 14-15 **Tutorials**	13:30 ~ 16:00	Applying the Basic Equation to a PN Junction Solving Diode Equation to find Total Current
Day5 2018.12.14 Solar Cell Operation	Lecture 16	10:00 ~ 11:00	Solar Cell Structure & Light Generated Current
	Lecture 17	11:15 ~ 12:15	The Photovoltaic Effect; Solar Cell Parameters: V_{oc}, J_{sc}, and Fill Factor
	Break	12:15~ 13:00	
	Lecture 18-19 **Tutorials**	13:30 ~ 16:00	Tutorials
Day6 2018.12.17 Design of Si Cells	Lecture 20	10:00 ~ 11:00	Resistive Effects Design of Optical Properties
	Lecture 21	11:15 ~ 12:15	Design for Reducing Recombination
	Break	12:15~ 13:00	
	Lecture 22	13:00 ~ 14:00	Design for Top Contact

Day7 2018.12.18 Manufacturing Si Cells	Lecture 23	10:00 ~ 11:00	Silicon Wafers & Substrates
	Lecture 24	11:15 ~ 12:15	Solar Cell Fabrication
	Break	12:15~ 13:00	
	Lecture 25-26 **Tutorials**	13:30 ~ 16:00	**Tutorials**
Day8 2018.12.19 Thin Film Solar Cells	Lecture 27	10:00 ~ 11:00	Modules and Arrays
	Lecture 28	11:15 ~ 12:15	Classification of Solar Cells
	Break	12:15~ 13:00	
	Lecture 29-30	13:30 ~ 15:30	Compound Thin Film Solar Cells: CIGS & CZTS; Next Generation Solar Cells
Day9 2018.12.20	Lecture 25	10:00 ~ 11:00	Examination
		11:30- 12:30	Closing Remarks
		15:00 -16:00	Certificate Distribution

Lectures: 20 hrs
Tutorials: 12:30 hrs