



Fundamentals of Photovoltaics

Overview

This course provides fundamental knowledge about photovoltaic materials and devices. Students will acquire analytical and numerical skills to analyze the quality of different photovoltaic materials and evaluate the performance of photovoltaic devices. Students will also learn to design solar cells for a given material system and technology and suggest ways to improve the efficiency of solar cells.

They will also be taught about different solar cell structures and fabrication technologies, including the first, second, and third generation PV technologies. Assignments will provide an opportunity for students to think critically about the course material and challenge their knowledge. Furthermore, students will practice literature survey on major PV topics including carrier transport in PV materials and junctions and characterization of PV materials and devices.

Course participants will learn these topics through lectures and tutorials. Also case studies and assignments will be shared to stimulate research motivation of participants.

Objectives

The participants will gain knowledge and skills of:

- i) Exposing participants to properties of sunlight and its management for photovoltaic applications.
- ii) Provide fundamental understanding of generation and recombination in photovoltaic materials.
- iii) Exposing participants to Junctions (homojunction, heterojunction, metal semiconductor) for PV application.
- iv) Providing exposure to advanced junction theory and third generation solar cells.
- v) Enhancing the capability of the participants to identify and select the most suitable materials for efficient light management

Modules	February 14-19, 2022 (6 days) 11 hrs lectures and 10 hrs Tutorials Number of participants for the course will be limited to 100.
Mode	Online
You Should Attend If...	<ul style="list-style-type: none">• Student at all levels (BTech/MSc/MTech/PhD) or Faculty from reputed academic/technical institutions and Universities.• Researchers from government organizations including R&D laboratories.
Fees	Free, Number of participants for the course will be limited.
Mode of Registration	All prospective participants need to do web registration for the course on GIAN (https://gian.iitkcp.ac.in/GREGN/index) portal. After the mandatory web registration, participants should share the registration details with course coordinator by email (mkumar@iitj.ac.in). The shortlisted participants will be informed by email by 10 th February.

The Faculty



Dr. Quinn Qiao is an NSF IUCRC CEPS Center Site Director and a Tenured Full Professor at Syracuse University. Prior to joining Syracuse University, Dr. Qiao was a Harold C. Hohbach Professor and Graduate Director at SDSU. He was the Director for the 3,300 ft² class 1000 cleanroom

facilities. He has published over 200 peer-reviewed articles in high-impact journals such as Science, Nature Communications, Energy and Environmental Science, the Journal of the American Chemical Society, Advanced Materials, Advanced Energy Materials, Advanced Functional Materials, Nanoscale, and Nano Energy and He received the 2015 Distinguished Researcher Award, 2014 F O Butler Award for Excellence in Research, the 2010 U.S. NSF CAREER Award, and the 2009 Bergmann Memorial Award from the U.S.-Israel Bi-National Science Foundation. Dr. Qiao chaired many national and international conferences, served as a primary organizer for ACS symposium “Organic, Perovskite and Hybrid Solar Cells”.



Dr. Mahesh Kumar is an Associate Professor in the department of Electrical Engineering, IIT Jodhpur. He has received M.Sc degree in Physics from University of Rajasthan, M.Tech degree in Solid State Materials from IIT Delhi and Ph.D degree in Engineering from IISc Bangalore. He worked at

Central Research Laboratory of Bharat Electronics Ltd. (CRL-BEL) Bangalore as Scientist from 2005 to 2013. He has also worked at University of Paderborn Germany through INSA Bilateral Exchange programme and South Dakota State University through prestigious BASE Fellowship supported by IUSSTF. His research interests are focused on 2D materials, Solar Cells, Sensors, Semiconductor materials and devices. He has received INSA Medal for Young Scientists-2014 by Indian National Science Academy and the MRSI Medal-2016 by Materials Research Society of India. He has published more than 100 research articles.



Dr. Mukesh Kumar is an Associate Professor in the department of physics, IIT Ropar. Prior to joining IIT Ropar, he did his Master and Doctoral studies in Indian Institute of Technology Delhi. After completing Ph.D. in 2010, he worked as a postdoctoral research fellow at the South Dakota State

University, SD, USA in the field of nanoscale charge transport studies of organic solar cells from 2010-2011. He then worked a post-doctoral fellow at Colorado School of Mines and National Renewable Energy Laboratory, CO, USA on the development of reliable and flexible thin films for next generation flexible optoelectronic devices. Dr. Kumar research interest includes functional and renewable energy materials, Organic solar cells, CZTS solar cells sensors and photodetector. Dr. Kumar is the recipient of Fulbright-Nehru Academic and Professional Excellence Award and BASE fellowship, Indo-US Science and Technology Forum

Course Co-ordinator

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