Advanced Group-IV Semiconductor Electronic and Optoelectronic Devices

Overview

As CMOS scaling is coming to an end, new materials and device concepts are being explored for their potential to realize devices at the end of the roadmap and beyond CMOS as well as More-than-Moore approaches. Going beyond Si with the group-IV-alloys GeSn and SiGeSn can provide higher device efficiency and enable new device concepts in a CMOS-compatible material system. In this course, state-of-the-art group-IV electronic and optoelectronic devices will be presented from material growth to device physics. Starting from the fundamentals of quantum mechanical description and material fabrication, the tunnel field-effect-transistor will be discussed as one of the most promising candidates to realize transistor functionality at the end of the roadmap. Spin-based devices will be introduced as potential device concepts that go beyond CMOS. Finally, an introduction to optoelectronic devices will be given with a focus on the use of GeSn- and SiGeSn-structures of reduced dimensionality.

The course will begin provide material of interest to researchers in optoelectronics, particularly Group IV device physics. We will introduce the basics concepts of electron spin and magnetism, the principles of group-IV-heterostructure fabrication, and lead into advanced topics such as electron spin diffusion and quantum tunneling as applicable to devices such as tunnel field effect transistors, spin-FETs. The course will also emphasize the role of quantum confinement in spintronic and optoelectronic devices.

Dates for the Course	**22nd February, 2017 to 28th February, 2017**
Host Institute	**IIT Madras**
No. of Credits	**2**
Maximum No. of Participants	**50**
You Should Attend If…	▪ You are an engineer or research scientist interested in the industrial applicability of optoelectronics or solid state physics ▪ You are a student or faculty from academic institution interested in advanced semiconductor device fabrication and characterization
Course Registration Fees	The participation fees for taking the course is as follows: **Student Participants:** Rs.1000 **Faculty Participants:** Rs. 2000 **Government Organization Participants**: Rs. 2000 **Non-for-profit Organization Participants:** Rs 2000 **Industry Participants:** Rs. 5000 The above fee is towards participation in the course, the course material, tutorials and assignments, and laboratory equipment usage charges. **Mode of payment: Demand draft in favour of "Registrar, IIT Madras" payable at Chennai** The demand draft is to be sent to the Course Coordinator at the address given below.
Accommodation	The participants may be provided with hostel accommodation, depending on the availability, on payment basis. Request for hostel accommodation may be submitted through the link: http://hosteldine.iitm.ac.in/iitmhostel

Course Faculty

Dr. Inga Anita Fischer joined the Institute of Semiconductor Engineering at the University of Stuttgart, Germany, in 2010. Her research is oriented towards the application of nanostructures in CMOS-compatible, group-IV-based semiconductor devices, e.g. the development of nano-pillar tunnel field-effect transistors or the fabrication and utilization of SiGeSn nanostructures for optoelectronic devices. Furthermore, she has initiated and is now responsible for the institute's research activities on group-IV-based spintronics and plasmonics in collaboration with national and international groups. She is the author or co-author of more than 60 papers in scientific journals and conference contributions, including invited talks.

Dr. Fischer obtained her PhD in theoretical solid state physics from the University of Cologne, Germany, in 2006 for research on phases and quantum phase transitions in metallic magnets. From 2007 to 2010 she was first a research scientist, then a program manager at Siemens Corporate Technology in Munich, Germany.

Prof. Anil Prabhakar is a faculty in the Dept. of Electrical Engineering at the Indian Institute of Technology, Madras. His research interests are in quantum optics, bio-photonics, magnonics and assistive technologies and photonics. He is a founder-Director of Unilumen Photonics Pvt. Ltd., a company incubated by IIT Madras to deliver indigenous fibre laser technology for biomedical and life science applications. Dr. Prabhakar was previously employed at ReadRite Corporation, Fremont, USA as a manager of the Advanced Recording Heads Group.

Dr. Bijoy Krishna Das is a faculty in the Dept. of Electrical Engineering at the Indian Institute of Technology, Madras. He heads the integrated optoelectronics laboratory and is an active member of the Centre for NEMS and Nanophotonics (CNNP). His current focus is on developing an integrated Silicon-on-Insulator (SOI) platform for a variety of optical devices such as couplers, resonators and wavelength interleavers.

Course Coordinator

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URL: http://www.ee.iitm.ac.in/mems/iolab/
http://www.ee.iitm.ac.in/optics/